SCOPE OF WORK
FOR
THE STUDY
ON
THE INTRODUCTION OF RENEWABLE ENERGIES IN RURAL AREAS
IN
MYANMAR

Agreed upon between
The Ministry of Electric Power of the Union of Myanmar
and
Japan International Cooperation Agency

Yangon, September 21, 2000

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Director General,
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Enterprise

I. INTRODUCTION

In response to the request of the Government of the Union of Myanmar (hereinafter referred to as "Myanmar"), the Government of Japan decided to conduct the Study on the Introduction of Renewable Energies in Rural Areas in Myanmar (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

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

The present document sets forth the scope of work with regard to the Study.

II. OBJECTIVE OF THE STUDY

The Study aims at formulating a guideline for the introduction of renewable energies in rural areas of Myanmar and preparing actual development plans for selected sites. Through the installation of pilot plant(s) in the Study, the transfer of necessary knowledge and technology to concerned personnel in Myanmar and the preparation of a manual will be implemented for efficient introduction of renewable energies in Myanmar.

III. THE STUDY AREA

In formulating the guideline for the use of renewable energies (hereinafter referred to as "the Guideline"), whole situation in the country will be taken into account. To collect detailed data necessary for the formulation of the Guideline, however, some specific areas will be selected. These areas will be decided in the course of the Study through discussions between the Myanmar counterparts and the Japanese study team dispatched for the Study (hereinafter referred to as "the Japanese study team").

IV. OUTPUT OF THE STUDY

The Study comprises two (2) components: Phase I and Phase II. However, the details of the Phase II study will be decided in light of the results of the Phase I study. The expected output of each phase is as follows:

Output of the Phase I study

1) The Guideline

The following issues will be included in the Guideline:

- Set-up of proper institutional and organizational schemes for rural electrification using renewable energies
- Necessary policies and regulations for the facilitation of rural electrification using renewable energies
- Proper financial plans for rural electrification using renewable energies. These include proper tariff structures and schemes for raising required capital
- Proper operation and maintenance schemes for power supply systems using renewable energies
- Proper mechanism for the development of human resources
- Criteria for the selection of appropriate sites to be electrified and energy resources to be used
- Criteria for prioritization of prospective electrification projects
- Technical standards for data collection, equipment and power supply systems, economic evaluation of the feasibility of projects, and environmental impact assessment
- Possibility of alternative configurations of power supply systems using renewable energies

2) Identification of prospective electrification projects using renewable energies

The prospective projects of rural electrification using renewable energies will be identified mainly based on existing data and information. The identified projects will be prioritized in accordance with the Guideline.

3) Formulation of development plans for prioritized projects

Development plans will be formulated for a couple of the highly valued projects, identified through the above-mentioned process. These plans will cover the conceptual design of the power supply system, time schedule of the project, cost estimation, proper operation and maintenance scheme.

Output of the Phase II study

4) Technology transfer and preparation of a manual for the introduction of renewable energies through (a) pilot project(s)

Based on the results of the Phase I study, (a) single or multiple pilot project(s) will be conducted with the purposes of actual technology transfer and preparation of a manual for the introduction of renewable energies. This manual will cover necessary issues in each development process such as project planning, design, operation and maintenance, monitoring, and technical and economic evaluation.

V. SCOPE OF THE STUDY

Phase I Study–Preparation of the Guideline and Development Plans

1) Collection and Analysis of Background Data and Information

The following data and information will be collected and analyzed. A socio-economic survey will be also implemented to collect necessary data on general situations in rural areas.

- Situations of existing relevant projects in Myanmar
- Current status of rural electrification including institutional issues such as relevant policy, plans, laws and regulations
- Relevant organizations and their roles, activities, and awareness of rural electrification
- Existing topographical maps, hydro-meteorological data, materials indicating the location of existing power stations, and existing grids, and information on power plants under construction and operation
- Socio-economic and energy situation in rural areas (socio-economic survey)
- Potential demand for electricity in rural areas
- Potential of the development of renewable energies in rural areas
- Availability of construction materials, machineries, and equipment in the local market

2) Preparation of the Guideline

The Guideline encompassing the above-mentioned issues will be prepared.

3) Identification of Prospective Electrification Projects Using Renewable

Energies

- Identification of potential projects sites in light of existing data and information
- Implementation of field surveys in some highly rated places sampled among the identified project sites
- Prioritizing the prospective projects sites in light of the data collected through the field surveys and the criteria defined in the Guideline

4) Formulation of Development Plans

(1) Preparatory Survey

- Selection of target sites in accordance with the priority of the prospective projects
- Execution of field surveys aimed at collecting data on detailed site conditions such as topological and hydrological conditions, and analyzing the collected hydro-met data and relevant development plans
- Execution of field surveys for the target sites to be electrified. Some of the necessary data are the number and distribution of consumers, potential demand, and socio-economic conditions

(2) Project Planning

- Development of the plan for power supply and demand
- Evaluation of the potential of development. This includes examinations of the optimal size of development, economic viability, and expected effects and side effects
- Examination of the engineering design with rough specifications for power supply systems, basic drawings and cost estimation
- Preparation of the implementation schedule for development

(3) Operation and Maintenance Plan (O/M Plan)

O/M plans will be developed.

(4) Accounting System

An appropriate accounting system will be developed. The work will include the methodology of tariff collection and management of accounting.

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(5) Economic and Financial Analysis

Economic and financial analysis for the formulated development plans will be carried out.

5) Comprehensive Workshop for Phase I

A comprehensive dissemination workshop shall be carried out to disseminate the entire output of the Phase I study. The expected participants will be concerned officials and personnel of national and local government, international organizations and Japanese organizations.

Phase II Study– Implementation of Pilot Project(s) and Preparation of the Manual

1) Implementation of (a) Pilot Project(s)

Stage 1: Selection of Target Site(s)

The target site(s) for the pilot project(s) will be selected among those for which the development plans are formulated in the Phase I study.

Stage 2: Detailed Design and Installation

(1) Detailed Design

Detailed design work will be carried out. Utilization of local materials and equipment shall be considered as much as possible. The specifications of the system(s) will be prepared.

(2) Procurement and Installation of Materials for the Plant(s)

Necessary materials will be procured and installed.

(3) Supervision of the Construction Work

The concerned personnel of Myanmar and the Japanese study team shall jointly supervise the construction work performed by (a) contractor(s) in a cooperative manner.

Stage 3: Operation & Maintenance, Monitoring and Evaluation of Pilot plant(s)

(1) Operation & Maintenance (O/M)

Based on the O/M plan prepared in the development plans, the organization in charge of O/M will be established in the target site(s), and O/M work and tariff collection will commence.

(2) Monitoring

Monitoring of the pilot plant(s) shall be continued after the commissioning of operation. The concerned personnel of Myanmar and the Japanese study team will implement the monitoring work in a cooperative manner.

(3) Evaluation

The viability of the pilot plant shall be evaluated based on the results of the above-mentioned monitoring.

2) Completion of the Manual and the Guideline

The manual shall be drafted in each stages and phases of the Study. These draft manuals will be compiled and completed. At this point, the Guideline will be revised to reflect the whole outcomes from above.

