

**Japan International Cooperation Agency
Ministry of Industry, Mines and Energy (MIME)
Electricity Authority of Cambodia (EAC)
Kingdom of Cambodia**

**The Follow-up Study
on
the Establishment of the Specific
Requirements for Electric Power
Technical Standards on Hydropower
for
the Study for Establishment of Electric
Power Technical Standards and Guidelines
in
The Kingdom of Cambodia**

**Final Report
(Main Report)**

October 2009

**Electric Power Development Co., Ltd.
Tokyo, Japan
The Chugoku Electric Power Co., Inc.
Hiroshima, Japan**

PREFACE

In response to a request from the Royal Government of Cambodia, the Government of Japan decided to conduct the Follow-up Study on the Establishment of the Specific Requirements for Electric Power Technical Standards on Hydropower for the Study for Establishment of Electric Power Technical Standards and Guidelines, and the study was implemented by the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Shigeru Nakamura of Electric Power Development Co., Ltd. (J-POWER), and consisted of J-Power and the Chugoku Electric Power Co., Inc. to the Kingdom of Cambodia four times from November 2008 to August 2009.

The study team held discussions with the officials concerned of the Royal Government of Cambodia, Electricity Authority of Cambodia and Electricite du Cambodge, and conducted related field surveys and studies. Upon returning to Japan, the study team compiled the final results in this report.

In the Study, the draft of “Specific Requirements for Electric Power Technical Standards on Hydropower” was developed in such a manner that it maintains conformity to the existing electric power technical standards and the relevant laws and regulations in the Kingdom of Cambodia as well as it provides with stipulations suitable to the conditions in the Kingdom of Cambodia. The developed Technical Standards consist of four parts; “Part 1: General Provisions”, “Part 2: Civil Structures and Hydromechanical Equipment”, “Part 3: Electrical Equipment” and “Part 4: Examination and Inspection”.

I hope this report will contribute to a prompt promulgation of “Specific Requirements for Electric Power Technical Standards on Hydropower” and appropriate enforcement of Electric Power Technical Standards in the Kingdom of Cambodia as well as to enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Royal Government of Cambodia for their close cooperation throughout the study.

October 2009

Atsuo Kuroda
Vice President
Japan International Cooperation Agency

October 2009

LETTER OF TRANSMITTAL

Mr. Atsuo Kuroda

Vice President

Japan International Cooperation Agency

Tokyo, Japan

We are pleased to submit to you the report on “the Follow-up Study on the Establishment of the Specific Requirements for Electric Power Technical Standards on Hydropower for the Study for Establishment of Electric Power Technical Standards and Guidelines in the Kingdom of Cambodia”. This study has been conducted by Electric Power Development Co., Ltd. in association with the Chugoku Electric Power Co., Inc. under a contract to JICA in a period from October 2008 to October 2009.

The draft of “Specific Requirements of Electric Power Technical Standards for Hydropower Facilities”, of which the prompt enforcement is desired in the Kingdom of Cambodia, was prepared in the Study together with the draft of Explanation Sheet and Glossary for guiding the application of the Technical Standards. The Study Team dedicated its efforts to develop such Technical Standards that contribute to public safety, stable power supply and environmental conservation under the current situation and future status of the electric power sector in the Kingdom of Cambodia.

We trust that “Specific Requirements for Electric Power Technical Standards on Hydropower” will be promptly promulgated based on the output of the Study, and it will contribute to the sound implementation of hydropower projects in the Kingdom of Cambodia.

We would like to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Economy, Trade and Industry of the Government of Japan. We are also most grateful for the cooperation and assistance from the officials and personnel concerned in the Royal Government of Cambodia, Electricity Authority of Cambodia, Electricite du Cambodge and the related agencies.

Very truly yours,

Shigeru Nakamura

Team Leader,

Follow-up Study on the Establishment
of the Specific Requirements for
Electric Power Technical Standards on
Hydropower for the Study for
Establishment of Electric Power
Technical Standards and Guidelines in
the Kingdom of Cambodia

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ABBREVIATIONS

Abbreviation	Description
CDC	Cambodia Development Council
DIME	Department of Industry, Mines and Energy
EAC	Electricity Authority of Cambodia
EDC	Electricite du Cambodge
EIA	Environmental Impact Assessment
F/S	Feasibility Study
GREPTS	General Requirements on Electric Power Technical Standards
IA	Implementation Agreement
IEC	International Electrotechnical Commission
IPP	Independent Power Producer
JICA	Japan International Cooperation Agency
KEPCO	Korea Electric Power Corporation
kW	Kilo Watt
kWh	Kilo Watt hour
MAFF	Ministry of Agriculture, Forestry and Fisheries
MEF	Ministry of Economy and Finance
MIME	Ministry of Industry, Mines and Energy
MLMUPC	Ministry of Land Management , Urban Planning and Construction
M/M	Minutes of Meeting
MOE	Ministry of Environment
MOU	Memorandum of Understanding
MOWRAM	Ministry of Water Resources and Meteorology
MPWT	Ministry of Public Works and Transport
MRD	Ministry of Rural Development
NGO	Non-Governmental Organization
ODA	Official Development Assistance
PPA	Power Purchase Agreement
Pre-FS	Pre-Feasibility Study
REE	Rural Electricity Enterprise
SREPTS	Specific Requirements on Electric Power Technical Standards
WB	World Bank

CHAPTER 1
INTRODUCTION

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Chapter 1 Introduction

1.1 Outline of the Study

The Follow-up Study (hereinafter referred to as “the Study”) on the Establishment of the Specific Requirements for Electric Power Technical Standards on Hydropower for the Study for Establishment of Electric Power Technical Standards and Guidelines has been carried out since October 2008 under the Minutes of Meeting (hereinafter referred to as “the M/M”) dated June 25, 2008 between Japan International Cooperation Agency (hereinafter referred to as JICA), and Ministry of Industry, Mines and Energy (hereinafter referred to as MIME) and Electricity Authority of Cambodia (hereinafter referred to as EAC) in the Kingdom of Cambodia (hereinafter referred to as “Cambodia”). MIME and EAC as well as Electricite du Cambodge (hereinafter referred to as “EDC”) have played the role as the counterpart agencies of the Study.

This Final Report describes the outcomes of the First to Third Field Works performed in Cambodia by the JICA Study Team during the period from November 2008 to August 2009, and outline of the development approach and the contents of the draft of Specific Requirements of Electric Power Technical Standards for Hydropower (hereinafter referred to as “SREPTS for Hydropower”) as well as its Explanation Sheets and Glossary, which have been developed based on the outcomes in the Field Works and Home Works.

1.2 Background of the Follow-up Study

In Cambodia, EAC which plays roles in the licensing procedure, and regulation and supervision of power supplier, was established based on the Electricity Law promulgated on February 2, 2001. In this Law, it was set up that electric power service providers have to abide by the Electric Power Technical Standard issued by MIME. However, since the Technical Standard had not been prepared at that time, JICA conducted “the Study for Establishment of the Electric Power Technical Standards and Guideline in Cambodia” from June 2002 to February 2004. In this study, the General Requirements of Electric Power Technical Standard (hereinafter referred to as “GREPTS”) was prepared. Then GREPTS was promulgated as a ministerial regulation in July 2004.

It was imperative for EAC, as the regulatory agency, to improve itself and prepare specific requirements for the standard so that GREPTS would be widely followed by power business enterprises. Under such circumstances, JICA conducted “the Technical Assistance Project for Capacity and Institutional Building of the Electric Power Sector in Cambodia” through the period from September 2004 to September 2007. In the Project, the draft Specific Requirements of Electric Power Technical Standards (hereinafter referred to as “SREPTS”) for Thermal Power Generating Facilities and Transmission and Distribution Facilities were prepared as they were important and required urgently at that time. These SREPTSs were promulgated by MIME as ministerial regulations in July 2007. As a result, EAC improved its processing capabilities. However, SREPTS for Hydropower has not been prepared so far.

On the other hand, hydropower development in Cambodia has been growing against the backdrop of rapid growth of domestic power demand at around 20% a year in these five years. Foreign IPPs, for example from China, Vietnam and South Korea, and domestic IPPs have already planned development of hydropower projects, and some of them are under operation or implementation. However, EAC is currently in the situation that it cannot execute licensing and facility inspection procedures with uniform, compatible and transparent standards, because the SREPTS for Hydropower has not been prepared yet.

In these circumstances, the Government of Cambodia requested the Government of Japan to conduct “the Follow-up Study on the Establishment of the Specific Requirements for Electric Power Technical Standards on Hydropower for the Study for Establishment of Electric Power Technical Standards and Guidelines”. Then the Study was commenced by JICA Study Team in October 2008 under the Minutes of Meeting dated June 25, 2008 between JICA, and MIME and EAC.

1.3 Objectives of the Study

The Study is to be conducted aiming at the following two (2) major objectives which were agreed in the M/M signed on June 25, 2008 between JICA and MIME/EAC for sound implementation of hydropower development in Cambodia.

- Establishment of Specific Requirements on Electric Power Technical Standards (SREPTS) for Hydropower which covers the fields of civil engineering works, hydromechanical works, electrical works and electro-mechanical works for hydropower projects
- Improvement of capability of EAC, which is regulatory agency for licensing procedures on hydropower projects, through the Study for establishment of SREPTS for Hydropower

1.4 Scope and Schedule of the Study

The Study has been carried out for the power sector in Cambodia based on the scope and schedule described in the M/M of June 25, 2008 between JICA and MIME/EAC. The agreed Scope of the Study agreed in the M/M covers the items listed below:

- (1) Collection and analysis of following data
 - Actual condition of hydropower installations and other related facilities
 - Construction, operation and maintenance records
 - Licensing procedure and system of hydropower project
- (2) Confirmation of contents of GREPTS, existing SREPTS and other related materials
- (3) Preparation of draft SREPTS on hydropower in English
- (4) Support translation of the drafted SREPTS on hydropower into Khmer
- (5) Holding seminar for explanation of SREPTS on hydropower target at parties concerned

The Study Team carried out the Study during the period from the commencement in October 2008 to the submission of Final Report in October 2009.

1.5 Counterpart Agencies

The Study has been implemented with MIME and EAC which are the two original counterpart agencies of the Study as the signers in the M/M of June 25, 2008 with JICA.

EDC, which is in charge of construction, operation and maintenance of the major power generation, transmission and distribution facilities in the power systems of Cambodia, has been also an important agency relating to the Study and, therefore, EDC has taken part in the Workshops and the activities of Working Groups in the Study.

1.6 JICA Study Team

The names and positions of the member of JICA Study Team are shown in **Table 1.6-1**.

Table 1.6-1 List of Members of JICA Study Team

Name	Position
Shigeru NAKAMURA	Team Leader / Institutional Framework
Yutaro MIZUHASHI	Hydropower Civil Engineering (Dam)
Hajime BUTSUHARA	Hydropower Civil Engineering (Waterway and Powerhouse)
Tatsuya KUNISHI	Hydropower Civil Engineering (Hydromechanical Equipment) (for the First and Second Field Work in Cambodia)
Akira IRIE	Hydropower Civil Engineering (Hydromechanical Equipment) (for the 2.5 th and Third Field Work in Cambodia)
Masafumi IORI	Electrical Engineering (Electrical Equipment) (for the First Field Work in Cambodia)
Hideaki MORISHITA	Electrical Engineering (Electrical and Electromechanical Equipment) (for the Second and Third Field Work in Cambodia)
Eiji TSUCHIYA	Electrical Engineering (Control System)
Hitomi OHASHI	Coordinator (for the First and Second Field Work in Cambodia)
Ryuichi SHINODA	Coordinator (for the Third Field Work in Cambodia)

1.7 Basic Policy for the Study

The Study for preparation of the draft SREPTS for Hydropower has been conducted with the following basic policies:

- (1) To maintain compatibility and consistency with the existing GREPTS, SREPTSs and relevant laws/regulations
- (2) To prepare the draft SREPTS for Hydropower with clear status and scope
- (3) To prepare the draft SREPTS for Hydropower and its Explanation Sheet suitable for the present situation of Cambodia
- (4) To develop the draft Glossary for the draft SREPTS for Hydropower in a practical manner

- (5) To support the translation work into Khmer to be performed mainly by the counterpart agency. The technology transfer shall be done by doing the translation work in cooperation with JICA Study Team. In this sense, the two Working Groups for civil work and electrical work formed by JICA Study Team, MIME, EAC and EDC shall be the main bodies for the translation work.

1.8 Composition of Final Report

This Final Report has been prepared with the composition and contents as follows:

“Chapter 1 Introduction” summarizes the outline of the Study by JICA Study Team. At the end of Chapter 1, “Section 1.9 Summary of Study Output” describes summary of outcomes obtained through the Study.

“Chapter 2 Policies and Future Plans on Power Sector in Cambodia” describes outlook of the current status, policies and future plans for development of the power sector in Cambodia in which SREPTS for Hydropower will play a role after its promulgation based on the draft prepared by the Study.

“Chapter 3 Enforcement Status of Existing GREPTS and SREPTS” describes the current framework and application status of the existing technical standards for electric power currently enforced in Cambodia. Then, “Chapter 4 Current Situation of Approval and Licensing System on Hydropower Business” describes the current framework and execution status of the approval and licensing system in the field of hydro electric power business which is closely related to the technical standards for hydropower. “Chapter 5 Current Situation of Existing Hydropower Facilities” describes the results of inspection and assessment on the situation of existing hydropower stations by the JICA Study Team in the view point of application of the SREPTS for Hydropower.

“Chapter 6 Basic Policies of the Study on SREPTS for Hydropower” discusses the major targets set in the Study on preparation of the draft SREPTS for Hydropower as well as the draft Glossary and the draft Explanation Sheet and basic policies and methodologies for achieving such targets in terms of technical and operational approaches.

“Chapter 7 Record of Activities during Field Works in Cambodia” describes the outline records of the Workshops, Working Group Meetings and Seminars conducted and performed in the First, Second, 2.5th and Third Field Works of the JICA Study Team. Then, “Chapter 8 Framework of Draft SREPTS for Hydropower” describes the contents and results of discussions on the major issues for preparation of the draft SREPTS for Hydropower made in the Workshops and Working Group Meetings during the First and Second Field Works.

“Chapter 9 Policy and Outline of Draft Glossary of SREPTS for Hydropower” describes the policy for preparation and outline of the draft Glossary which constitutes a part of the draft SREPTS for Hydropower. “Chapter 10 Policy and Outline of Draft SREPTS for Hydropower” describes the policy for preparation and outline of the text of draft SREPTS for Hydropower. Then, “Chapter 11 Policy and Outline of Draft Explanation Sheet of SREPTS for Hydropower” describes the policy for

preparation and outline of the draft Explanation Sheet which also constitutes a part of the draft SREPTS for Hydropower.

Finally, “Chapter 12 Recommendations on Improvement of Approval and Licensing System on Hydropower Business” discusses some recommendations regarding the measures for proper arrangement and implementation of flow or institutional framework of the approval and licensing system of hydropower business.

1.9 Summary of Study Output

The outcomes of the Study performed under the process, purposes and policies described in the previous sections of Chapter 1 are summarized as follows;

1.9.1 Preparation of Draft SREPTS for Hydropower (Chapter 6 to Chapter 11)

The following four (4) items are the considered to be the major issues in the Study for development of the draft SERPTS for Hydropower to be performed taking into consideration the current framework of the existing GREPTS and relevant laws and regulations as well as the objective of the Study:

Issue-1: To maintain compatibility and consistency with the existing GREPTS, SREPTSs and relevant laws/regulations

Issue-2: To clarify the status and scope of SREPTS for Hydropower

Issue-3: To prepare the draft SREPTS for Hydropower and its Explanation Sheet suitable for the present situation of Cambodia

Issue-4: To develop the draft Glossary for the SREPTS for Hydropower in a practical manner

As the result of the Study and discussions with the Cambodian side Counterpart Team taking account of the four issues listed above, the draft of SREPTS for Hydropower, Explanation Sheet and Glossary have been prepared in the manner described below.

(1) Draft Glossary of SREPTS for Hydropower

The draft Glossary of SREPTS for Hydropower was prepared in accordance with the basic policy explained below:

There are not so many existing hydropower facilities in Cambodia, so the Cambodian engineers and/or technicians do not have abundant experiences in design, construction, operation and maintenance of these facilities. Considering this situation, brief explanations are attached to the technical terms which appear in the SREPTS for Hydropower so that the member of Cambodian side counterpart team may understand names, contents of design standards of hydropower facilities and phenomena which occur in those facilities, and may translate those terms into Khmer more easily. At the request of the Cambodian side counterpart team, figures and photographs are attached to some technical terms to help them understand forms and functions of structures.

(2) Draft SREPTS for Hydropower

The draft SREPTS for Hydropower was prepared in accordance with the basic policy explained below:

- i) The draft SREPTS for Hydropower consists of the following four (4) parts including an independent Part for examinations and inspections as shown follows;
 - Part 1 : General Provisions;
 - Part 2 : Civil Structures and Hydromechanical Equipment;
 - Part 3 : Electrical Facilities; and
 - Part 4 : Examination and Inspection.
- ii) The draft SREPTS for Hydropower has been prepared so as to maintain consistency with the provisions of the existing GREPTS and SREPTS for Thermal Power and Transmission and Distribution Facilities in principle.
- iii) As the particular provisions, the flowing are prepared in Chapter 2 of Part 1;
 - Assignment of Chief Engineers
 - Environmental Protection (to comply with the existing environmental laws and regulations)
 - Order of Remedy for Conformance to Technical Standards
 - Obligation for Reporting
 - Safety and Technical Training
 - Exemptions for Small Projects
 - Exemptions for Projects under Implementation
 - Exemptions for Projects under Operation
 - Exception of Exemptions (for reporting, monitoring and inspections)
- iv) In “Part 2 Civil Structures and Hydromechanical Equipment,” “Chapter 4: Fundamental Requirements” are provided to describe provisions regarding fundamental requirements for preventing civil structure and hydromechanical equipment from threatening public safety. The provisions for structures and reservoirs as well as effect to downstream areas are provided from the following three viewpoints;
 - Facilities shall be safe against disasters,
 - Facilities shall be safe against loads, flow of water and change of flow rate, and
 - Facilities shall fulfill the required function.
- v) In “Part 3 Electrical Facilities”, the provisions are provided concerning the technical and safety requirements for electrical facilities in hydropower plants. In order to cover complete contents, Part 3 has been prepared, as the provisions for hydropower, so as to also cover the contents stipulated in the existing SREPTS for Thermal Power Facilities and Transmission and Distribution Facilities without contradiction with the existing SREPTS.

(3) Draft Explanation Sheet of SREPTS for Hydropower

The draft Explanation Sheet of SREPTS for Hydropower was prepared in accordance with the basic policy explained below:

The draft Explanation Sheet of SREPTS for Hydropower is prepared to explain meanings and backgrounds of provisions in the draft SREPTS for Hydropower to promote its understanding and to use it properly. The draft Explanation Sheet of the SREPTS for Hydropower describes backgrounds of main standards, technical terms which require an explanation to illustrate the point of the draft SREPTS, and the process which numerical values in the draft SREPTS for Hydropower were selected, while an explanation of technical terms which the JICA Study Team judged unnecessary was omitted. The composition of the draft Explanation Sheet is the same as the main body of the draft SREPTS for Hydropower so that its users can easily understand its contents considering users' convenience.

1.9.2 Recommendations on Improvement of Approval and Licensing System on Hydropower Business (Chapter 12)

Based on the information and results of discussions obtained through the Study, the following recommendations are proposed against the current status and issues of the approval and licensing system for electric power businesses:

- 1) Development of a guideline for the procedures for development and operation of hydropower projects from investigation to operation and maintenance including the following aspects:

As the contents of a procedure guideline mentioned above include the fields for which laws and regulations are already exist such as ones for execution of EIA, and plural number of governmental agencies are related to these issues, inter-organizational coordination is required among the related agencies for preparation of a procedure guideline.

- 2) Development of a manual for examination and inspection

In order to properly operate the provisions of examination and inspection in Part-4 of the draft SREPTS for Hydropower, it is recommended to develop a manual which clarifies the detailed procedures and methods of examination and inspection on hydropower facilities.

- 3) Development of safety and security guideline for workers of operation and maintenance at hydropower stations

The draft SREPTS for Hydropower stipulates the requirements for safety of hydropower facilities in principle. On the other hand, regarding the personal safety, it is recommended for the public sector to prepare a safety guideline as a standard document for proper preparation and operation of safety manual by individual power companies.

- 4) Capacity building for hydropower engineers of concerned agencies (MIME, EAC, EDC)

Sufficient experiences are required for technical judgments for hydropower stations and, therefore, qualified engineers who have capability in technical examination and evaluation.

However, the number of hydropower engineers, particularly in the field of civil engineering, is very limited in Cambodia. Therefore the capacity building for hydropower engineers of the concerned agencies would be an issue to be solved under the situation of expected progress of hydropower development.

5) Establishment of certification and registration system of qualified engineers

The general provisions in the draft SREPTS for Hydropower provides with an Article of assignment of chief engineers. In this connection, it is desirable to establish a system of registered engineers which determine procedures and conditions for registration and assignment of chief engineers.

Also, an Article of the draft SREPTS for Hydropower stipulates the obligation of owner to provide his engineers and technicians with safety and technical training. In this connection, it is desirable to establish a public system of qualification, certification and registration of engineers in order to maintain or improve technical level of the maintenance and operation staff and to maintain safety conditions of power stations continuously.

In particular, hydropower projects to be developed in the near future may have dams with spillway gates, and it is required that the operation of spillway gates, which are strongly related to the safety of downstream area, shall be done by a qualified operators in a responsible manner.

CHAPTER 2

POLICIES AND FUTURE PLANS ON

POWER SECTOR IN CAMBODIA

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Chapter 2 Policies and Future Plans on Power Sector in Cambodia

2.1 Organization of Power Sector in Cambodia

The Electricity Law of Cambodia, which was promulgated on February 2, 2001, covers all issues in the electric power business from the electric power supply services to the end use of electricity and defines the basic policies concerning operation of electric power business, conditions required for investment by private sector for development and operation, promotion on operation of electric power supply facilities by private sector, and the fundamental rules for competition in the power market. The Electricity Law provides MIME with the authorities to control the policy framework, strategic measures and framework planning for the power sector, and declared the establishment of EAC as an independent authority which should execute the responsibilities determined in the Electricity Law in order to achieve stable electric power supply services in nationwide areas. EDC is the largest electric power company in Cambodia who is operating the major power generation plants, transmission systems and power distribution systems in Cambodia. Moreover, some independent power producers (hereinafter referred to as “IPPs”) and the Rural Electricity Enterprises (hereinafter referred to as “REEs”) are operating power supply business in the power sector. **Fig. 2.1-1** below shows the organization framework of the power sector in Cambodia.

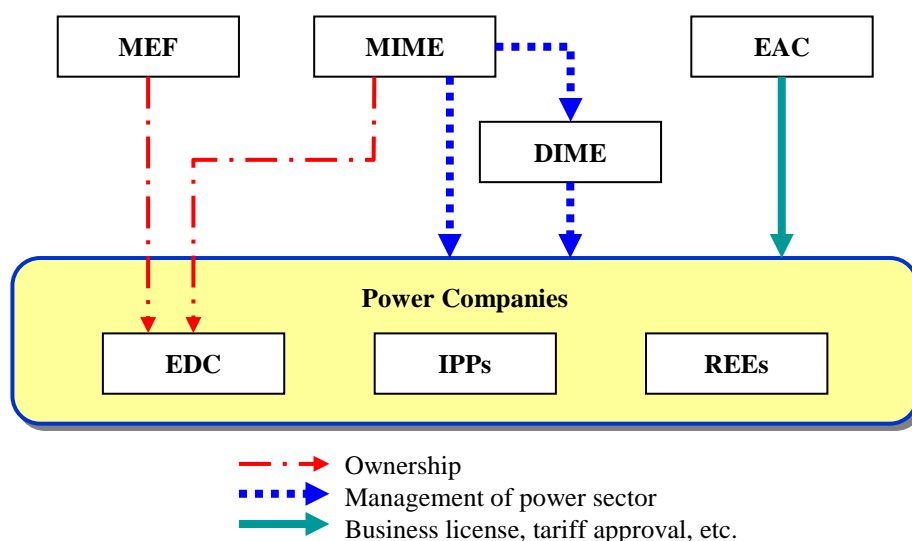


Fig. 2.1-1 Organization Framework of Power Sector

2.2 Current Status and Issues in Power Sector

2.2.1 Current Status of Power Sector

(1) Power Demand and Supply

As shown in the tables below, electricity demand in Cambodia is growing rapidly with annual growth rate of 21.5% for energy supply and 22.3% for peak power demand in average of 5 years from 2003 to 2007. In particular, the highest record of growth rate is being updated year by year and reached to 26.7% and 27.5% for energy supply and peak power demand respectively in 2007.

Table 2.2.1-1 Electric Energy Supply in the Past 5 Years by Supplier

Unit: GWh

	2003		2004		2005		2006		2007		Average
EPC Own Generation	165.29	273.30	65.3%	233.45	-14.6%	208.87	-10.5%	171.89	-17.7%	1.0%	
IPP (Sent-out)	456.24	450.85	-1.2%	625.13	38.7%	853.99	36.6%	1,141.27	33.6%	25.8%	
Consolidated	15.23	19.37	27.2%	20.79	7.3%	24.24	16.6%	36.16	49.2%	24.1%	
Import	58.27	59.49	2.1%	82.25	38.3%	109.70	33.4%	167.41	52.6%	30.2%	
Total	695.03	803.01	15.5%	961.62	19.8%	1,196.80	24.5%	1,516.73	26.7%	21.5%	

Source: EDC & EAC Annual Reports 2005, 2006 and 2007

Table 2.2.1-2 Peak Power Demand in the Past 5 Years by Group

Unit: MW

	2003		2004		2005		2006		2007		Average
EDC	115.70	136.60	18.1%	162.12	18.7%	201.92	24.5%	249.12	23.4%	21.1%	
a) Phnom Penh	100.90	116.30	15.3%	133.10	14.4%	165.00	24.0%	204.50	23.9%	19.3%	
b) Others ^{*1}	14.80	20.30	37.2%	29.02	43.0%	36.92	27.2%	44.62	20.9%	31.8%	
Consolidated	5.80	7.37	27.2%	7.91	7.3%	9.22	16.6%	13.76	49.2%	24.1%	
Import	13.30	13.58	2.1%	18.78	38.3%	25.05	33.4%	38.22	52.6%	30.2%	
Total	134.80	157.55	16.9%	188.81	19.8%	236.19	25.1%	301.10	27.5%	22.3%	

Source: EDC & EAC Annual Reports 2005, 2006 and 2007

Remark: *1 Demand of areas imported from Vietnam is included in the item of "Import"

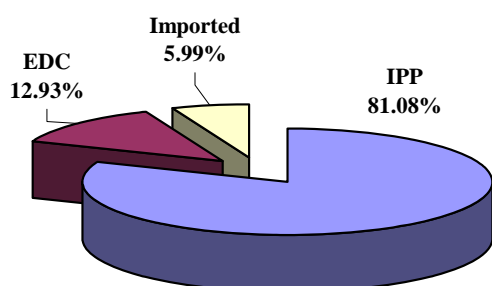
The total population of Cambodia is 14 million and 85% are the population in the rural areas. On the other hand, the household electrification rate is 60% in the urban area and only 12% in the rural area (overall average is around 20%). As the result, the population of urban areas, which shares only 15% of total population, is consuming 90% of national total electricity consumption. The Phnom Penh capital zone, in particular, shears 80% or more of national total electricity consumption, and the remarkable growth rate in the recent years, which is more than 20% annually, can be attributed mainly to the high growth of energy consumption in the Phnom Penh urban area.

The electricity generation record of Cambodia by supplier is shown in **Fig. 2.2.1-1**. The electricity purchased from IPPs shares 81% of the total electricity generation in Cambodia and EDC generates by his own power stations only 13% of electricity and the remaining are being supplied by the electricity imported from Thailand and Vietnam.

The electricity generation record of Cambodia by energy sources is shown in **Fig. 2.2.1-2**. The electricity generated by the power plants using imported oil such as heavy fuel oil and diesel oil plants shares as high as 90% of total energy generation in Cambodia, and this condition provides the power sector with unstable conditions in terms of energy security. The two (2) hydropower plants existing in Cambodia are generating only 4% of total electricity generation in Cambodia. Moreover, the dependable capacity of these hydropower plants decreases in the dry season, so that the power system cannot rely much on the hydropower plants.