3) Comprehensive Workshop for the Study

To disseminate the whole outcomes of the Study, a comprehensive workshop shall be carried out. The expected participants will be concerned officials and personnel of national and local government, international organizations and Japanese organizations.

VI. WORK SCHEDULE

The Study will be carried out in accordance with the tentative work schedule shown in the appendix I.

VII. REPORTS

JICA shall prepare and submit the following reports in English to the Government of Myanmar:

- Inception report: Ten (10) copies in English
- Progress report 1: Ten (10) copies in English
- Interim report: Ten (10) copies in English
- Progress report 2: Ten (10) copies in English
- Draft final report: Twenty (20) copies in English (main reports and summaries)

Tentative time schedule for submission of these reports is shown in the attached Appendix I.

The Ministry of Electric Power (hereinafter referred to as "MOEP") shall provide its comments on the draft final report within one (1) month after the submission of the report.

- Presentation

The presentation of the draft final report shall be made to MOEP.

- Final report: Twenty (20) copies in English (main reports and summaries)

JICA will submit these reports within six (6) weeks after receiving the comments of the Government of Myanmar on the draft final report.

During the field survey in Myanmar, monthly meetings will be held, and monthly reports will be prepared for submission at these meetings.

VIII. DIVISION OF TECHNICAL UNDERTAKING

The division of technical undertakings by MOEP and JICA of the Phase I study is detailed in the appendix II.

IX. UNDERTAKING OF THE GOVERNMENT OF MYANMAR

To facilitate the smooth conduct of the Study, the Government of Myanmar shall take necessary measures:

(1) to secure the safety of the Japanese study team,

(2) to permit the members of the Japanese study team to enter, leave and sojourn in Myanmar for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,

(3) to exempt the members of the Japanese study team from taxes, duties, fees and other charges on equipment, machinery and other materials brought into, and out of, Myanmar for the conduct of the Study,

(4) to exempt the members of the Japanese study team from income taxes and charges of any kind imposed on, or in connection with, any emoluments or allowances paid to them for their services for the implementation of the Study,

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

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

(7) to secure permission for the Japanese study team to take all data and documents including

maps and photographs related to the Study out of Myanmar to Japan,

(8) to provide medical service as needed (expenses will be chargeable to members of the Japanese study team) and

(9) to facilitate prompt clearance through customs and inland transportation of equipment, materials and supplies required for the Study and of the personal effects of members of the Japanese study team.

The Government of Myanmar shall bear claims, if any arises, against members of the Japanese study team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Japanese study team.

MOEP shall act as counterpart agency to the Japanese study team and also as coordinating body in relation with the other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

MOEP shall, at its own expense, provide the Japanese study team with the following, in cooperation with other organizations concerned:

(1) available data and information related to the Study;

(2) counterpart personnel;

(3) suitable office space with necessary equipment in Yangon;

(4) identification cards;

(5) necessary vehicles with drivers, fuel and maintenance services for carrying out the field survey; and

(6) communication facilities during the execution of the Study, such as telephone, telex, transceiver, etc., if necessary.

X. UNDERTAKING OF JICA

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

(1) to dispatch, at its own expense, study teams to Myanmar, and

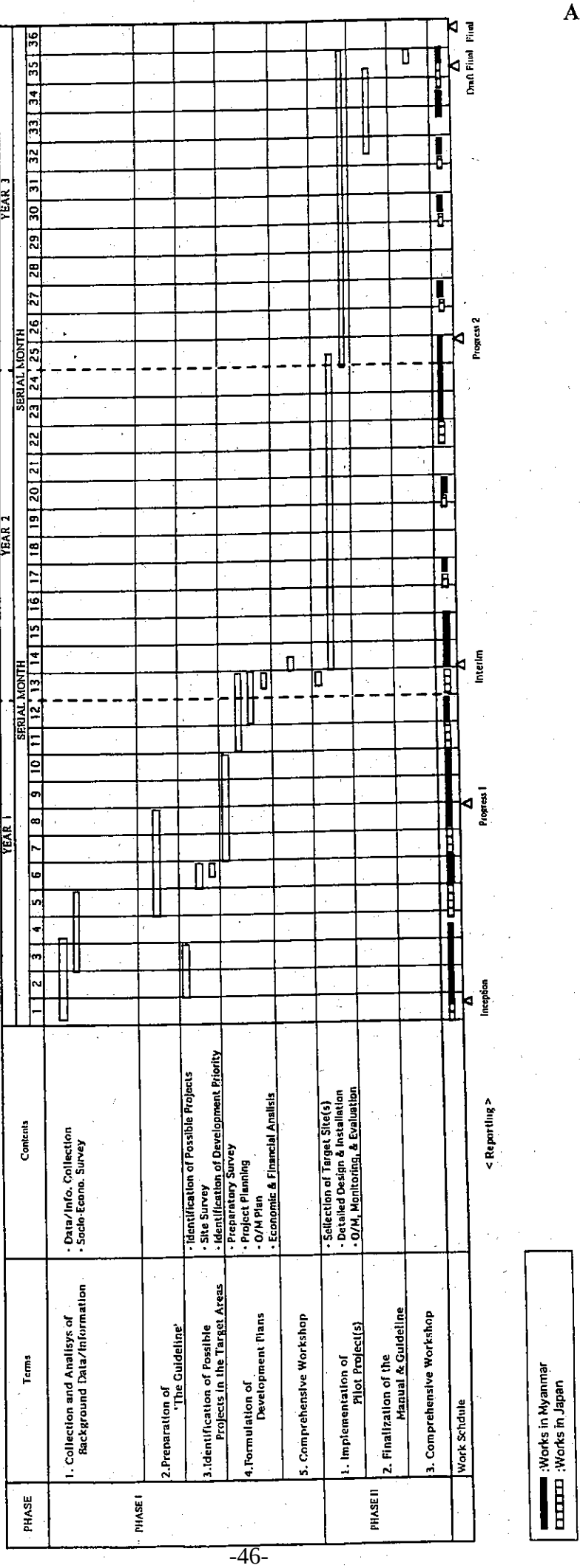
(2) to pursue technology transfer to the Myanmar counterpart personnel in the course of the Study.

XI. OTHERS

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

Appendix I

TENTATIVE SCHEDULE FOR THE STUDY



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Appendix II

Outline of Division of Technical Undertaking

	MOEP	JICA (study team)
PHASE I (Preparation of the Guideline and Development Plans)	1) Arrange the meetings with relevant authorities and organizations.	1) Collect information from relevant authorities and organizations. Discuss the progress and results of the Study with relevant authorities and organizations.
	2) Arrange the site reconnaissance in cooperation with PBANRDA.	2) Conduct site reconnaissance.
	3) Assist the collection of necessary data and information.	3) Collect and analyze relevant data and information.
	4) Examine the prepared Guideline and the development plans with concerned authorities.	4) Formulate the Guideline and the development plans in cooperation with Myanmar personnel.
	5) Arrange and Hold the comprehensive workshop.	5) Provide technical support for the implementation of the comprehensive workshop.