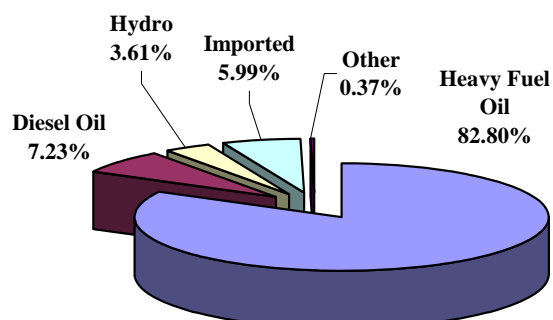
The balance between the power demand and supply is currently being achieved barely by purchasing energy from IPPs without maintaining sufficient reserve margin under the rapid growth of power demand over 20%/year. Also, the aged diesel power plants have been retiring since 2005 and the

power supply contract with some IPPs is to be terminated. Under these circumstances, it is required for the power sector of Cambodia to reinforce the supply capacity.



Source: Annual Report 2006, EAC

Fig. 2.2.1-1
Energy Generation by Supplier (2006)



Source: Annual Report 2006, EAC

Fig. 2.2.1-2
Power Generation by Source (2006)

(2) Electricity Tariff

Electricity tariff is at a high level in Cambodia compared with those in the neighboring countries. The average electricity tariff of EDC was as high as US¢18.2/kWh in 2007. This high tariff rate in Cambodia could be mainly attributed to the fact that the electric energy is being supplied mainly by small scale diesel generators which consume high price imported fuel as well as low efficiency of isolated power supply systems and high power losses in distribution networks. The average electricity tariffs of EDC are shown in the table below for each consumer group.

Table 2.2.1-3 Average Electricity Tariff by Consumer Groups of EDC

	2005		2006		2007	
	Riel/kWh	US¢/kWh	Riel/kWh	US¢/kWh	Riel/kWh	US¢/kWh
Residential	628.3	15.7	733.7	18.3	736.5	18.4
Industrial & Handicraft	464.9	11.6	733.4	18.3	692.1	17.3
Commercial	677.6	16.9	754.7	18.9	732.3	18.3
Hotel & Guest House	614.7	15.4	712.5	17.8	706.2	17.7
Embassy, Foreigners' House, NGO	824.6	20.6	873.8	21.8	887.2	22.2
Government Institutions	731.3	18.3	808.3	20.2	802.7	20.1
Others	416.6	10.4	467.7	11.7	459.1	11.5
Average	621.2	15.5	745.6	18.6	730.0	18.2

Source: EDC & EAC Annual Reports 2005, 2006 and 2007

In the above regard, it is strongly required for the power sector of Cambodia to develop or purchase cheaper electric energy from the available resources in the country or importing from neighbor countries.

2.2.2 Issues in Power Sector of Cambodia

As stated in 2.2.1, the electric energy consumption in Cambodia is showing remarkable growth due to recent economic growth, and under such circumstances, the Government of Cambodia understands that there are some issues to be considered in the power sector of Cambodia as listed below:

- 1) High electricity tariff due to lack of low cost power supply facilities
- 2) Low electrification rate at less than 20%
- 3) Low reliability of power supply

Therefore, it can be said that, in order to solve the above issues, strategic policy for reinforcement of power sector in Cambodia is required in view of the following matters:

- 1) To lower the electricity tariff for sound economic development for industrial and commercial sectors
- 2) To improve the electrification rate of the country for improvement of living standard of the people of Cambodia
- 3) To improve the reliability of power supply also for sound economic development for industrial and commercial sectors as well as for improvement of living standard

2.3 Policy and Strategy for Development of Power Sector

The Government of Cambodia set the policy of “Cambodia Power Sector Strategy 1999-2016” in 1999 under the support of World Bank in order to reinforce the power sector and solve the above mentioned issues. Since then, promotion of hydropower development has been one of the key policies for energy security and efficient use of domestic energy resources. However, only 13 MW of hydropower in total has been developed in Cambodia so far. This situation of a low hydropower development level achieved until now could be attributed to the disadvantage of hydropower comparing with diesel power plants in terms of required time and relatively high initial investment cost for development as well as distribution of potential areas which are generally located far from demand centers in case of hydropower. On the contrary, the thermal power plants of which more than 95% are diesel power plants have been installed until recently in order to catch up the rapid growth demand.

Under the circumstances mentioned above, it is recognized by the Government of Cambodia that the medium to large scale power development is required for stable power supply for the future. In this sense, the Government of Cambodia is promoting the power development by private sector with IPP scheme mainly implemented by foreign investors in order to overcome the lack of capital in the domestic power sector for development of medium to large scale power projects. Potential of hydropower in Cambodia is at a high level as much as 10,000 MW or more comparing the current total installed capacity of Cambodia which is around 300 MW. Taking into account this condition of domestic energy resource potential, hydropower development is set as one of the strategies to achieve the target of electrification in Cambodia.

On the other hand, the rural electrification strategy of Cambodia sets the target that all villages will have access to electricity with at least one of some different forms including access to mini-grid and off-grid electricity by the year 2020. In order to facilitate access to electricity supply at reasonable and affordable price in rural areas, the Government of Cambodia has established “Rural Electrification Fund” for enabling the development of power supply facilities in such areas. The objectives of the fund include to promote and encourage the private sector to participate in providing the sustainable rural electrification services. According to the “the Master Plan Study on Rural Electrification by Renewable Energy in Cambodia (June 2006, JICA), the maximum use of renewable energy including micro-hydropower was proposed to secure sustainability for source of energy. This study recommended the off-grid electrification with micro-hydro scheme for such mountainous or hilly areas where hydro potential is bigger than demand (village size) and village exists within an economic distance for transmission from the potential site as the most promising energy source for such areas. The 145 number of micro (0–500 kW) to mini-hydro (501 – 5,000 kW) potential sites in the capacity range from 1 kW to 2,585 kW were identified in this Master Plan study. Also, the objectives of Rural Electrification Fund for the four year term from 2006 to 2009 include provision of grant for development of 850 kW of micro-hydro and 6,000 kW of mini-hydro power plants.

2.4 Current Status of Hydropower Development Plans including IPP

2.4.1 Power Demand Forecast

According to the available power demand forecast in Cambodia prepared by MIME in 2007 based on the demand forecast by World Bank and KEPCO in 2006, the future peak power demand is expected as shown in the table below.

Table 2.4.1-1 Power Demand Forecast in Cambodia

(MW)

Year	Prepared by World Bank/KEPCO			Revised by MIME	
	Low Case	Base Case	High Case	Selected Case	Annual Average Increase
2005	134	134	134	129.96	-
2010	404	467	502	431.74	60 MW/year (2005-2010)
2015	768	1009	1155	1349.12	182 MW/year (2011-2015)
2020	1070	1610	1985	2400.88	210 MW/year (2016-2020)

Source: Power Development Master Plan, World Bank/KEPCO, MIME

According to the above table, it is required for the power sector of Cambodia to achieve annual average development capacity of more than 60 MW/year, 182 MW/year and 210 MW/year for the period from 2005 to 2010, 2011 to 2015 and 2016 to 2020 respectively. These development capacities are rather large compared with the current total installed capacity of 314 MW in Cambodia at the end of 2007 according to Annual Report of EAC. In this sense, strategic policy is required for the implementation of power development in Cambodia.

2.4.2 Available Resources for Hydropower Development

It was reported that the major natural resources for power generation available in Cambodia is the hydropower with potential of 10,000 MW or more according to the annual report of EAC for 2007. The potential of 10,000 MW is not of abundant compared with neighbor countries such as Vietnam and Lao PDR due to the topographic conditions of Cambodia in general. However, the hydropower capacity already developed in Cambodia is very limited to be only around 13 MW and 10,000 MW is large enough compared with the current total installed capacity of 314 MW in 2007.

2.4.3 Power Development Plan and Hydropower Development Plan

Power Development Plan (PDP) for 2008-2021 is shown in **Table 2.4.3-1**. According to PDP, power import from the neighboring countries such as Vietnam, Thailand and Lao PDR is planned with a high increasing rate. This will cause a high dependency on the imported energy and consequently a high risk in energy security. On the other hand, some hydropower projects such as Kamchay, Kirirom III, Stung Atay and Lower Russey Chrum are planned to be developed by IPPs for starting operation after the year 2013. Hence, 2,025 MW of the total capacity of hydropower projects planed to be commissioned by the year 2021 shares more than 55% of 3,676 MW, the overall total capacity of the projects on PDP for the years from 2008 to 2021. In summary, it is the strategic plan for the power sector of Cambodia to procure the required energy by the power import from the neighboring countries for the coming several years and, after that, to utilize hydropower, which is the major source of domestic renewable energy, as much as possible in parallel with development of coal thermal plants step by step. It shall be noted, however, that the development of Lower Se San II and Lower Sre Pok II projects is planned by the Vietnamese investor mainly for power export to Vietnam with a limited domestic supply.

Table 2.4.3-1 Power Development Plan (PDP) 2008-2021

Year	Power Station	Type	Expansion Capacity (MW)	System Capacity (High Case) (MW)	Peak Demand (MW)	Reserve Margin (%)
2008	SR-BB-BMC - Thai	Import	80	267	271	18.8
	Kampong Cham - Vietnam	Import	25			
2009	Phnom Penh - Vietnam (Increase)	Import	200	272	271	0.0
2010	Stung Treng – Lao PDR	Import	10	650	502	29.6
	Kamchay	Hydro	193			
	Kampong Cham - Vietnam	Import	10			
2011	Kirirom III	Hydro	18	650	561	15.9
	Coal SHV	Coal	100			
2012	Stung Atay	Hydro	120	977	719	36.0
	Caol SHV	Coal	100			
2013	Retirement - C3 (GM)	(DO)	3	1,026	800	28.4
	Coal SHV	Coal	100			
	Lower Russei Chrum	Hydro	338			
	Upper Ressei Chrum	Hydro				
2014	Coal SHV	Coal	100	1,203	979	22.9
2015	Stung Tatay	Hydro	246	1,382	1,155	19.6
	Coal SHV	Coal	100			
	Stung Treng – Lao PDR	Import	20			
	Kampong Cham - Vietnam	Import	22			
2016	Lower Se San II	Hydro	420	1,597	1,302	22.6
	Lower Sre Pok II	Hydro				
2017	Stung Chay Areng	Hydro	240	1,650	1,435	15.0
2018	Coal SHV	Coal	300	1,800	1,600	10.0
2019	Sambour	Hydro	450	2,110	1,746	20.8
2020	Kampong Cham - Vietnam	Import	31	2,567	1,985	29.3
2021	Coal/Gas SHV	Coal/Gas	450	2,567	2,195	16.9
Total		Import	398			
		Hydro	2,025			
		Coal	1,253			
			3,676			

Source: EDC Annual Report (2007)

CHAPTER 3

ENFORCEMENT STATUS OF

EXISTING GREPTS AND SREPTS

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Chapter 3 Enforcement Status of Existing GREPTS and SREPTS

3.1 Current Status of Electric Power Technical Standards

In Cambodia, the Electricity Law was promulgated on February 2, 2001 and, consequently, the institutional framework for approving and licensing of electric power businesses and for controlling and regulating electric power service providers has been established. Under this Law, the electric power service providers have to abide by the Electric Power Technical Standard issued by MIME. However, since the Technical Standard had not been prepared at that time, the draft GREPTS was prepared in February 2004 with cooperation of JICA, and based on the draft, the GREPTS was promulgated as a ministerial regulation of MIME in July 2004.

It became imperative for EAC, as the regulatory agency established under the Electricity Law, to improve itself and to prepare specific requirements for the electric power technical standard so that GREPTS would be widely followed by power business enterprises. Under such circumstances, the draft SREPTS for Thermal Power Generating Facilities and Transmission and Distribution Facilities, which were important and required urgently at that time, were prepared also with the cooperation of JICA, and based on the draft, these SREPTS were promulgated as a ministerial regulation of MIME in July 2007. As a result, EAC improved its processing capabilities. However, SREPTS for Hydropower, which is required under such circumstances that the development of hydropower is being promoted, has not been prepared so far.

3.2 Enforcement Status of GREPTS

General Requirements of Electric Power Technical Standards (GREPST) was prepared in cooperation with JICA and issued by MIME under “the Prokas (No.470) on Establishment of General Requirement of Electric Power Technical Standards of Cambodia” dated July 16, 2004 and promulgated on August 16, 2004. GREPTS covers the general provisions on technical standards for thermal power generating facilities, hydropower generating facilities, transmission and distribution facilities and house wiring. Some amendments were made on GREPTS under “the Prokas (No.796) on the First Amendment on the Prokas No.470, dated July 16, 2004 on the Establishment of General Requirement of Electric Power Technical Standards of Cambodia” dated August 9, 2007.

The GREPTS provides the principles of Electric Power Technical Standards and has the following main purposes:

- 1) To specify the technical, design, and operational criteria of Electrical Power Facility, House Wiring and Electrical Appliance,
- 2) To ensure that the basic rules for supply of electricity are fair and non-discriminatory for all Consumers of the same category, and

- 3) To maintain the technical standards (levels) of Electrical Power Facility, House Wiring and Electrical Appliance installed in Cambodia.

The GREPTS provides the following provisions in Clause 4 “Enforcement” and, therefore, the Specific Requirements of Electric Power Technical Standards (SREPTS) shall conform to these provisions.

- 1) All persons who are related to electric power supply, electrical works, use of electricity, manufacturing electric power facilities, trading in the facilities in Cambodia shall strictly follow the Technical Standards.
- 2) In planning of electric power projects, the feasibility studies shall be made to examine the long term technical, economical and financial viability, and social acceptability.
- 3) The design, manufacturing, assembling and procurement of power facilities should be such that the facilities can be operated with the designated performance for a long time.
- 4) During installation of the electric power facilities and equipment and construction of the facilities, enough attention shall be paid in selection of the materials and construction management during the construction work.
- 5) In operation and maintenance of the electric power facilities, enough attention for maintaining the required performance of the power facilities for long time and to protect the environment in the surrounding areas, shall be paid.
- 6) Licensees of power utilities shall employ qualified electrical engineers or technicians as appropriated for supervision, operation and maintenance of the power facilities as provided in the Technical Standards and other regulations.

3.3 Enforcement Status of SREPTS

As per Article 3 of “the Prokas (No.470) on Establishment of General Requirement of Electric Power Technical Standards of Cambodia” dated July 16, 2004, the Specific Requirements of Electric Power Technical Standards (SREPTS), that provides specific provisions in detail, is being prepared for the areas covered by GREPTS step by step in cooperation with JICA. Considering the immediate needs for development of power generating facilities, SREPST for thermal power generating facilities and transmission and distribution facilities was prepared as the first phase and issued by MIME for implementation under “the Prokas (No.701) on Establishment of Specific Requirements of Electric Power Technical Standards of Kingdom of Cambodia” dated July 17, 2007.