	MOEP	JICA (study team)
PHASE 2 (Implementation of pilot project(s) and preparation of the Manual)	1) Examine the target site(s) for the pilot project(s).	1) Evaluate the results of the Phase I study in order to select the target site(s) for the pilot project(s).
	2) Assign Myanmar personnel who will work with the Japanese study team for the detailed design, supervision and so on.	2) Carry out detailed design and supervision work in cooperation with Myanmar personnel. Transfer necessary technology and knowledge to the personnel.
	3) Arrange the site studies with local authorities and PBANRDA.	3) Carry out the site studies.
	4) Establish the O/M system and organization for O/M activities.	4) Develop O/M system and the structure of the organization in cooperation with the Myanmar personnel.
	5) Monitor and evaluate the project(s).	5) Identify criteria for monitoring and evaluation of project(s) in cooperation with the Myanmar personnel.
	6) Examine the manual and the Guideline.	6) Complete the manual and the Guideline in cooperation with the Myanmar personnel.
	7) Arrange and hold the comprehensive workshop.	7) Provide technical support for the implementation of the comprehensive workshop.

MINUTES OF MEETING
FOR
THE PREPARATORY STUDY
ON
THE INTRODUCTION OF RENEWABLE ENERGIES
IN RURAL AREAS
IN
MYANMAR

Yangon, September 21, 2000

U Zaw Win
Director General,
Department of Electric Power,
Ministry of Electric Power

Yuji Otake
Leader,
Preparatory Study Team,
Japan International
Cooperation Agency

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U Yan Naing
Managing Director,
Myanma Electric Power
Enterprise

The Department of Electric Power, the Ministry of Electric Power (hereinafter referred to as "DEP") requested officially to implement the study on rural electrification using renewable energy in Myanmar to the Government of Japan in September 1998.

In response to the request, the preliminary study team organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") had been dispatched to Myanmar from June 18th to July 1st, 2000.

In Yangon the preliminary study team held a series of discussions on the proposed study, which was named "the Study on the Introduction of Renewable Energies in Rural Areas in Myanmar," with DEP and Myanma Electric Power Enterprise (hereinafter referred to as "MEPE"), a state owned utility responsible for generation, transmission and distribution of electric power in Myanmar, and other relevant government departments. Through these discussions the outline of the proposed study had been clarified.

The scope of work for the actual study was drafted by JICA based on the results of the preliminary study. The preparatory study team was dispatched to Myanmar from September 14th to September 23rd to have a series of discussions on the drafted scope of work with DEP and MEPE.

Discussions were conducted in a friendly and cordial atmosphere, and both sides agreed to record the following points as summarized conclusions of the discussions:

1. Objectives of the Preparatory Study

The objectives of the preparatory study are:

(1) To collect relevant data and information; and

(2) To build up a mutual understanding regarding the contents of the scope of work for the actual study.

2. Procedure of the Implementation of the JICA Development Study

In general, the JICA Development Study is carried out through the following

three stages:

(1) Preliminary study (completed in July 2000): In this stage, the outline of the proposed study is clarified, and necessary data and information to formulate the scope of work are collected. Between JICA and the relevant organization of the recipient country (i.e., DEP), mutual understanding for the outline of the actual study is reinforced.

(2) Preparatory study: In this stage, based on the result of the preliminary study, the detailed scope of work is formulated through the discussions of the two parties. The mission of the preparatory study is sometimes called Scope of Work (S/W) mission.

(3) Actual study: In this stage, the JICA study team composed of Japanese consultants is organized and carries out the actual study in accordance with the agreed scope of work. The actual study is expected to commence in January or February 2001.

3. Responsible Agencies

DEP shall take a full responsibility for the implementation of the actual study and coordinate the related authorities and government departments such as the Ministry for Progress of Border Areas and National Races and Development Affairs (PBANRDA). MEPE shall be the actual execution body for the study.

4. Counterpart Personnel

DEP and MEPE will assign the counterpart personnel who will actually work with the members of the JICA study team in the whole course of the actual study. Through joint works in the actual study, the JICA study team will implement technical transfer to the counterpart personnel. Expertise of the counterpart personnel must correspond to that of the JICA study team members. Prior to the commencement of the actual study, the JICA will submit a member list of JICA study team to DEP; then, DEP will assign the counterpart personnel.

5. Necessary Data and Information

The preparatory study team requested DEP to ensure the availability of necessary data and information listed in the attached sheet. DEP replied that they

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would be able to provide in-house data per the request of the JICA study team; however, in regard to those data only available outside MOEP/MEPE, they would do their best with the relevant authorities to collect them.

6. Pilot Project

6.1 Comments on the Pilot Project

DEP commented on the drafted pilot project scheme as follows:

(1) DEP expects a substantial size of facilities: for example, about (1) MW capacity for mini-hydropower, and about 150 kW capacity for PV and wind-power system.

(2) For PV and wind power systems DEP prefers a centralized system which can supply electricity to a village or a group of villages, rather than a stand-alone system which can supply only one building.

(3) Similarly small size micro hydro power stations such as 50kW or 100kW are not preferable because these are not cost effective in the light of current MEPE operation.

Conversely, the JICA preparatory study team explained their standpoints for the pilot project:

(1) The pilot project is one part of the actual study that is aimed at formulating appropriate schemes for rural electrification. These schemes will include not only the current form of MEPE operation but also something new forms based on collaboration between MEPE and local communities.

(2) In this context, the size of the pilot project cannot be the precondition for the project implementation but will be decided through the evaluation and discussion of the first phase study, in particular, the formulation of guideline.

6.2 Site Selection

(A) pilot project(s) will be conducted in the second phase of the actual study. The potential areas for the pilot project(s) will be nominated through the formulation of the development plan in the first phase, but the actual site(s) and type(s) of energy to be used in the pilot project(s) will be determined at the beginning of the second phase.

6.2 Installation of the Plant(s)

The whole expenses for the procurement and installation of the plant(s) will be

borne by JICA. On the other hand, DEP will support JICA's activities regarding the procurement and installation of the plant(s) in cooperation with concerned government departments.

6.3 Ownership

Facilities of the pilot project(s) must belong to JICA during the period of the actual study, but the ownership will be transferred to the Myanmar side after the completion of the pilot project.

6.4 Tariff Collection

Tariff collection will be executed in the pilot project to develop and demonstrate an appropriate financial management system.

7. Workshop

The preparatory study team explained the necessity of the implementation of workshops. The aim of the workshops is to disseminate output and lessons of the actual study to all concerned officials and personnel of national, local and international organizations. The workshops shall be held at both the ends of the first and the second phases. DEP will lead the arrangement of the workshops in cooperation with the JICA study team, while the JICA study team will provide technical and financial support to DEP and the counterpart personnel. JICA's support will also include the preparation of necessary documents for the workshops.

8. Others

8.1 Counterpart Training in Japan

DEP and MEPE requested that the counterpart personnel be trained in Japan for the purpose of effective implementation of the actual study.

8.2 Documentation of the Final Report

The final report including background data and information will be digitalized and provided to the Myanmar side. These documents must be processed and readable by personal computer (PC). The JICA study team will also provide technical transfer regarding handling of the digitalized documents and PC operation.

Attachment

Information necessary for setting up guidelines

(1) Laws and regulations

All laws, decrees, and regulations related to electric power supply, including the following.

- Laws that define the roles of the government, the Ministry of Electric Power (MOEP), the Myanmar Electric Power Enterprise (MEPE), and other energy related ministries.
- Regulations that clarify power tariff setting and collection
- Regulations that govern establishment of electric cooperatives or local entities which are engaged in power supply

(2) Financial statements of the MEPE

Data on the following items for the past five years:

- Budget allocation
- Balance sheet
- Profit and loss statement

(3) Organizational Structure of the MEPE in Rural Operation

- Management of each regional headquarters and branch office
- Role of each local office
- Composition of staff

(4) Training system of the MEPE

- Training programs

Information necessary for screening the potential sites

(1) Hydro

- Hydrological data (periodical yearly flow measurements in last several years to judge adequate flow) at the site.
- Topographic map at site with plane table in a scale of 1/50,000 or 1/25,000

(2) PV

- Monthly irradiation energy data for several years in various areas.
- Topographic map at site with plane table in a scale of 1/50,000 or 1/25,000

(3) Wind

- Periodical yearly data for wind speeds and wind directions in various areas
- Topographical maps and utilization maps with plane table in a scale of 1/50,000 or 1/25,000 for the areas where wind data are available.

(4) Biomass

- Monthly production of biomass resources by areas, and by types

Minutes of Meeting
for
Progress, Findings, and Interim Study Results of
1st Assignment in Myanmar
on
Introduction of Renewable Energies in Rural Areas in Myanmar

Yangon, 18 March 2001

U Soe Myint Lwin
Leader of Counterpart,
Deputy Chief Engineer of
Planning Division
Myanma Electric Power Enterprise

Akio Katayama
Team Leader of
JICA Study Team
19.3.2001

Minutes of Meeting
for
Progress, Findings, and Interim Study Results of
1st Assignment in Myanmar
on
Introduction of Renewable Energies in Rural Areas in Myanmar

Date : 18 March 2001
Time : 9:00 - 12:00, 14:00-15:00
Place : MEPE Office

JICA Study Team explained the Progress of the Study, their findings, and interim study results of the First Assignment in Myanmar (21.1.2001-20.3.2001). The explanation covered Institution, Village & Economy, Mini-hydro, Solar and Wind, and Biomass.

In particular, the Study Team proposed the Nam Lan Mini-hydro Scheme, located about 50 km to the south of Hsipaw, Northern Shan State, as the best candidate for the Pilot Project. The Team explained that the Nam Lan Scheme would pass the Draft Selection Criteria and would be one of the highest ranked by the Draft Prioritization Criteria. The Study Team also stressed the needs and importance of the utilization of the current dry period for the field investigations of the Pilot Project so that its pre-construction engineering works including design can be executed in the coming rainy season and the construction works could be commenced even from January 2002. With such special arrangement in time schedule, the Pilot Project could be commissioned within the Fiscal Year 2002/03 as originally envisaged in the Terms of Reference.

The Counterparts expressed their basic agreement to the Team's proposal to select the Nam Lan site as the Pilot Project as well as to the basic concept of the Selection and Prioritization Criteria. The Counterparts expressed their strong wishes to the earliest implementation of the Pilot Project as well as to procurement of turbines and generators from qualified manufacturers.

Both Parties hereto agreed that the selection of the Nam Lan Scheme be reviewed and confirmed in accordance with the Guidelines that will be finalized and submitted as part of the Progress Report No. 1 in November 2001.

ATTENDANCE LIST

Date : Mar. 18, 2001

Place : MEPE

Subject : Presentation & Discussion for Progress, Findings and Interim Study Results of 1st Assignment in Myanmar

No.	Name	Title	Signature
1	Daw Min Min Than	EE	Hni Hni Aye
2	U Ye Win Myint	A.E.E	
3	Daw Hnin Hnin Aye	E.E.	Hni Hni Aye
4	Akio Katayama	Team Leader	A. Katayama
5	KAORU YAMAGUCHI	Economist	K. Yamaguchi
6	Haruhiko KANAI	Hydro Planner	
7	Takafumi KADONO	Coordinator	T. Kadono
8	SAITO Katsuhiko	PV & Wind	斎藤克彦
9	U Soe Myint Lwin	S.E	
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Introduction of Renewable Energies in Rural Areas in Myanmar

Minutes of Meeting
for
2nd Assignment in Myanmar

Yangon, June 29, 2001

4/07/2001

U Soe Myint Lwin
Leader of Counterpart,
Superintending Engineer of
Planning Division
Myanma Electric Power Enterprise

Akio Katayama
Team Leader of
JICA Study Team

Minutes of Meeting
for
2nd Assignment in Myanmar

Date : June 29, 2001
Time : 10:00 - 12:30
Place : JICA Study Team Office in MEPE

1. Presentation for Progress and Outcome

Following the opening speech by Mr. A. Katayama – Team Leader, the JICA Study Team explained the following topics that has been worked out up to the present:

(1) Field surveys conducted and the results
- Village social survey (Northern Shan, Southern Shan, and Kachin States)
- Topographic survey at Nam Lan and Heho schemes
- Discharge measurement and test pitting at Nam Lan and Heho schemes

(2) Data collection and the analyses
- Institution and organization
- Village data
- Economic and financial data
- Meteorological data
- Data on small hydro, solar, wind, biomass, construction, manufacturing, etc.

(3) Approach to preparing the Guideline
- Institution and organization
- Preliminary demand forecast and financing

(4) Reconnaissance of potential sites
- Institution, social, finance team/small hydro team/solar-wind team/biomass team

(5) Proposed priority projects
- Selection of prospective projects
- Prioritization
- Selection of three priority projects
- Explanation for proposed priority projects

2. Discussion

The Counterpart Team and the Study Team discussed about the above agenda, and came to the following conclusions:

(1) The Counterpart Team agreed with the selection of 3 priority projects in line with the basic concept of the Guideline and the criteria proposed by the JICA Study Team.

(2) 3 priority projects agreed by the both parties are as follows.

- Inle (Heho) Small Hydro with about 2.5 MW - 10 MW (Southern Shan State)
- Nam Lan Small Hydro with about 100 kW - 400 kW (Northern Shan State)
- Rice Husk Gas Engine with about 30 - 100 kW + Solar/Wind Powered BCS (location is not specified yet)

It is noted that the installed capacities are tentative and shall be elaborated further.

(3) The Counterpart Team stated that MEPE would be willing to undertake the execution of the Pilot Project(s), however, the operation, maintenance and management of the Project(s) in future should be worked out through the further study and discussion, taking into account a possibility to hand-over them to Village Electrification Association through the knowledge transfer.

(4) Both parties confirmed that the Pilot Project(s) would be finally selected through discussion with parties concerned by 4th assignment in Myanmar scheduled in November – December 2001.

(5) The Counterpart Team expressed its strong request for earlier commencement of the Pilot Project(s), hopefully within January 2002.