During the period from the promulgation of SREPTS for thermal power facilities and transmission and distribution facilities on July 17, 2007 until August 2008, EAC issued the 46 Consolidated Licenses, 7 Generation Licenses including one for Sinohydro Kamchay Hydroelectric Project Co., Ltd. issued on August 31, 2007, 5 Distribution Licenses, and 2 Special Purpose Transmission Licenses according to the information of EAC. These licenses include the condition that the licensee shall

abide the requirements in the existing technical standards. In this sense, the GREPTS and SREPTS are operated as a part of the licensing system. On the other hand, the licensing process to be conducted for verifying conformity of power facilities to the requirements in GREPTS and SREPTS is an issue for EAC. In this regard, as the safety and technical training being provided for Small and Medium Licensees are in progress and being expanded according to EAC, improvement of the licensing system is expected for effective application of SREPTS in the future.

On the other hand, Article 53 in Chapter 7 “Transitional Provisions” of SREPTS for Thermal Power Facilities defines Small Licensee and Medium Licensee as one who has the generation capacity less than 500 kW and between 500 kW to 3,000 kW respectively, and the SREPTS provides exemptions for these Small and Medium Licensees as transitional provisions in relation to prevention of electric power disasters, safety of third persons, safety measures for fuel and chemical materials, environmental protection, requirements for operation and safety and technical training.

CHAPTER 4

**CURRENT SITUATION OF APPROVAL AND
LICENSING SYSTEM ON HYDROPOWER BUSINESS**

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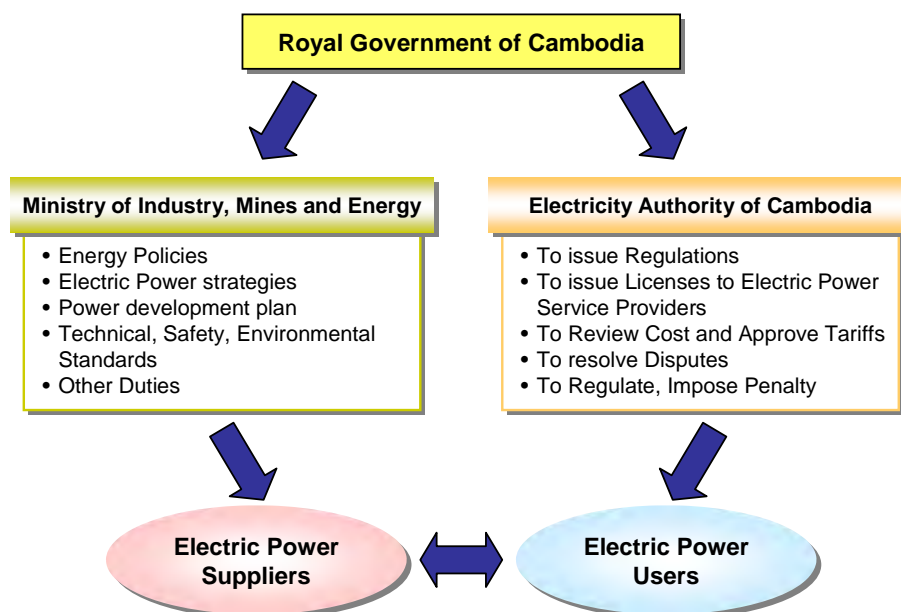
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Chapter 4 Current Situation of Approval and Licensing System on Hydropower Business

4.1 Current Status of Electricity Law and relevant Regulations

The Government of Cambodia established and promulgated the Electricity Law on February 02, 2001 in order to promote private investors to participate in the power sector in the country under the frameworks of power sector reform. The purpose of the Electricity Law is to govern and to prepare a framework for the electric power supply and services throughout the country. This law covers all activities related to the supply, the provision of services and use of electricity and other associated activities in the power sector. This law aims to establish the principles for operations in the electric power industry, the favorable conditions for the investments and commercial operation of the electric power industry including the principles for the protection of the rights of consumers, the principles for the promotion of private ownership of the facilities for providing electric power services and the principles for establishment of competition wherever feasible within the electric power sector.

The Electricity Law also stipulates that MIME shall be responsible for setting and administering the government policies, strategies and planning for the power sector. Also, under the Electricity Law, EAC was established as the Regulator of the power sector being granted with the right to be an autonomous agency to carry out the duties stipulated in the Electricity Law including the licensing to electric power service providers and issuing Regulations, Procedures, Rules, Orders and Decisions as well as performing the right to resolve complains and disputes related to the provision of services and the use of electricity. The Electricity Law promotes the private ownership of the facilities for providing electric power services in the country leading to the establishment of competition wherever feasible within electric power sector. The role sharing status between the two organizations of MIME and EAC in the power sector provided in the Electricity Law is shown in **Fig. 4.1-1** below.



Source: EAC Annual Report (2007)

Fig. 4.1-1 Role Sharing between MIME and EAC

Here, the Electric Power Services means services in electricity sector provided by one party to other parties. Electricity Power Service does not only mean provision of “Electricity” by suppliers to the consumers or generation, transmission or distribution services provided by one service provider to other service providers but also mean any electricity work such as the installation of electrical equipments and network, operation and maintenance, the services in relation to providing the electric power services, implementation of any work for electric power services etc., which one electric service provider delivers to other electric service providers or to consumers. The Electricity Law has granted the right and authorities to EAC to govern these relations between the Delivery, Receiving and Use of Electricity.

According to Annual Report of EAC for 2007, legal documents for governing and regulating electric power services and use of electricity in Cambodia are classified as shown in **Table 4.1-1** below.

Table 4.1-1 Legal Documents for Governing and Regulating Electric Power Services and Use of Electricity

1. Law	The Electricity Law of the Kingdom of Cambodia and other Laws to manage and regulate the power sectors. Laws are main documents in regulating all activities in power sector and also the main base for preparation of other legal documents needed for managing and regulating the power sector.
2. Legal Documents of Government Class	Sub-Decree, Decision, Notification etc. of the Royal Government. These documents are for determining the power sector policy and for regulating the activities in power sector and are issued by the Royal Government under the provisions of the Electricity Law. The main principles of the power sector, which are not defined in the Law, can also be issued for application as a standard document of the Royal Government.
3. Legal Documents of Ministry Class	Declaration (Prokas) and Decisions of the Ministry of Industry, Mines and Energy. These are the documents for managing the works, which are under the duties of Ministry of Industry, Mines and Energy such as policy, development, planning, strategy, technical standards and other determinations in power sector such as: <ul style="list-style-type: none"> - Investments in the rehabilitation and development of power sector in the short, medium and long term; - Restructuring, private sector participation and privatization of Public Utilities; - Promotion of the use of indigenous energy resources in the generation of electricity; - Planning and agreements on the export and import of electricity; - Subsidies to specific classes of customers and priorities regarding consumers of electricity; - Promotion of efficiency in generation, transmission, distribution and consumption of electricity and action taken to create a Comprehensive Electricity Conservation Program for the Kingdom of Cambodia; and - Electricity sector emergency and energy security strategies.
4. Legal Documents of EAC	Licenses, regulations, procedures and decisions of Electricity Authority of Cambodia (EAC), which are issued by EAC under the framework of the Electricity Law. These documents are for managing and regulating the electric power services and the use of electricity in the Kingdom of Cambodia.

Source: EAC Annual Report (2007)

The legal documents prepared and put into force for managing and regulating provision of services and use of electricity in Cambodia up to the end of the year 2006 are shown in **Table 4.1-2** below.

Table 4.1-2 Legal Documents prepared and put into force for Managing and Regulating Provision of Services and Use of Electricity

No.	Name of Standard Documents	Promulgated by	Date Promulgated
1	Electricity Law of the Kingdom of Cambodia	The King	February 2, 2001
2	Sub-Decree on the Rate of the Maximum License Fees applicable to Electric Power Service Providers in the Kingdom of Cambodia	Royal Government	December 27, 2001
3	Procedures for Issuing, Revising, Suspending, Revoking or Denying Licenses	EAC	September 14, 2001
	Revision 1		December 12, 2002
	Revision 2		March 16, 2004
4	Regulation on General Conditions of supply of Electricity in the Kingdom of Cambodia	EAC	January 17, 2003
	Revision 1		December 17, 2004
5	Regulatory Treatment of Extension of Transmission and Distribution Grid in the Kingdom of Cambodia	EAC	October 28, 2003
6	Regulations on Overall Performance Standards for Electricity Suppliers in the Kingdom of Cambodia	EAC	April 2, 2004
7	Procedure for Filing Complaint to EAC and for Resolution of Complaint by EAC	EAC	April 2, 2004
8	General Requirements of Electric Power Technical Standards of the Kingdom of Cambodia	MIME	August 16, 2004
9	Sub-Decree on Creation of Rural Electricity Fund of the Kingdom of Cambodia	The King	December 4, 2004
10	Sub-Decree on Principles for Determining the Reasonable Cost in Electricity Business	Royal Government	April 8, 2005
11	Prokas on Principles and Conditions for issuing Special Purpose Transmission License in the Kingdom of Cambodia	MIME	July 21, 2006
12	Specific Requirements of Electric Power Technical Standards of the Kingdom of Cambodia	MIME	July 17, 2007
13	Regulations on General Principles for Regulating Electricity Tariffs in the Kingdom of Cambodia	EAC	October 26, 2007
14	Procedures for Data Monitoring, Application, Review and Determination of Electricity Tariff	EAC	October 26, 2007

Source: EAC Annual Report (2007)

4.2 Current Licensing System for Providing Electric Power Services

Each electricity service provider is required to have a license issued by EAC and to abide by the provisions of the Electricity Law and those of its license, regulations and procedures set by EAC. The licenses for electric power services are to be issued by EAC to individual or legal entities giving the right to provide electric services as per the provisions defined in the license as “the Conditions of License.”

There are eight (8) types of licenses as follows:

(1) The Generation License

The Generation License grants the right to generate electric power from specified generation facilities.

(2) The Transmission License

The Transmission License grants the right to provide transmission service. There are 2 types of Transmission License: National Transmission License and Special purpose Transmission License.

The National Transmission License can be issued only to state power transmission company which is under the Government control, to have the right to provide the transmission service for delivering the electric power to the distribution companies and bulk power consumers throughout the Kingdom of Cambodia.

The Special Purpose Transmission License grants the right to construct, own, and operate specified transmission facilities in the Kingdom of Cambodia for the specified purpose.

(3) The Distribution License

The Distribution License grants the right to provide the electricity distribution services in a determined contiguous territory.

(4) The Consolidated License

The Consolidated License is a license, which may be the combination of some or all types of licenses. The Consolidated License can be issued to EDC and to the isolated systems to grant the right to generate, transmit, dispatch, distribute and sale electric power to the consumers. Consolidate License can also be issued on consideration of long term planning and the objectives of Government policy to reduce long run marginal cost for supply of electricity to consumers, establish a national grid and progressively expand this grid throughout Kingdom of Cambodia.

(5) The Dispatch License

The Dispatch License grants the right to control, manage, and operate the dispatch facilities for facilitating the delivery and receiving the electricity from the generation, transmission and distribution systems.

(6) The Bulk Sale License

The Bulk Sale License grants the right to buy electricity from any Generation Licensee or from the power systems of neighboring countries for sale to Distribution Licensees or to the large customers in one connected power system.

(7) The Retail License

The Retail License grants the right to engage in the sale of electric power to consumers in a contiguous service territory.

(8) The Subcontract License

The Subcontract License grants the right to provide electric power services according to the subcontract agreement with the existing licensee.

Numbers of each type of licenses issued and currently valid as of 2007 are summarized as shown in **Table 4.2-1** below.

Table 4.2-1 Types and Number of Licenses

No.	Type of License Issued	Number of License Issued			Licenses valid at end of 2007
		up to 2006	during 2007	Total	
1	Consolidated License consisting of Generation, Distribution and Transmission Licenses (for EDC)	1		1	1
2	Generation License	20	2	22	14
3	Special Purpose Transmission License		1	1	1
4	Distribution License	13	2	15	16
5	Rental License	1		1	1
6	Consolidated License consisting of Generation and Distribution Licenses	116	36	152	147
Total		151	41	192	180

Source EAC Annual Report (2007)

Among the above table, only EDC has the Consolidated License consisting of Generation, Distribution and Transmission Licenses.

Among the above eight (8) types of licenses, the Generation License or the Consolidation License is related to hydropower business.

4.3 Current Status and Problems of Licensing System for Hydropower Business

4.3.1 Current Status of Licensing on Hydropower Business

According to the information from EAC and EDC, the current status of licensing system and procedure for hydropower business is described as follows:

- (1) The following four (4) hydropower plants are being granted with the Generation License or Consolidation License from EAC:
 - 1) O'Chum 2 Hydropower plant (completed in 1993 / EDC)
 - 2) Kirirom 1 Hydropower Plant (completed in 2001 / IPP)
 - 3) Mondul Kiri Rural Electrification Project including two (2) micro-hydropower plants (completed in October 2008 / Electricity Unit of Mondul Kiri Province)
 - 4) Kamchay Hydropower Project (under construction / IPP)

For the two (2) existing hydropower plants of O'Chum 2 and Kirirom-1, the licenses have been granted by EAC to the Licensees automatically and/or without condition accepting the existing conditions.

Also for the two micro-hydro plants at Mondul Kiri Project which are connected to a small isolated local power system, EAC issued the License on October 23, 2008 accepting the as-built conditions after the commissioning test conducted by the Engineer under MIME. The micro-hydropower plants of the Mondul Kiri Project were constructed applying the Japanese technical standards and codes in principle.

EAC has issued the Generation License for 193 MW Kamchay Hydropower Project under construction by IPP from Republic of China who has received special concession from the Government of Cambodia. However, EAC himself has not executed technical inspection and examination in the process of licensing.

(2) For the hydropower development by IPP scheme, the following procedure is generally applied for implementation and commissioning at present.

1) IPP investor proposes a project plan for obtaining a concession agreement for its development and providing electric power service with the Government of Cambodia.

MIME, CDC (Cambodia Development Council) and MEF are responsible for this step.

There are two (2) steps in this procedure as follows:

- Implementation Agreement (IA)
- Power Purchase Agreement (PPA)

After initial agreement on PPA between the IPP and EDC who is the off-taker for IPP business, EDC will submit a draft PPA to EAC indicating power tariff and purchase conditions (take or pay condition).