Introduction of Renewable Energies in Rural Areas in Myanmar

Minutes of Meeting
in
3rd Assignment in Myanmar

Yangon, Oct. 03, 2001

U Soe Myint Lwin
Leader of Counterpart,
Deputy Chief Engineer of
Planning Department
Myanma Electric Power Enterprise

Akio Katayama
Team Leader of
JICA Study Team

Minutes of Meeting
in
3rd Assignment in Myanmar

Date : Oct 03, 2001
Time : 10:00 - 15:00
Place : JICA Study Team Office in MEPE

1. Presentation for Progress and Outcome

The JICA Study Team explained the following study results for the Guidelines and the three priority Development Projects that have been worked out up to the present:

(1) The Guidelines — Presented by Messrs. Katayama/Kanai/Harris

- Needs for Electrification
- Feasibility for Rural Electrification with Renewable Energy
- Development Potentials of Renewable Energy
- Selection and Prioritization Criteria for RE Schemes Selected
- Strategy for Implementing RE Using Renewable Energy
- Guidelines for Micro Hydro
- Proposed Institutional and Organizational Schemes for RE
- Framework for Development of Human Resources

(2) Development Plan of Heho Small Hydro Scheme — Presented by Mr. Kadono

- Development Potential of Heho Small Hydro Scheme
- Demand Forecast and Distribution Alternatives
- Role of Heho Hydro as Sustainable Rural Electrification
- Basic Design and Salient Futures

(3) Development Plan of Nam Lan Mini Hydro Scheme — Presented by Mr. Kanai

- Development Potential of Nam Lan Mini Hydro Scheme
- Demand Forecast in Nam Lan
- Investigation Results
- Basic Design and Development Concept
- Construction Schedule
- Role of VEC

(4) Development Plan of Biomass-Gas Engine Scheme — Presented by Miss Nakagawa

- Selection of Model Villages
- Development Plan of Rice Husk Gas Engine and Solar BCS in Kayin Seik Village

- Development Plan of Rice Husk Gas Engine in Banbwe KoneVillage
- Fund Plan for Implementation

2. Discussion

The discussion between the Counterpart Team and the Study Team is summarized below:

(1) The Counterpart Team agreed with the basic concept of the Guidelines and 3 Development Projects proposed by the JICA Study Team.

(2) The Counterpart Team stated that the organization structure of MEPE for promotion of the rural electrification proposed by the Study Team would need further discussion.

(3) The Counterpart Team asked about the irrigation water to be supplied in the river basin, sharing the river water with power discharge. The Study Team replied that the discharge requirements for the irrigation supply water had been incorporated into the study based on the areas of paddy fields in each river basin.

(4) The Counterpart Team asked whether the river discharge used in Nam Lan Small Hydro Scheme had been measured in a long term. The Study Team replied that the development scale of Nam Lan Scheme was based on the lowest discharge measured in the dry season in this year to assure the dependability of the power. In addition, the Hosang Chaung is originated from a spring with relatively stable flow throughout a year, and no severe floods are expected due to the small catchment area of about 1 km^2. The village people undertook the discharge measurement at Hisang Chaung, Nam Pankan Chaung, and Kyutaw Chaung twice a week from September 2001.

(5) The Counterpart Team asked whether the combustion gas of biomass is harmful. The Study Team replied that the gas contains hydrogen, methane, and carbon monoxide mainly, therefore, the combustion plants shall be airtight, and ventilation needs to be kept in the powerhouses.

(6) The Counterpart Team asked about the possibility for biomass gas engine by use of maize. The Study Team replied that it would be available, however, rice husk, bagasse, and saw dust would be the main materials which are collected from farmland to certain place like rice mill, saw mill, sugar mill to be supplied for biomass power in Myanmar. In case of maize, combs are not collected, but left in the farmland.

(7) The both parties confirmed that participation of village people in the construction of the pilot project, but not as forced labor, would be important for the implementation as well as for the subsequent operation & maintenance of the facilities.

(8) A list of Abbreviations should be attached to the Guidelines.

(9) The Counterpart Team strongly requested to proceed with the early construction of Nam

Lan Mini Hydro Scheme as a Pilot Project next year, and to seek for the detailed design of Heho Small Hydro Scheme by JICA toward the implementation, which would be quite attractive scheme to MOEP/MEPE. MEPE wishes the detailed design of Heho Small Hydro Scheme to be implemented at an early date as an additional work to this Study or a subsequent development project of JICA.

Introduction of Renewable Energies in Rural Areas in Myanmar

Minutes of Meeting
in
4th Assignment in Myanmar

Yangon, Nov. 22, 2001

U Soe Myint Lwin
Leader of Counterpart,
Deputy Chief Engineer of
Planning Department
Myanma Electric Power Enterprise

Akio Katayama
Team Leader of
JICA Study Team

Minutes of Meeting
in
4th Assignment in Myanmar

Date : Nov. 22, 2001
Time : 10:30 - 15:00
Place : Meeting Room in MEPE LDC

1. Presentation for Progress Report-1

The JICA Study Team explained the following study results for the Guidelines and the three priority Development Projects described in the Progress Report-1:

(1) The Guidelines	Presented by Mr. Katayama
(2) Development Plan of Heho Small Hydro Scheme	Presented by Mr. Kanai
(3) Development Plan of Nam Lan Mini Hydro Scheme	Presented by Mr. Kanai
(4) Development Plan of Biomass-Gas Engine Scheme	Presented by Mr. Katayama
(5) Selection of Pilot Project	Presented by Mr. Katayama
(6) Study Schedule	Presented by Mr. Katayama

2. Discussion

The discussion between the Counterpart Team and the Study Team is summarized below:

(1) The Counterpart Team agreed with the technical matters presented in the Progress Report-1.
(2) The Counterpart Team stated that the proposed organization with the RE Department to be newly established in MEPE and the operation of the RE Fund involving MADB proposed by the Study Team should need further examination on the Myanmar side and approval by the Cabinet of SPDC.
(3) The Counterpart Team is considering to establish the RE Department under the Planning Department of MEPE, however, it will be finalized through discussion with DEP.
(4) The Counterpart Team agreed that the Nam Lan Mini Hydro Scheme proposed by the Study Team be the Pilot Project to be implemented in FY-2002 since the Scheme is suitable for the Pilot Project for the rural electrification in every aspect. The final decision for selection of the Pilot Project will require an approval of the Minister.
(5) Both parties agreed that the Draft Implementation Agreement of the Pilot Project

between MEPE and JICA would be prepared by the Study Team to specify the conditions that should contain the scope of the works, obligations of each party, and the responsibility on the Myanmar side for land compensation, tax payment, customs clearance, etc. MEPE will be responsible for the procedures for confirmation of the villager's consensus, the land acquisition, and getting an approval of the Minister prior to implementation of the Project. In addition, MEPE will obtain permission for the Work Shop at Nam Lan village to be held on 10 ~ 11 March 2002 after getting approval of the Minister.

(6) The both parties understood the high potential of the Heho Small Hydro Project to be pursued for early implementation, while the Development Plan of Biomass-Gas Engine Project would be applied to the other grant schemes by NGO with the assistance of the Study Team.

MINUTES OF MEETING
FOR
THE CONSULTATION STUDY
ON
STUDY ON INTRODUCTION OF RENEWABLE ENERGIES TO RURAL AREAS
IN
THE UNION OF MYANMAR

AGREED UPON BETWEEN

JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE MINISTRY OF ELECTRIC POWER

YANGON, THE UNION OF MYANMAR, AUGUST 23, 2002

H. Kurakata

Mr. KURAKATA Hiroshi
Leader, Consultation Study Team
Japan International Cooperation Agency
Japan

Thein Tun 23/8

Dr. Thein Tun
Director General
Department of Electric Power
Ministry of Electric Power
The Union of Myanmar

The Consultation Study Team (hereinafter referred to as "the Team") sent by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Mr. KURAKATA Hiroshi, had a series of discussions for "the Study on introduction of renewable energies in rural areas in Myanmar" (hereinafter referred to as "the Study") with the officials of the Department of Electric Power, the Ministry of Electric Power (hereinafter referred to as "DEP"), Myanmar Electric Power Enterprise (hereinafter referred to as "MEPE") , a state owned utility responsible for generation, transmission and distribution of electric power in Myanmar from August 22 to August 23, 2002. Discussions were conducted in a friendly and cordial atmosphere, and both sides agreed to record the following points as summarized conclusion of the discussions.