2) After the agreement on PPA between a developer of hydropower project (IPP) and EDC, EAC will issue licenses of power generation business to IPP to generate and sell electricity to EDC. However, there were no technical examination and inspection or evaluation by EAC or MIME based on specific criteria since no SREPTS for Hydropower has been prepared for the present.

(3) Prior to the commencement of commercial operation of a power generating project including IPP project, project owner (project operator) and EDC jointly develop operating procedures addressing operational interfaces between two parties including the method of day to day communication, notification of key personnel list, clearances and switching practices, outage schedule, capacity and energy reporting, operations logging, procedures in relation to dispatch of the facility. The operation procedures shall be established properly so as to be consistent with the design of the project and the connected power grid facilities, the Grid Code of EDC and the technical limits of operation.

4.3.2 Problem in Licensing System for Hydropower Projects

EAC recently issued a license for Mondul Kiri rural electrification project including two micro-hydropower plants in October 2008. In this licensing procedure, EAC examined the power

tariff of the project for supplying electricity to the isolated power system. On the other hand, the commissioning test was conducted on technical matters for starting the operation of power generation by the Engineer (consultant) on behalf of MIME. Currently, EAC does not have a capacity to inspect and examine the hydropower project for licensing from the technical point of view, because no Technical Standards or other reference documents are available for hydropower projects and no hydropower engineers are available at EAC.

On the other hand, as shown in **Table2.4.3-1**, there are many hydropower projects planned to be developed until the year 2021, and the commissioning of the priority hydropower projects are scheduled by the middle of 2010's. Many of the planned hydropower projects are categorized to be large scale having installed capacities more than 50 MW in accordance with a criteria of hydropower scale adopted in Cambodia. As such large scale projects have impacts to stability and security of power system and also safety of reservoir and downstream areas.

In the above context, it is required for the power sector of Cambodia to develop or improve the capacity of technical inspection and examination for licensing as well as monitoring of hydropower projects before such time when many hydropower projects are commissioned. In order to achieve this target, it is essential to prepare the practical licensing and monitoring systems for hydropower projects to be adopted during their life period including construction, commissioning and operation stages. For establishment of such licensing and monitoring systems, it is required to prepare Specific Requirement of Technical Standards for Hydropower as the reference for technical inspection and examination in the process of licensing and monitoring of projects in view of conformity with the technical requirements.

Concerning the environmental impact assessment (EIA), MOE promulgated "Environmental Impact Assessment Process" as a ministerial decree in 1999. According to this decree, execution of EIA is required for the power plants over 5 MW and hydropower projects over 1 MW, and EIA has been or is being executed for the hydropower projects under study or investigation by IPP groups of China and Vietnam in accordance with the provisions in the decree of MOE. It is also important for the hydropower projects to be implemented in the future to abide the existing environmental law and relevant regulations. In this sense, it is necessary to provide an article that stipulates the requirement to abide the existing environmental law and regulations in the SREPTS for Hydropower in view of the environmental conservation.

CHAPTER 5

CURRENT SITUATION OF EXISTING

HYDROPOWER FACILITIES

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Chapter 5 Current Situation of Existing Hydropower Facilities

5.1 General Status of the Existing Hydropower Facilities

According to the annual report of EDC, the total electric installed capacity in Cambodia is around 300 MW excluding the capacity of imported power as of the end of 2007 and the most of them (94%) rely on imported oil, in contrast, hydropower account for only 4%.

According to “the WB Master Plan 2006”, the potential hydro power in Cambodia was estimated around 10,000 MW. Although the hydro potential in Cambodia is high, there are only 2 mini and medium sized hydropower stations and 3 micro hydropower stations at 2 sites, and the total capacity is only around 13 MW.

The specification of the existing hydropower plants in Cambodia is in the table below.

Table 5.1-1 Existing Hydropower Plants in Cambodia

Category	Name	Capacity (kW)	Province	Operation
Mini hydro	O’Chum 2	960	Rattanak Kiri	1993
Medium hydro	Kirirom 1	12,000	Koh Kong	2001
Micro hydro	Mondul Kiri	370 (185 x 2)	Mondul Kiri	2008
	NEDO Hybrid	48	Kampong Cham	2005

Source: JICA Study Team

The geological formation of the central part of Cambodia, such as the capital city Phnom Penh and the Tonle Sap Lake, is flat and in low altitude, so that this area is not suitable for hydropower development in general. The areas suitable for hydropower development are both of the southwest mountain area along the Gulf of Thailand and the northeast mountain area near the border to Lao PDR and Vietnam. The existing one mini and one medium sized hydropower stations are located in these areas, and also the ongoing and planning stage projects are located there.

The location of the existing hydropower plants are shown in **Fig. 5.1-1**.



Adapted from Google Map

Fig. 5.1-1 Map of the Existing Hydropower Plants Sites

The O'Chum 2 Hydropower Station located in Ban Lung town in Rattanak Kiri Province, northeast part of Cambodia, was constructed with the finance by the Government in 1993. Initially, Department of Industry, Mine and Electricity (DIME) operated it for 10 years and it was transferred to EDC in 2003. As the O'Chum 2 hydropower plant is not connected to the national grid, the electricity is consumed in the isolated local grid of Ban Lung area.

The Kirirom 1 Hydropower Station is located in Kampong Speu Province, some 110 kilometers southwest of Phnom Penh. It was firstly constructed in 1968 with the aid from Yugoslavia in cooperation with a state owned enterprise in charge of development of water resources but destroyed due to the civil war, then left untreated for a long time. After that, under the 30 years BOT contract made between MIME and the China Electric Power Technology Import and Export Co. (CETIC) in 2000, the power plant was renovated in 2001 and has been operated by CETIC. The electricity is being sent to Phnom Penh through the 115 kV transmission line which was constructed together with power plant by CETIC.

The Mondul Kiri hydropower plant was just completed in November 2008 with Japanese grant. It is located in the east plateau region near the Vietnam border and operated by Electric Unit of Mondul Kiri Province (EUMP). The electricity is consumed in Mondul Kiri Province within the isolated local grid.

A hybrid system constructed by NEDO (New Energy and Industrial Technology Development Organization) in 2004 and located in the vicinity of Kampong Cham town 80 km northeast from Phnom Penh consists of micro hydropower and solar power. It is under the control of the local community electricity unit now but there is no useful power generation due to the local problems and equipment failure.

5.2 O'Chum 2 Hydropower Station

The JICA Study Team visited the O'Chum 2 Hydropower Station and obtained useful information for drafting SREPTS for Hydropower as follows.

Date : 2008/11/12 10:00–15:00
Location : Rattanak Kiri Province, Ban Lung town

(1) Project Outline (according to site information)

1) Dam and Power Plant

Construction period : 1990 - 1993

O'Chum 1 dam data : Dam Type : Earth fill
Dam height : around 20 m (14.5 m to the top of spillway crest)
Dam crest length : 860 m
Crest width : 6 m
Bottom width : 60 m
Reservoir capacity : 12 million m³
Catchment area : 23.7 km²

Power plant data : P = 480 kW × 2 units = 960 kW
Q = 1.875 m³/s/unit
He = 31.0 m (rated)

Overview:

- The water, once impounded and regulated in O'Chum 1 dam (upper dam), is released into O'Chum 2 dam (lower dam) through the energy dissipating valve and the open channel.
- The power plant uses the water from the upper dam and the watershed area between the upper dam and lower dam for the power generation.
- An intake located at the right bank of the lower dam followed by a 40 m length settling basin, a 150 m length pressure type concrete conduit and a surge tank.
- A single penstock connects the surge tank to the power house, and divides into double at the power house, then link to 2 Francis turbines.
- After power generating, the water is released into river directly.
- As a rule, the river water is saved in the upper reservoir during the rainy season and used for power generation in the dry season (mainly from January to August). In the rainy season, power plant uses the natural river water from the downstream area of the upper dam.

2) Design and Construction

The O'Chum 2 hydropower plant is constructed with the Government budget.

The manufacturers of France supplied and installed the turbines (DUMONT) and generators (LEROYSOMER/ALSTHOM) and Vietnamese contractor was in charge of civil structures.

3) Operation and Maintenance

During the period from the completion of the construction in 1993 to 2003, DIME had been in charge of operation and maintenance and it was transferred to EDC in August 2003.

It is difficult for EDC to implement operation and maintenance sufficiently due to the several reasons such as the lack of adequate handover from the predecessor. For example, there is only one technical document (the manual of the turbine) handed over from DIME at the power station office.

There are 27 employees including the director in the regional EDC. Of this, 4 full-time operators for the power plant operation.

As for the maintenance work, instead of the local EDC, the central EDC dispatches 3-4 electrical engineers to the site once a month.

The major repair work that has been done so far is the replacement of the bearings at the unit 1 and it took 18 days for this work. Singapore manufacturer supplied materials.

4) Electric Power Supply

The local EDC supplies electricity to Rattanak Kiri province (mainly Bun Lung town) by the total operation with the O'Chum 2 hydropower plant and IPP's diesel generators (3 units: 200 kW × 2 and 400 kW × 1).

According to the hourly power generating record in October 2007, the base electric source in this area is the hydropower, and the diesel power mainly covers the peak period demand, from 5 p.m. to 10 p.m.

EDC purchases electricity from IPP diesel plant at the rate of 1,800 Riel/kWh, meanwhile selling to customers at 633 Riel/kWh. This means that EDC should cover the gap.

According to the monthly power generating record in 2007, the share of hydropower was about 60% in the dry season and 80% in the rainy season, and the annual energy generation was 3.2 GWh by hydropower, 1.8 GWh by diesel power and 5 GWh in total and the plant utilization factor was 36% at the hydropower and 26% at the diesel power. According to the monthly records, the total energy generation from January to October increased by 13% in 2008 from that in 2007 in which the diesel generation increased by 46% while the hydropower generation decreased by 9% due to water shortage.

(2) Field Survey

The study team surveyed the upper earth dam (O'Chum 1), energy dissipating valve located at just downstream of the upper dam, lower earth dam (O'Chum 2), intake, settling basin, surge tank, penstock and powerhouse.

(3) Controversial Points on Operation and Maintenance

The following points were detected as potential problems in operation and maintenance of O'Chum 2 hydropower plant;

1) Operation

- The sand flashing gate at the intake has never operated by the local EDC of Rattanak Kiri after the handing over from DIME. And there is no rule on the sand flashing and no measurement is being performed on the reservoir sedimentation.
- According to the power plant operation record, one unit is used for full generating and the other is used for load adjustment, and the equivalent load operation is not adopted.
- The upper reservoir is usually expected to be full with water at the end of a rainy season. However, the reservoir was almost empty in November 2008 when the JICA mission visited the site. It was found, according to the obtained record, that the reservoir water level in October 2008 was lower by 20m than that in October 2007. This means there is some possibility of dam operational problem.
- According to the local EDC, river inflow has decreased recently due to the deforestation in the upper stream area.
- According to the operation record, the local EDC operated the valve at the upper dam 5 times for changing the rate of intake water flow in October 2007.

2) Maintenance

- There is no drawings and instrumentation measuring devices for the maintenance and monitoring work.
- The electrical engineers come to the site from the EDC head office in Phnom Penh and check the facilities once a month. However, it seems that check sheets and maintenance records are not available at the site office.
- No discharge measurement is performed on the inflow from each river into the upper dam.
- The water level in the upper reservoir is being measured daily at 9:00 a.m. at the intake tower by using survey tape.
- As for the upper dam, it is difficult to observe any deformation on the dam body due to the matted grass covering the bank surface.
There are several pipes installed at the dam for monitoring seepage water level in the dam body. However, no monitoring record was available at the site office.

According to the local EDC, there are two water leak points at the downstream surface of the bank. However, no monitoring works are performed for leakage amount and water turbidity as well as displacement of dam body.

- The patrol path to the surge tank and penstock were covered with matted grass which may discourage the regular inspection during rainy seasons.
- EDC implemented the recoating on the gates at the intake and the settling basin one-time since 2006. However, no measurement was performed for monitoring the gate plate thickness.
- The coating on the penstock has degraded and the rusts were observed at many spots. In this regard, the local EDC has a plan to recoat the penstock in 2009.
- The junction between the penstock and the lower end anchor block was covered with surface water due to insufficient drainage. This condition may cause deterioration in the steep pipe.
- The inside of the powerhouse was kept clean well and no serious problems are expected in the operation. Since the installed capacity is small, the high-level maintenance work does not seem to be necessary. As the local EDC cannot spend a large amount of money on the maintenance work due to a limited annual energy generation at only about 3 million kWh, the corrective maintenance currently applied at O'Chum 2 hydropower station seems to be reasonable. However, the local EDC should care about the replacement planning of the electronic parts of which the life time is limited to about 15 years.
- Most civil structures are not maintained well and the deteriorative process is growing. The drive equipment of the dissipating valve has been removed because of its breakdown and the valve is operated manually. The guard rail at the upper dam spillway is lost partially. Several concrete structures have degraded.

(4) Issues Not Satisfying Requirements for Hydropower

Current operation and maintenance issues which are not satisfying the requirements for hydropower are as follows in general.

- The regular measurement necessary for a fill dam maintenance, such as the measurement of leakage water, deformation, water pressure in the dam body and sand sedimentation in the reservoir is not implemented. (Monitoring and Inspection)
- The specific chief engineer is not nominated and there has not been the handover among the design, the construction and the operation. (Nomination of Chief Engineers)
- There are no records and information of the examination for commencement of construction, the inspection of dam foundation and the inspection prior to the first impounding. (Examination and Inspection)
- The monitoring is not implemented. (Requirement for Operation)
- The report to EAC is not implemented. (Obligation for Reporting)

As for the electrical and mechanical facilities, the Study Team could not perform a precise evaluation because they could not get any detailed drawings and records.

(5) Information from the Local Office

- Monthly electric power generation record of 2007 and 2008
(EDC: O'Chum 2 (2 units), IPP: Diesel (3 units))
- Average hourly electric power generation record of October, 2007
(EDC: O'Chum 2 (2 units), IPP: Diesel (3 units))
- O'Chum 1 reservoir water level record and the valve operation record of October, 2007, and the change of the reservoir water level over the last year.