1. Basic agreement on the plan for the Study phase 2

The Team proposed the following alternatives for the future plan of the Study phase 2 and both sides agreed to choose the alternative (1) which will be agreeable to the Ministry.

(Alternatives proposed by the Team)

(1) To prepare a manual for proper operation, maintenance, organization, and tariff system by monitoring of existing Small Hydropower Plant
(2) To prepare a manual for proper operation, maintenance, organization, and tariff system by implementing a pilot project of Rice Husk Gas Engine Generator
(3) To terminate the Study

2. Purpose of the Study phase 2

Both sides agreed that the main purpose of the Study phase 2 is to prepare a manual for proper operation and maintenance of Small Hydropower Plant by monitoring the existing Small Hydropower plant.

3. Criteria for the choice of target site

Both sides agreed to choose the target site for monitoring among those, which meet every criteria, described bellow.

(Criteria for the choice of target site)

(1) Capacity of the plant should be less than approximately 1MW.
(2) The plant should be operated in a proper condition without any disorder.
(3) The plant should not be connected to the Interconnected Grid.

4. Selection of target site for monitoring

The Myanmar side submitted the list of the existing Small Hydropower plants (Appendix 1), and explained that the following plants should be prioritized. The Team took note of the suggestion regarding the priority.

- Hhopin Ga Lang Chung (1,260KW)
- Zi Chaung (1,260KW)
- Ba Htu Tut Kyi (1,200KW)

The Team explained that the target site for monitoring should be selected taking into account the result of the socioeconomic survey of the area around the site.

5. Revised tentative schedule

Both sides draw up the Table for the Revised Tentative Schedule (Appendix 2) in unanimous cooperation.

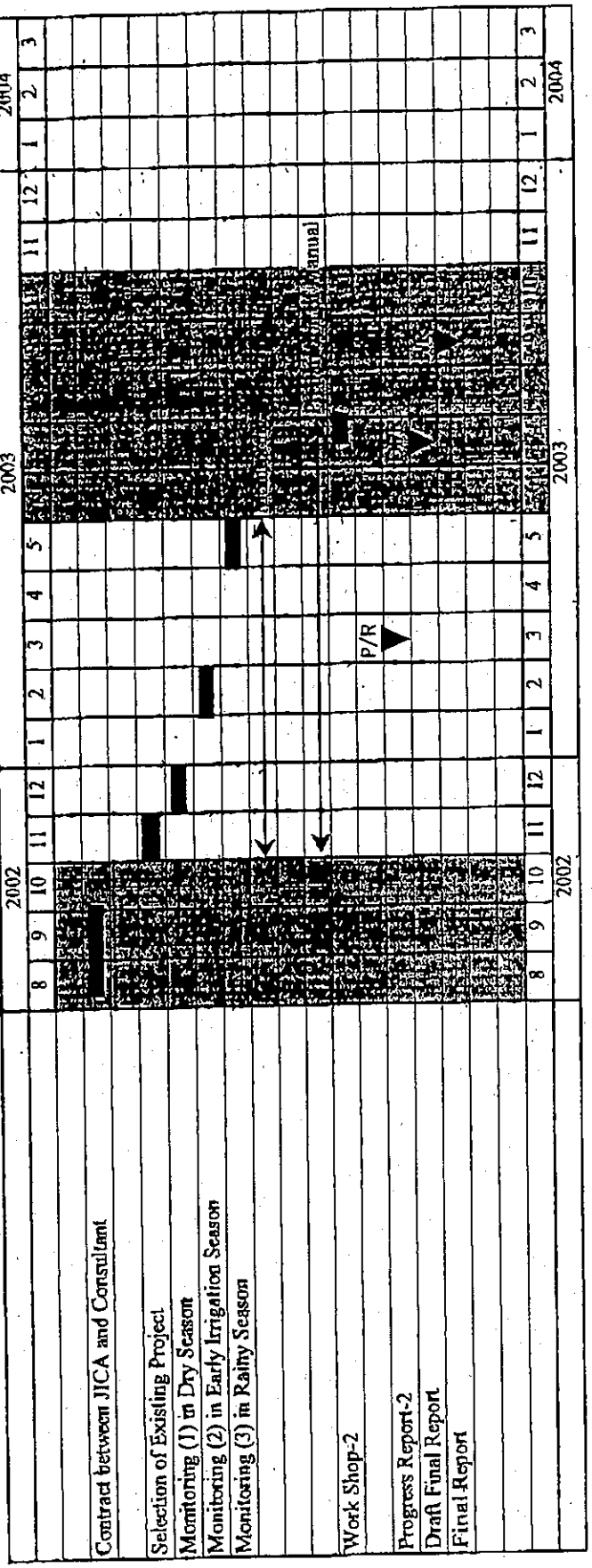
6. Request for Equipment

Myanmar side requested to provide necessary equipment for maintenance and inspection of the Plant. The Team replied that the issue would be considered in the process of the Study considering the budgetary allocation.

Small Hyder Installed Capacity (2002 - 2003)

Sr. No.	Name of Power Stations	Installed Capacity (.KW)
1	Kheng Kharan Kha	2520.00
2	Nam Khan Kha	5000.00
3	Putao	160.00
4	Hhopin Ga Lang Chaung	1260.00
5	Pha Saung	108.00
6	Pha Pon	49.00
7	Chi Chaung	200.00
8	Nga Sit Bar	1000.00
9	Za Lwei	400.00
10	Htwi Chaung	200.00
11	Daung Bar	400.00
12	Nam Laung	200.00
13	Line Bar	600.00
14	Thin Thwel	50.00
15	Zi Chaung	1260.00
16	La Hei	50.00
17	Katalu	150.00
18	Mali	192.00
19	Mogok	4000.00
20	Wet Wun	450.00
21	Zin Kyaik	198.00
22	Kun Hein	150.00
23	Ba Htu Tut Kyi	1200.00
24	Nam Latt	480.00
25	Nam Wok	3000.00
26	Nam Kham	200.00
27	Nam San Chaung	500.00
28	Nam Sam Ngaung	4000.00
29	Nam Mhaw	4000.00
30	Tone Kham	225.00
31	Pa Chet Haw	300.00
32	Mae Pan	1200.00
33	Se Lu	12.00
34	Mine Lar	30.00
Total		**33744.00**

Revised Tentative Schedule



List of the Members

(JICA Consultation Study Team)
Mr. KURAKATA, Hiroshi
Team Leader, Director, the Energy and Mining Development Study Div., JICA
Mr. TATEMATSU, Shingo
Study Planning, Program Officer, Energy and Mining Development Study Div., JICA