(6) Pictures on the Site

Pictures of the O'Chum 2 Hydropower Station are shown below;



**Photo 5.2-1 Upstream Face of O'Chum 1 Dam and Intake Tower
(from the right bank)**



Photo 5.2-2 Downstream Face of O'Chum 1 Dam, Dissipating Valve House and Open Channel to O'Chum 2 Dam



Photo 5.2-3 Intake and Spillway at O'Chum 2 Dam (from the sand basin)



Photo 5.2-4 Surge Tank of O'chum 2 Hydropower Station



Photo 5.2-5 Powerhouse of O'chum 2 Hydropower Station



Photo 5.2-6 Turbine and Generator of O’chum 2 Hydropower Station



Photo 5.2-7 Penstock of O’chum 2 Hydropower Station



Photo 5.2-8 Junction of Penstock and Lower end Anchor Block of O’chum 2 Power Station



Photo 5.2-9 Powerhouse and Outlet of O’chum 2 Hydropower Station

5.3 Kirirom 1 Hydropower Station

(1) Outline

According to the information collected by the Study Team, the outline of the Kirirom 1 Hydropower Station is as follows.

This hydropower station was constructed by the international aid of the government of Yugoslavia and started operation in 1968, however, it was destroyed by a civil war two and half years after its inauguration and has been left unmended. After the end of the civil war, the China Electric Power Technology Import and Export Corporation, CETIC, concluded an implementation agreement with MIME and started construction of a waterway, powerhouse, switchyard and transmission line in April, 2001 by exchanging BOT contract with EDC. The restored hydropower station started operation in May, 2002. The contents of the BOT contract are;

- The Kirirom 1 Hydropower Station shall supply 53 GWh/year of electricity to EDC,
- EDC makes “Take-or-Pay” contract with CETIC, which stipulates that EDC shall pay an amount corresponding to the contract annual generated energy although EDC does not consume the energy and the Government of Cambodia guarantees the payment,
- The wholesale price at the inception of generation is US¢7/kWh, and
- The power station will be transferred to EDC 30 years after.

A shortage of water in the dry season sometimes stops the power station from generation, which fails in a stable supply of electricity. A transmission line extending for 120 km, constructed by CETIC and transferred to EDC after completion, supplies electricity to the G1 substation located at Phnom Penh and to Kampong Speu area via the substation stepping down from 115 kV to 22 kV located there.

1) Reservoir

Catchment area	: 98.8 km ²
Gross capacity	: 9.8 million m ³
Effective capacity	: 9.3 million m ³

2) Dam

Type	: Central core earthfill
Height	: 30 m
Crest length	: 343 m
Design flood	: 1,110 m ³ /s
Spillway	: Gateless type with fuse plug

3) Waterway

Headrace	: 1.4 m in inner diameter and 3,100 m long
Surge tank	: Exposed type, 4.0 m in inner diameter and 45 m high

Penstock : Exposed type, 1.0 to 1.3 m in inner diameter and 2,600 m long

4) Powerhouse

Type : Surface type
Maximum discharge : 3.94 m³/s
Effective head : 373.5 m
Rated output : 12 MW
Guaranteed output : 3.8 MW
Turbine type : 2 Units of Horizontal Pelton with five (5) nozzles
Annual energy production : 40.85 GWh (results for 2005)
Transmission line : 115 kV, 120 km long

(2) Site Survey

Date and time : 13:00 to 15:00, Nov. 27, 2008

Location : Koh Kong and Kampong Speu States, Stung Chral River

According to the explanation of the engineers of power station, the state of the power station is as follows;

- Fifteen Chinese staffs are working at Power Station for operation and maintenance. In addition, three Cambodian workers are employed as maintenance staff,
- Reservoir water level is measured at the Intake and monitored at Powerhouse. Normal High Water Level and Low Water Level of the reservoir are at EL.487m and EL.496m respectively and the reservoir water level as of November 27, 2008 in the beginning of dry season was EL. 494.8 m, near Normal High Water Level,
- Power generation is suspended whenever the water level drawn down to EL.487m during the dry season with only intermittent operation and total suspension period normally reaches several months a year,
- Displacement and settlement of the embankment and its seepage water level are measured once a month at the survey points installed on the dam,
- The dam is equipped with a gateless type service spillway and an emergency spillway. The emergency spillway is so designed that an abnormal flood exceeding capacity of the service spillway is to be discharged at emergency spillway by blasting the embankment of fuse plug portion,
- Power Intake is located upstream of dam in the reservoir,
- Headrace tunnel crosses the dam from upstream to downstream under the foundation and once expose above the ground at downstream of dam where drain valve is installed, and
- Current structure and equipment of dam (original dam was repaired and piled up), waterway and powerhouse were designed by a Chinese design company, and no design documents and as-built drawings are available at the power station.

No photographs were allowed in and around the powerhouse, and approaching the reservoir area out of the dam crest road was strictly prohibited because mines were laid there.

(3) Conformity with Requirements for Hydropower

As a provision that exempt existing hydropower facilities from the application of specific requirements will be provided in the draft SREPTS for Hydropower accepting continuous operation as long as the operation of the power station does not harm the public safety, the Kirirom 1 Hydropower Station can continue power generation. However, the Kirirom 1 Hydropower Project is required to follow EAC's recommendation to satisfy fundamental requirements stipulated in GREPTS and SREPTS for Hydropower.

As the result of site visit to Kirirom 1 Hydropower Project, no serious problems were detected from the visual inspection on the structures. It is recognized that no serious problem exists for operation of the power station in short run as the monitoring of structures such as dam is being performed properly. However, the following are recommended for the Kirirom 1 Project for improvement or confirmation;

- A fence at the switchyard shall be stretched to the designated height,
- To confirm compiling status of as-built drawings and design documents of civil structures and inspection and operation records at the power station,
- To confirm rules of inspection and maintenance of civil structures, and
- To confirm the design method and process of the emergency spillway and the layout of dam and headrace tunnel which are not ordinary application to be subject to design evaluation by a regulatory agency.

When SREPTS for Hydropower is promulgated, it is recommended to verify for confirmation the procedure and method of design examination in relation to public safety issues.

(4) Pictures on the Site

Pictures of the Kirirom 1 Hydropower Station are shown below;



Photo 5.3-1 Dam Crest , Kirirom 1 Hydropower Station (1/2)



Photo 5.3-2 Dam Crest, Kirirom 1 Hydropower Station (2/2)



Photo 5.3-3 Lateral Overflow Weir of Gateless Type Service Spillway at Left Abutment of Dam, Kirirom 1 Hydropower Station



Photo 5.3-4 Fuse Plug Type Emergency Spillway at Left Abutment of Dam, Kirirom 1 Hydropower Station



Photo 5.3-5 Tower Type Surge Tank, Kirirom 1 Hydropower Station
(photo as of August 16, 2004)

5.4 Mondul Kiri Rural Electrification Project

(1) Background

The current condition of Cambodia's power sector is characterized by delayed development, due to the long civil war that devastated most of the existing power facilities. It is only about 13% of the total households in the country receives electricity, and the annual energy consumption per capita is 35 kWh, the lowest level in Southeast Asia.

The project site, Sen Monorom city, with some 1,400 households and a population of about 8,000, the capital of Mondul Kiri province, is situated in the mountains near the border of Viet Nam. No public power service is available in the city, except for small-scale independent power producers, who supply electricity generated by diesel generators during meal times, including the morning and evening hours. Chronic power shortage is a steady scene in this area.

The electricity tariff rate is in a range between 1,800 Riel/kWh and 2,300 Riel/kWh, which is about 4 times that in Phnom Penh and far beyond the reach of low-income group. Such poor power availability hinders the local economic growth and development. The current national transmission system expansion plan, however, excludes this part of the country as a coverage area planned for electrification, even up to 2016. This means Sen Monorom city and its vicinity will not be able to obtain any power from the outside in more than a decade to come.

These circumstances are a major impediment to poverty reduction, local vitalization and promotion of the living infrastructure of the inhabitant in Mondul Kiri. If this continues, it will certainly aggravate the widening gap of the living standard between areas in Cambodia. Early and stable availability of a power energy source is very much desired to promote local development in this province.

To find ways to solve this problem, Mekong River Commission carried out an investigation on small hydropower generation in Sen Monorom city and its vicinity in 1999. Based on the results of this investigation, the Government of Cambodia requested application of Japan's Grant Aid to a plan of constructing three micro-hydropower plants with a total output of 200 kW, including the transmission and distribution facilities to Sen Monorom city, as part of Cambodia's electrification plan to better the living standards of the people and reduce poverty in the Project site.

The Mondul Kiri Rural Electrification Project was implemented and completed in 2008 with the grant aid from of Japan under the above circumstances. The outline of the project is presented below:

(2) Outline

1) Project Features

This project is to construct a micro-hydropower plants at 2 sites, with a total power output of 370 kW, and an auxiliary power source for the dry season (diesel power generation, 300 kW), and 22 kV transmission line with low-voltage distribution lines in Sen Monorom City, to electrify about 1,650 households whose population is about 9,000 by the end of 2012.

This project will be executed based on the Japan's Grand Aid. Considering the scale and terms of works of the Project, following schedule is proposed.

A layout of power generating facilities is as shown in **Fig. 5.4-1**.

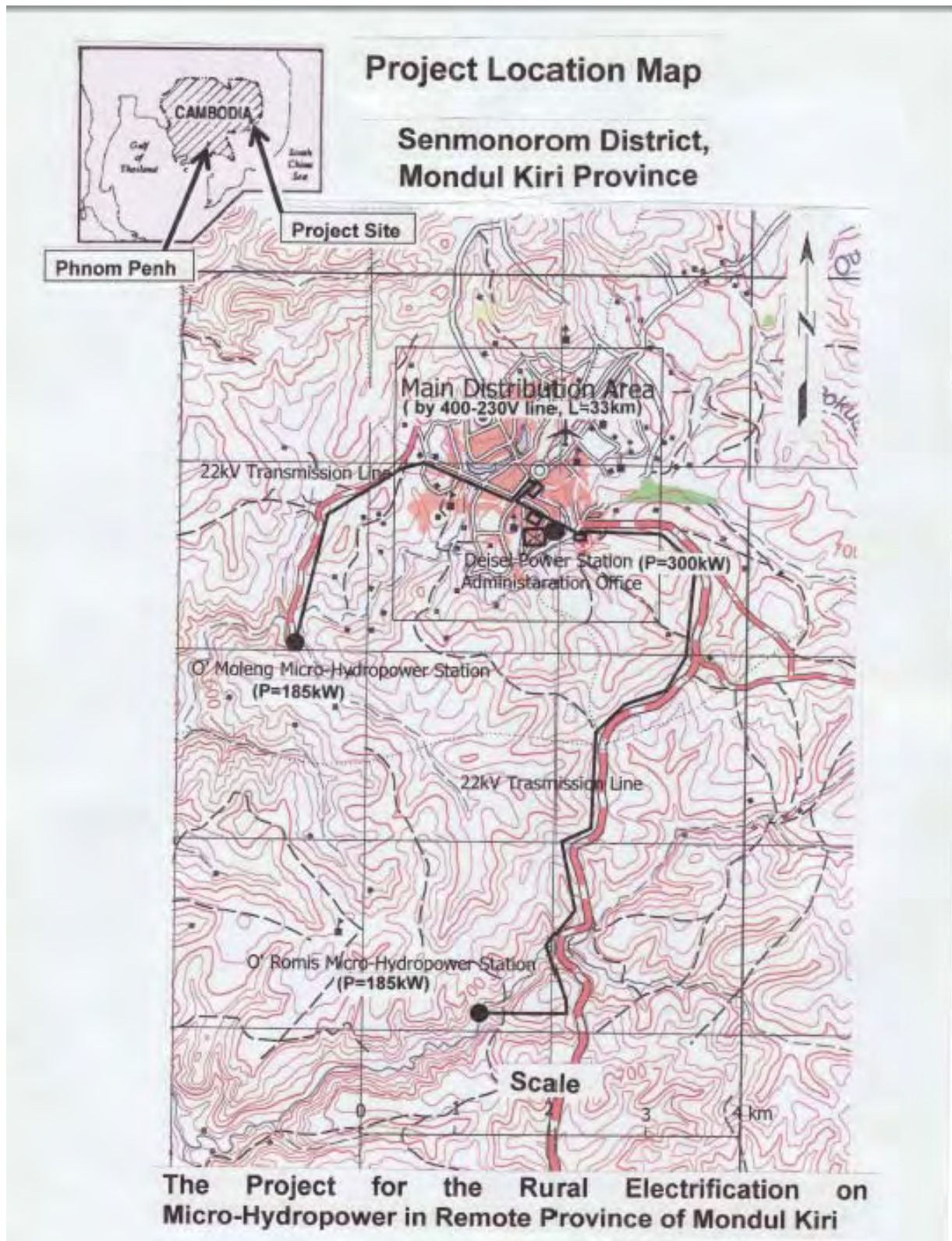


Fig. 5.4-1 Layout of Power Generating Facilities

The outline of the project is as shown in **Table 5.4-1**.

Table 5.4-1 Outline of the Project

1.	O'Moleng Hydropower Station: Output 185 kW Access road (411 m in length), Intake weir (5.2 m in height, 60.0 m in crest length), Settling basin (23 m in length), Penstock (700 to 1,200 mm in inner diameter, 415 m in length), Turbine and generator (Cross flow turbine and 3-phase synchronous generator, Rated output: 185 kW), Tailrace outlet
2.	O'Romis Hydropower Station: Output 185 kW Access road (1,850 m in length), Intake weir (4.3 m in height, 41.0 m in crest length), Settling basin (20.2 m in length), Headrace (1.0 m in width, 1.4 m in height, 1,015 m in length), Headtank, Spillway (92 m in length), Penstock (600 to 800 mm in inner diameter, 63 m in length), Turbine and generator (Cross flow turbine and 3-phase synchronous generator, Rated output: 185 kW), Tailrace outlet
3.	Diesel Generator: Output 300 kW Powerhouse (floor area 144 m ²), Generator (3-phase synchronous generator driven by diesel engine, Rated output: 300 kW), Fuel tank (capacity: 10 m ³)
4.	Transmission and Distribution Lines Middle voltage transmission line (22 kV, 28 km in length), Low voltage distribution line (400-230 V, 33 km in length), Switchyard, Substation, Telecommunication equipment

Source: JICA Study Team

2) Schedule

This project was implemented in the following schedule.