(JICA Myanmar Office)
Mr. SATO, Toshiya
Assistant Resident Representative
U Maung Maung Than
Programme Officer

(DEP)
Dr. Thein Tun
Director General
U Saw Win
Deputy Director General
U Aung Khaing
Superintending Engineer
U Kyaw Tin
Deputy Director

(MEPE)
U Soe Myint Lwin
Deputy Chief Engineer (Planning)
U Cho Aye
Deputy Chief Engineer (Planning)
U Ye Win
Superintending Engineer
U Ba Ngwe
Superintending Engineer
U Myo Aung
Executive Engineer
Daw Hnin Hnin Aye
Executive Engineer

Introduction of Renewable Energies in Rural Areas in Myanmar

Minutes of Meeting
in
5th Assignment in Myanmar

Yangon, Mar. 13, 2002

U Soe Myint Lwin
Leader of Counterpart,
Deputy Chief Engineer of
Planning Department
Myanma Electric Power Enterprise

Akio Katayama
Team Leader of
JICA Study Team

Minutes of Meeting
in
5th Assignment in Myanmar

Date : Mar. 08, 2002
Time : 14:00 - 20:30
Place : MEPE Headquarters and Mandalay Room at Hotel Nikkou

1. Workshop in Yangon

The JICA Study Team held the Workshop in Yangon to explain and discuss the Guidelines and the three priority Development Projects described in the Interim Report that was submitted in February 2002. The presentation was made by the Study Team for the following items:

(1) The Guidelines
(2) Development Plan of Heho Small Hydro Scheme
(3) Development Plan of Nam Lan Mini Hydro Scheme
(4) Development Plan of Rice Husk Gas Engine

2. Discussion

The discussion between the Counterpart Team and the Study Team is summarized below:

(1) The Counterpart Team agreed with all the contents in the Guidelines and the Development Plans presented in the Interim Report except the implementation of the pilot project.
(2) Both parties agreed that the RE section would be established under the Planning Department of MEPE to promote the rural electrification.
(3) The Counterpart Team stated that he wishes to implement a pilot project anyhow. Also he requested it would be supervised by the JICA Study Team by stationing the responsible resident engineer in order to transfer knowledge especially in the civil design fields through the project implementation. MEPE would not be able to dispatch respective engineers who have sufficient experience to supervise the construction since experienced MEPE engineers have been assigned to ongoing Generation Expansion Project except for junior staff who need intensive on-the-job training and knowledge transfer by JICA Team when a pilot project is commenced.

(4) The Counterpart Team requested the Study Team to submit 1,000 copies of the Visual Guide to deliver them to the Township Engineers and the relevant organizations for spreading of the rural electrification.

ATTENDANCE LIST

Date : 08 March 2002

Place : MEPE Headquarters / Hotel Nikkou

Subject : Workshop for Guidelines and Priority Projects

No.	Name	Title	Signature
1	U SOE MYINT LWIN	DY CE (Planning)	8/3/2002
2	U Kyaw Kyaw	Dy. Director	
3	U Soe Bin	Dy Director (Finance)	
4	U Kyaw Tin	Dy Director	
5	Daw Min Min Than	S.E (Planning)	
6	U Khin Maung Htay	Assistant Director	
7	H. ICANA 1	JICA Study Team	
8	A. Katayama	JICA Team Leader	
9	T. Kadono	JICA Study Team	
10	U Win Kyi	MEPE. (CE)	
11	U Naing Win	SE (Hydel)	
12	Y. Nakagawa	JICA Study Team	
13	Dr. Thein Tun	D.G, DEP	
14	U Yan Naing	MD, MEPE	
15	U Win Kyaw	DG, DHP	
16	U Bi Liang San	SE, DHP	
17	U Ba Si	SE, DHP.	
18	Daw Hnin Hnin Aye	E.E(b), Planing.	
19	U Myint Than	Asl. Director, DEP	
20	U Wan Kyi	SE, DHP	
21	Dr. San Oo	C.E	

ATTENDANCE LIST

Date : 08 March 2002

Place : MEPE Headquarters / Hotel Nikko

Subject : Workshop for Guidelines & Pilot Projects.

No.	Name	Title	Signature
22	R HARRIS	JICA STUDY TEAM INSTITUTIONAL EXPERT	
23	Moe Shwe Sym Naing	JICA-Study Team	
24	U NAING MOE	GAS TURBINE, MEPE	
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Introduction of Renewable Energies in Rural Areas in Myanmar

Minutes of Meeting
on
Site Selection for Monitoring

Yangon, December 3, 2002

U Soe Myint Lwin
Leader of Counterpart,
Deputy Chief Engineer of
Planning Department
Myanma Electric Power Enterprise

Akio Katayama
Team Leader of
JICA Study Team

Minutes of Meeting
in
6th Assignment in Myanmar

Date : December 3, 2002
Time : 14:00 – 15:00
Place : DyCE's office in MEPE

1. Site Selection for Monitoring

The JICA Study Team and the MEPE Counterpart Team discussed the results of the field inspection of the following sites together with their findings obtained through inspection of the 4 more existing small hydros of MEPE visited in 2001.

Small Hydros of MEPE

(1) Hopin (1,260 kW), Hopin, Kachin State
(2) Nam Khan Kha (1,250 kW x 4), Moe Gaung, Kachin State
(3) Zi Chaung (1,260 kW), Kalaymyo, Sagaing Division

As presented in the paper attached, the following sites are jointly selected for the forthcoming Monitoring, by the JICA Study Team and the MEPE Counterpart Team:

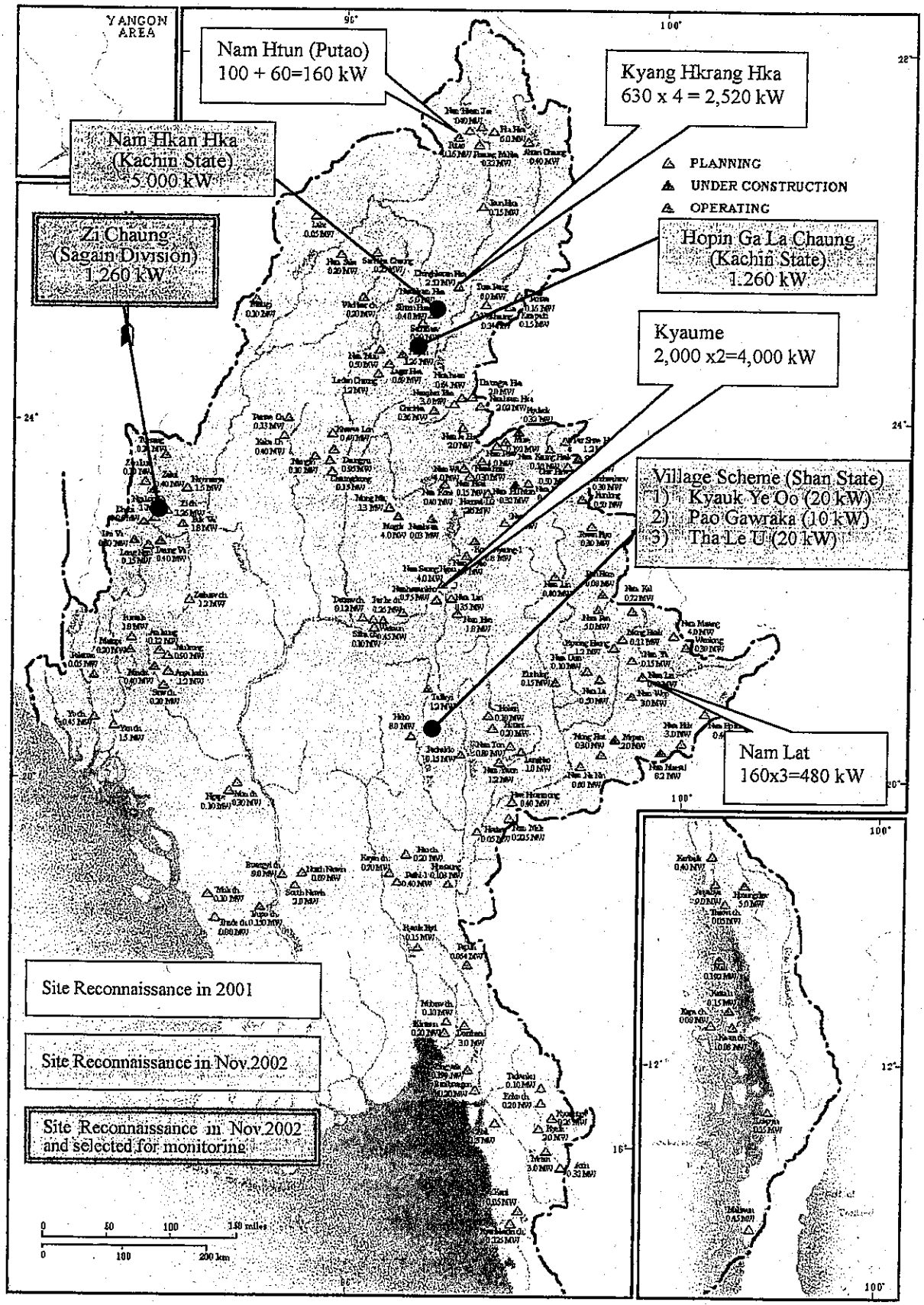
- Zi Chaung Small Hydro (1,260 kW) of MEPE in Kalaymyo, Sagaing Division

The MEPE Counterpart Team strongly requested that the measures found necessary to improve the present operation and maintenance be implemented as part of the Monitoring in addition to preparation of the Manual including such measures. The JICA Study Team took note.

Also it is agreed not to monitor, under the JICA Study, the micro hydros of Village Schemes since these are private sector activities and not under the administration and control by MEPE at the present time.

Attachments:

1. Location Map
2. Project Brief Sheet of Zi Chaung Small Hydro
3. A paper on "Selection of Monitoring Site for Preparation of Manual"
4. Project Brief Sheets of the other 6 projects of MEPE

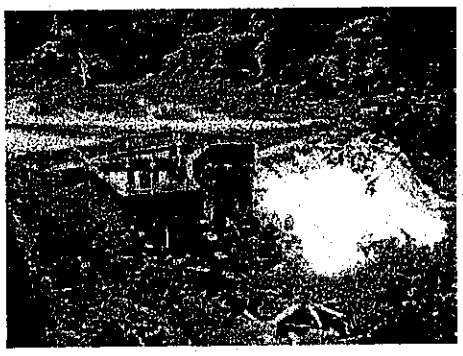


Location Map of Candidates for Existing Power Stations as Monitoring Sites

Zi Chaung Existing Hydropower Station

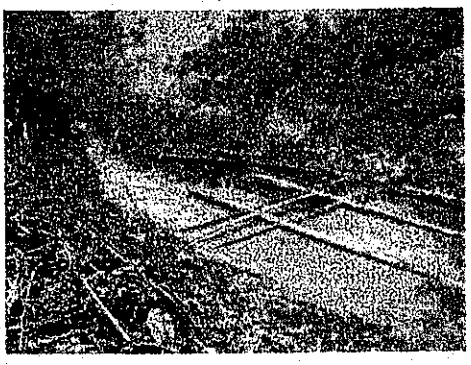
Inspection date	28-29 Nov 2002
Location	Kalaymyo Township, Sagain Division
Commissioning	Sep. 1996
Waterway	2.0 m(B) x 1.5 m(H) x 3,581 m(L)
Regulating Pond	9,600 m^3
Penstock	ϕ1.2 m x 90 m x 1 line
Installed capacity	630 kW x 2 units = 1,2600 kW
Head	H = 39.6 m
Discharge	Q = 2.12 x 2 = 4.24 m^3/sec
Turbine	Francis type with horizontal shaft, made in China
Transmission line	11 kV – 14.5 km
Project cost	115 x 10^6 Kyats
Present conditions	(1) Water leakage through holes of casing of No. 1 unit (2) Meters for generating equipment are malfunctioning (3) Severe corrosion on spiral casings (4) Sediment problem due to high velocity in the waterway

Forebay

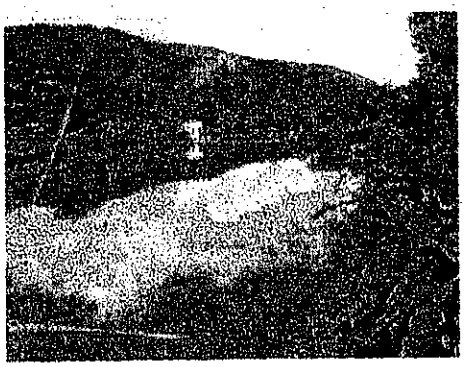


Intake & Weir

Trashracks



De-silting Basin



Regulating Pond

Generating Equipment

Selection of Monitoring Site for Preparation of Manual

3.12.2002

1. The target users of the Manual are MEPE engineers and administrators while potential users would include independent hydro experts, NGOs, and villagers who are interested and engaged in survey, planning, design, and operation & maintenance of small hydros (<10 MW).

2. The Manual will be prepared through monitoring of one of the existing small hydros of MEPE. The key criteria for selection are:

   - The installed capacity is in an order of 100 kW to MW class.
   - The station is not connected to the nationwide grid of MEPE.
   - The station is in operation.
   - There is no security issue.
   - The station may have some issues in design and O&M that would be common to many of the small hydros in Myanmar.

3. Through comparison of the three sites (Hopin, Nam Khan Kha, and Zi Chaung) as presented in Table 1, the JICA Study Team and MEPE Counterpart Team have jointly selected the Zi Chaung Hydro for monitoring and preparing the Manual. The Zi Chaung Hydro has the following themes in operation and maintenance:

   - Intake needs design review for reducing sediment inflow.
   - Headtank needs water level gauge for peak power generation during the dry season.
   - Governors need some adjustments and improvement.
   - Parallel operation with diesel generators is needed and essential to save fuel consumption while reinforcing the supply capacity.

   The first three issues above are almost common to all the small hydros in Myanmar as observed and identified through the inspection of 7 small hydros of MEPE since January 2001. The last issue is observed also in many places in Myanmar and will, if achieved, contribute to saving fuel expenditures of MEPE for rural electrification.

3. Conclusion

   The following will be monitored and reported to MEPE:

   - Zi Chaung Small Hydro (1,260 kW) in Kalaymyo, Sagaing Division