- 1) Basic design : Nov., 2004 to Jun., 2005
- 2) Definite design : Oct., 2005 to Mar., 2006
- 3) Tender and contract : Jun., 2006 to Apr., 2007
- 4) Construction : May, 2007 to Nov., 2008
- 5) Operation : Dec., 2008 to present

3) Project effects

a) Direct Effects

With the implementation of the Project, Sen Monorom city will have a stable power supply and some 9,000 residents in 1,650 households will get benefit of electrification at the end of 2012: direct effects will be expected as shown in **Table 5.4-2**:

Table 5.4-2 Direct Effects of the Project

Item	Outcome index	
	Current Situation (the end of 2004)	Planning (in 5 years after completion, the end of 2012)
1) Power Supply (generation end)	170 kW (provided by private power providers, who are expected to close their businesses)	400 kW (stable year-round output, including reserve capacity)
2) Hours of Power Supply	3 hours in the morning; 3 hours in the noon time; and 6 hours in the evening; irregular power supply often occurs.	24 hour supply
3) Electrification Rate	About 32%	About 80%
4) Electricity Tariff Rate	1,800Riel/kWh (US 45 ¢/kWh) to 2,300Riel/kWh (US 58 ¢/kWh)	About 630 Riel/kWh in average (US 15 ¢/kWh in average)
5) Improvement in Public Service	No street lights installed	Installation of street lights, introduction of PCs to schools, round-the-clock availability of medical equipment at hospital, etc.

Source: JICA Study Team

b) Indirect effects

i) Development of regional economy

Sen Monorom city is the capital of Mondul Kiri province and is the center of administration as well as regional economy in the province. Improvement of electricity availability in this city will boost up the entire growth of regional economy in the province.

ii) Development of tourist industry

Cambodian national road No. 7 was recently repaired with the help of Japan's grant aid. The road improved traffic accessibility to Mondul Kiri with the start of a long-haul regular bus service and then the number of tourists to the province has been rapidly rising in these years. If electricity availability in the area is improved, the tourist industry, especially construction of hotels in the province is expected to be further promoted.

c) Conformity with Technical Requirements for Hydropower

The total output of this project is less than 1 MW, which is not applicable to an environmental impact assessment according to the Environment Law. This project comes under a rural electrification project in an isolated grid and its trip affects a limited area. Therefore, Article 10 "Exemptions for Small Projects" of the draft SREPTS for Hydropower would be applied to this project in principle.

As this project is designed and constructed according to Japanese technical standards in principle, and the commissioning test was conducted on the items listed below before starting operation, it is judged that the project satisfy requirements of the draft SREPTS for Hydropower.

- Visual inspection of civil structures
- Operation test of gates

- Operation test of turbine-generator, diesel generator, parallel-in test, electric power supply test, energy stop test and alarm test.

(3) Pictures on the Site

Pictures of the Mondul Kiri Rural Electrification Project are shown below;



Photo 5.4-1 Intake Weir and Settling Basin
(O'Moleng Hydropower Project)



Photo 5.4-2 Powerhouse
(O'Moleng Hydropower Project)



Photo 5.4-3 Intake Weir and Settling Basin
(O'Romis Hydropower Project)



Photo 5.4-4 Powerhouse
(O'Romis Hydropower Project)



Photo 5.4-5 Diesel Power Station (this side)
and Administration Building (left side)



Photo 5.4-6 Transmission Line
of Modul Kiri Project

CHAPTER 6

BASIC POLICIES OF THE STUDY ON SREPTS FOR

HYDROPOWER

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Chapter 6 Basic Policies of the Study on SREPTS for Hydropower

6.1 Major Issues and Basic Policies of the Study

6.1.1 Major Issues in Preparation of SREPTS on Hydropower

The following four (4) items are the major issues in the Study for development of the draft SERPTS for Hydropower to be performed taking into consideration the current framework of the existing GREPTS and relevant laws and regulations as well as the objective of the Study:

Issue-1: To maintain compatibility and consistency with the existing GREPTS, SREPTS and relevant laws/regulations

Issue-2: To clarify the status and scope of the SREPTS for Hydropower

Issue-3: To prepare the draft SREPTS for Hydropower and its Explanation Sheet suitable for the present situation of Cambodia

Issue-4: To develop the draft Glossary of the SREPTS for Hydropower in a practical manner

In order to execute the above four (4) issues satisfactory in the development of the draft SREPTS for Hydropower and its Explanation Sheet and Glossary, the Study has been performed with the basic policies described below.

6.1.2 Basic Policies on Technical Issues

(1) Basic Policy for Issue-1

Issue-1: To maintain compatibility and consistency with the existing GREPTS, SREPTS and relevant laws/regulations

In preparation for the draft SREPTS for Hydropower, it is required to investigate and grasp the controversial point concerning the existing Electricity Law and the technical standards and also to examine the proper status of the SREPTS for Hydropower in terms of compatibility and consistency with the existing SREPTSs and GREPTS.

According to the Electricity Law enacted in 2001, functions and responsibilities of electric power service providers are stipulated in Article-5 and Article 42 respectively. Article-5 stipulates that “EAC shall ensure that the licensees shall use the standard related to technical operation, safety and environment, which is issued and published by MIME.” and Article-42 stipulates that “each Licensees must comply with all conditions set forth in its License, the rules and regulations adopted by the Authority (EAC), and the laws of Cambodia.” Accordingly, as shown in **Fig. 6.1.2-1** below, the electric power service providers shall have the responsibility to comply with the technical standards for hydropower project throughout all stages including investigation, planning, design, construction,

operation and maintenance, and EAC has the responsibility to ensure the compliance of electric power service providers with the technical standards. Presently in Cambodia, there are lots of hydropower projects which are going to be executed by foreign IPPs and, therefore, it is necessary to investigate how MIME and EAC are implementing stipulations in the existing laws and regulations and also how EAC is ensuring compliance of IPPs with technical standards in accordance with Article-5 of the Electricity Law.

Generally, approval and licensing procedures for the power business and those procedures for environmental issues are closely related each other. In this sense, it is necessary to investigate how the procedures for these two matters are being implemented against foreign IPPs from China, Vietnam, etc. and how the existing systems in Cambodia in relation to the process of biddings, power purchase agreement, business licensing are implemented not only by MIME, EAC and EDC but also by the Ministry of Environment (MOE) and other relevant authorities.

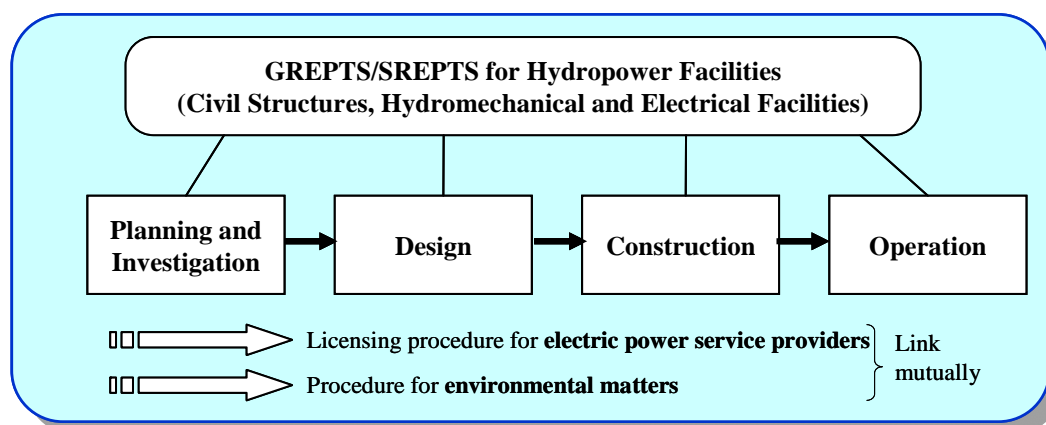


Fig. 6.1.2-1 Status of Technical Standards in the Electricity Law

(2) Basic Policy for Issue-2

Issue-2: To clarify the status and scope of the SREPTS for Hydropower

Generally, a hydropower technical standard stipulates “requirements on design and installation of civil structures and electrical facilities” and “requirements on inspections”, and the later is further divided into two categories; one is “completion inspection” to be performed at the end of construction stage and the other one is “regular periodical inspection” to be performed during the operation stage. Both of the SREPTS for Thermal Power and the SREPTS for Transmission and Distribution Facilities promulgated in 2007 stipulate only the requirements on design and installation but not stipulate the requirements on inspections. However, the requirements on inspections or inspection standards are important for hydropower projects particularly for civil structures in view of long-run behavior to be monitored at each stage during construction and operation. The scope of SREPTS for Hydropower is discussed with the counterpart agencies taking into consideration the above mentioned matters.

Moreover, as for the small hydro generation facilities stipulated in “Article-29 Renewable Energy, Portable Generators and Small Hydro Generations” of the GREPTS, the range of size (capacity) or

definition of small hydro generations shall be clarified by discussing with the counterpart agencies to make clear the range of application of the SREPTS for Hydropower. On the other hand, Article 30 “Pumped storage generating facilities” in GREPTS shall be exempted from the scope of work for the SREPTS for Hydropower.

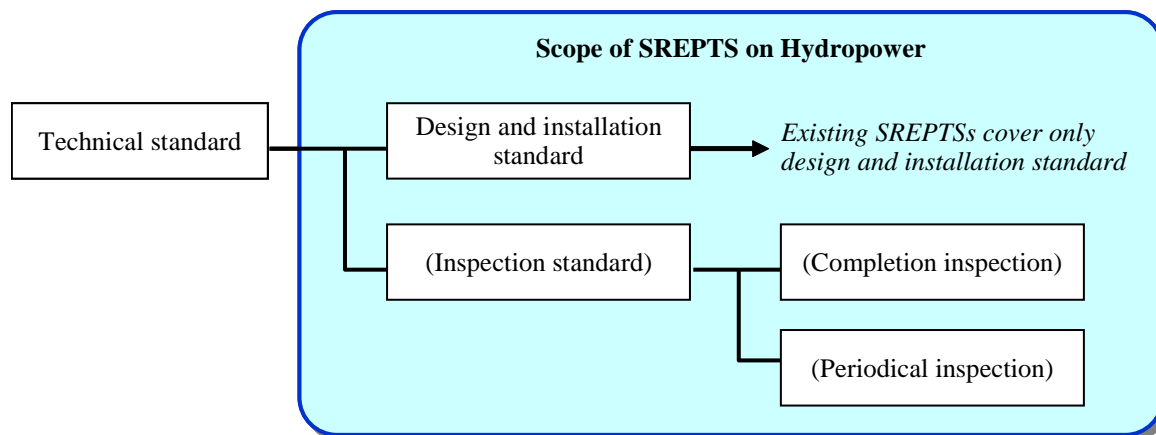


Fig. 6.1.2-2 Scope of SREPTS for Hydropower (to be consulted)

(3) Basic Policy for Issue-3

Issue 3: To prepare the draft SREPTS for Hydropower and its Explanation Sheet suitable for the present situation of Cambodia

As for the standards for hydropower, there are three articles specifically stipulating the requirements on hydropower facilities in the GREPTS; these are Article-26 “Dams, Waterways, Powerhouses and Other Facilities”, Article-27 “Prevention of Damage caused by Hydroelectric Power Plant” and Article-28 “Hydraulic Turbines and Generators”. The contents of each article are as follows:

Article-26:
26.1: Prevention of Overflow from Non-overflow Sections of Dams
26.2: Dam Stability
26.3: Prevention of Seepage Failure of Dams
26.4: Prevention of Serious Deformations and Cracks of Dams
26.5: Prevention of Failure of Waterways
26.6: Prevention of Failure and Damage of Powerhouses and Other Facilities

Article-27:
27.1: Prevention of Damage to Reservoirs and Ground around Reservoirs
27.2: Prevention of Damage to Downstream Areas of Dams and those of Outlets

Article-28:

- 28.1: Prevention of Damage to Hydraulic Turbines
- 28.2: Equipment to Quickly Shut off the Inflow of Water
- 28.3: Mechanical Strength of Hydraulic Turbines and Generators
- 28.4: Thermal Strength of Hydraulic Turbines and Generators
- 28.5: Protective Devices for Hydraulic Turbines and Generators

Each of the above mentioned articles stipulates so called “performance requirements” but not stipulates specific numerical requirements such as required strength, factor of safety for facilities. On the other hand, Article-28 stipulates the requirements only for hydraulic turbine and generator but no stipulations are available for main transformer, control equipments and switchgear as well as for measurement of insulation resistance and insulation withstand test which are common issues in the electrical works.

Taking into consideration the facts mentioned above, the draft SREPTS for Hydropower will be prepared with the following policies for both of civil structures and electrical facilities aiming to provide EAC with measures for implementing inspection and examination on hydropower facilities to be developed by power service providers properly:

**Policies for preparation of the draft SREPTS for Hydropower
and Explanation Sheet
(Civil engineering facilities)**

- To prepare standards suitable for presents condition of Cambodia while the present international standards and Japanese technical standards for hydropower facilities will be examined for reference.
- To stipulate with more specific numerical descriptions and more detailed figures as much as possible instead of the manners of stipulations in the GREPTS such as “required strength”, “shall be stable” and “shall be safe” etc., and to provide examples of calculations, drawings etc. in the Explanation Sheet
- To stipulate conditions required for design of dam such as design flood, specific water levels, freeboard, load conditions, etc.
- To provide stipulations for each dam type of concrete type and fill type separately
- To provide stipulations for each of intake, settling basin, headrace tunnel, surge tank or head tank, penstock and tailrace separately
- To provide stipulations for spillway gates and other gates separately.

**Policies for preparation of the draft SREPTS for Hydropower
and Explanation Sheet
(Electrical facilities)**

- To prepare electrical standards suitable for present situation of Cambodia by referring to the present international standards and Japanese standard for electrical facilities while selection or adjustment of articles shall be made to suit the contents required for SREPTS for Hydropower
- To provide examples and backgrounds in the Explanation Sheet for descriptions of performance requirements in the manners such as “shall withstand” or ”shall be equipped” used in the GREPTS showing numerical information, calculation method, drawings, references, etc. as much as possible, and to provide the Explanation Sheet with supplemental concrete examples, in case of being unable to stipulate numerical provisions in SREPTS
- To provide electrical shock, fire and electrical or magnetic interference
- To provide standard value with insulation level, thermal strength and structure, performance and installation applied to electrical facilities as below;
 - Insulation Level : Transformer, AC Electrical Equipment,
 - Thermal Strength : Transformer, Switchgear, Main circuit, Bearing, Rotating Equipment
 - Structure, Performance : Turbine, Inlet Valve, Switchgear, Main circuit
- To provide stipulations for measurement of insulation resistance and insulation withstand test
- To maintain compatibility with the SREPTS for Thermal Power and Transmission and Distribution Facilities as much as possible

(4) Basic Policy for Issue-4

Issue-4: To develop the draft Glossary for the SREPTS for Hydropower in a practical manner

As there are technical terms which are not available in Khmer, Glossary for explanation of technical terms will be prepared in English and in Khmer in the Study.

The draft Glossary is to be prepared in the form of parallel translation of English and Khmer and have to be the base of Khmer version of the draft SREPTS for Hydropower prepared by the Cambodian side. Therefore, the technical terms to be incorporated into Glossary will be selected from the draft SREPTS for Hydropower and its Explanation Sheet in a practical manner as much as possible by referring the existing similar glossaries.

The translation work into Khmer shall be performed mainly by the counterpart agency. However, technology transfer will be done by doing the translation work in cooperation with JICA Study Team. In this sense, the two Working Groups for civil work and electrical work formed by JICA Study Team, MIME, EAC and EDC shall be main bodies for the translation work.

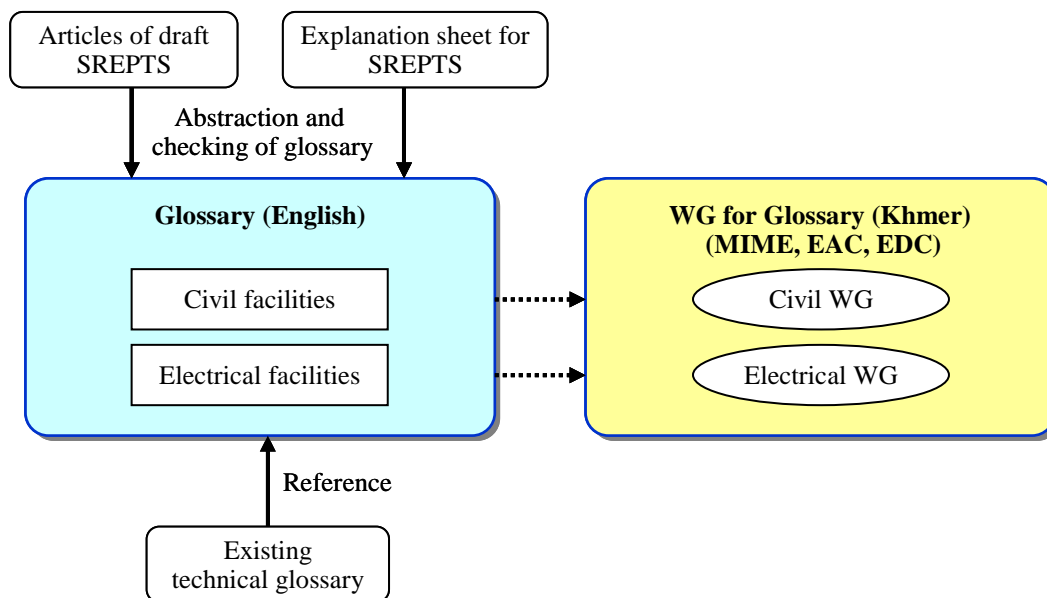


Fig. 6.1.2-3 Method for preparation of Glossary (English, Khmer)

6.1.3 Basic Policies on Operational Issues

In the Study, close cooperation with the counterpart agencies, MIME, EAC and EDC is indispensable. In this context, the JICA Study Team planned to perform the Study according to the basic policies on operation issues as described below.

(1) Establishment of Working Group

It is important that the Cambodian side participates in the Study voluntarily in order to carry out technology transfer from JICA Study Team efficiently. In this context, two (2) Working Groups (WGs), which are Civil Work WG and Electrical Work WG, are to be established receiving the members from the counterpart agencies, MIME and EAC and relevant agencies such as EDC.

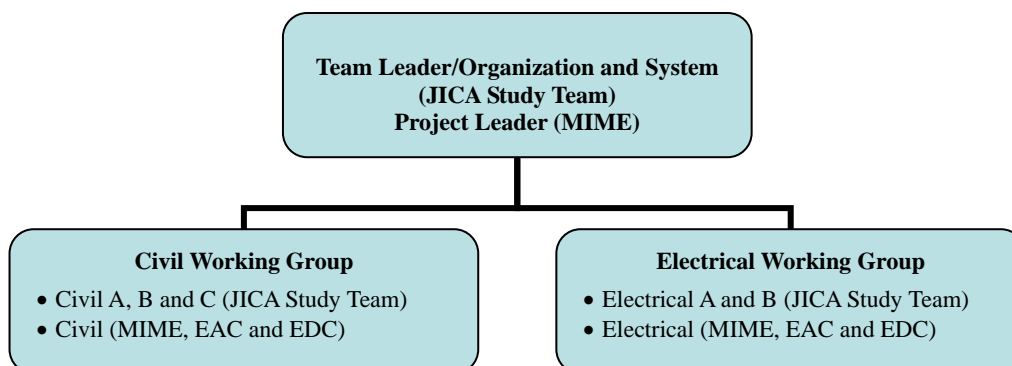


Fig. 6.1.3-1 Organization of Working Group

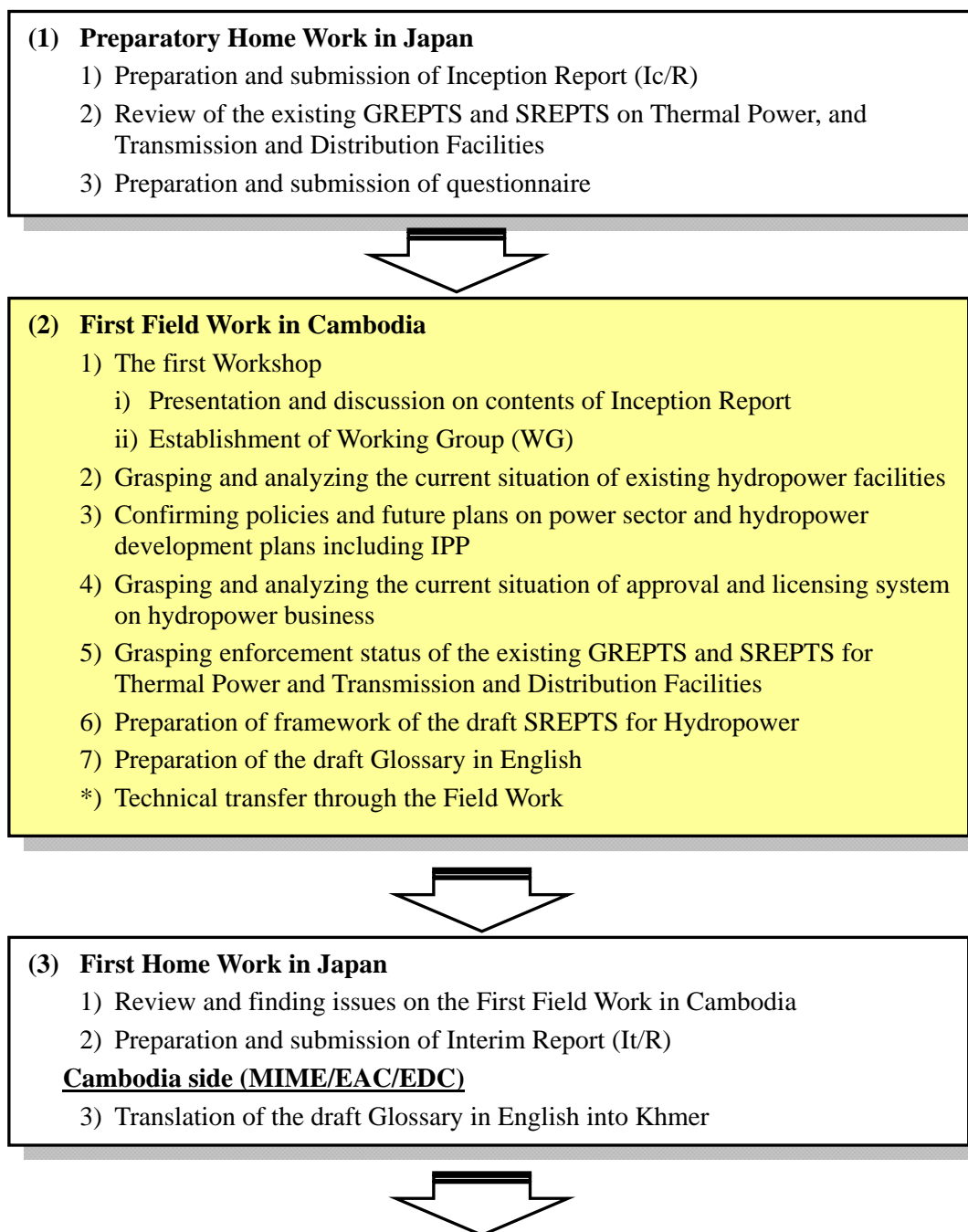
(2) Support for the Translation Work to Khmer

The translation work of draft SREPTS for Hydropower and its Explanation Sheet and Glossary shall be executed mainly by the counterpart agency. In order to proceed with the translation work effectively, the JICA Study Team supports the translation work through the Study.

6.2 Overall Study Flow

The Study was carried out in the eight (8) stages which consist of four (4) times of Home Work in Japan and four (4) times of Field Work in Cambodia as shown in accordance with “Overall Study Flow” shown below. The overall study flow is also described in Page 6-11.

Overall Study Flow



(4) Second Field Work in Cambodia

- 1) The Second Workshop
 - i) Presentation and discussion on contents of Interim Report (framework of the draft SREPTS for Hydropower)
 - ii) Arrangement and agenda of the First Seminar
- 2) The First Seminar (explanation of the framework of draft SREPTS for Hydropower)
- 3) Preparation of the draft SREPTS for Hydropower in English
- 4) Preparation of the draft Explanation Sheet of the SREPTS for Hydropower in English
- 5) Providing recommendations on improvement of approval and licensing system on hydropower business
- *) Technical transfer through the Field Work



(5) Second Home Work in Japan

- 1) Preparation and submission of Draft Final Report (Df/R)
Cambodia side (MIME/EAC/EDC)
- 2) Translation of the draft SREPTS for Hydropower into Khmer
- 3) Translation of the draft Explanation Sheet for the SREPTS for Hydropower into Khmer



(6) 2.5th Field Work in Cambodia

- 1) Supporting translation of the draft SREPTS and Explanation Sheet into Khmer by Cambodia side (MIME/EAC/EDC)
- *) Technical transfer through the Field Work



(7) Third Field Work in Cambodia

- 1) The third Workshop
 - i) Presentation and discussion on contents of Draft Final Report (Df/R) (the draft SREPTS for Hydropower)
 - ii) Arrangement and agenda of Second Seminar
- 2) The Second Seminar (explanation of the contents of the draft SREPTS for Hydropower)
- 3) Supporting translation into Khmer
- *) Technical transfer through the Field Work



(8) Third Home Work in Japan

- 1) Preparation and submission of Final Report (F/R)

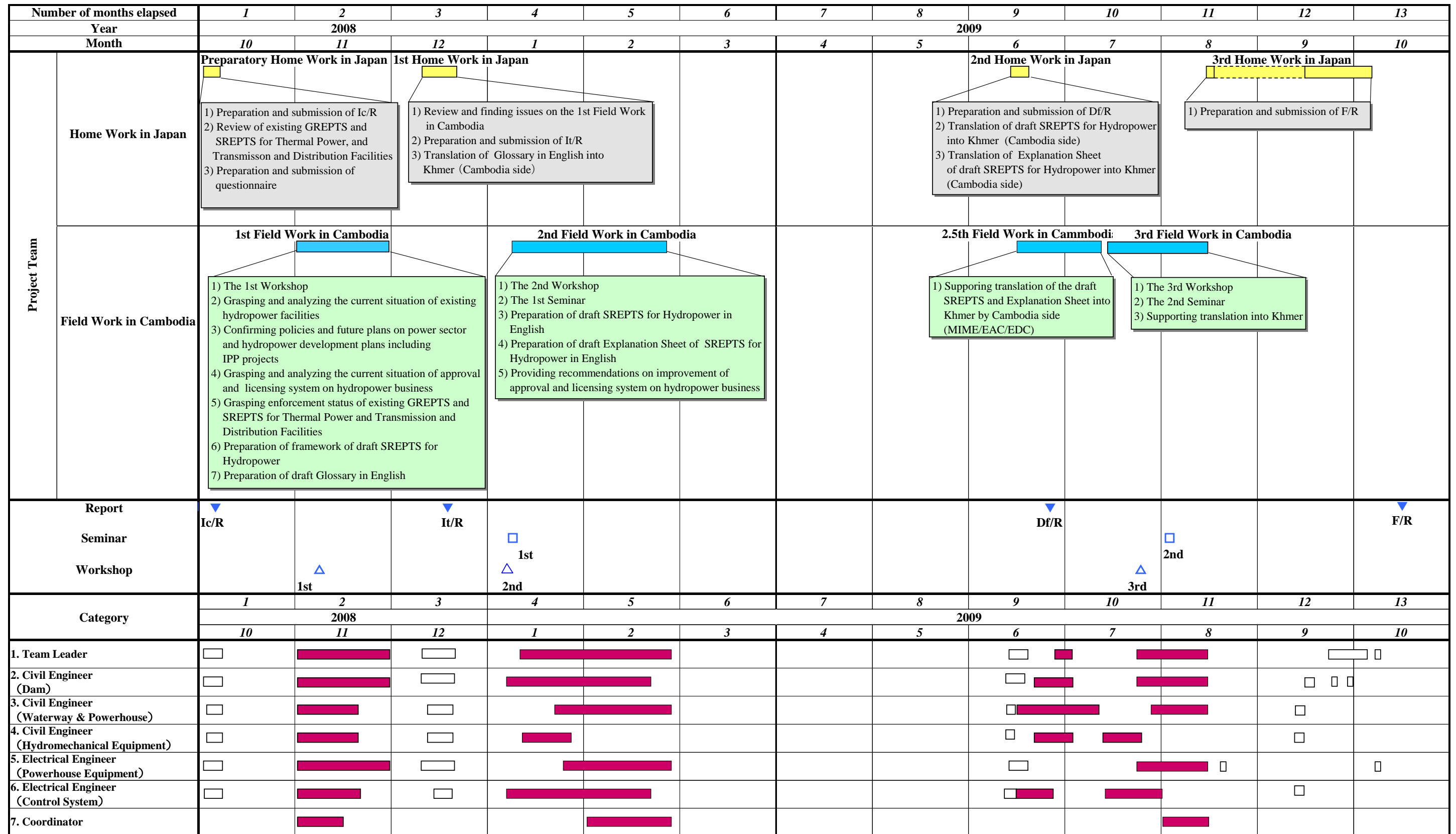


Fig. 6.2-1 Overall Activity Schedule

6.3 Methodology for Each Study Stage

Methodologies applied to each of eight (8) stages of the Study described in “6.2 Overall Study Flow” are detailed in the following sections.

6.3.1 Preparatory Home Work in Japan

(1) Preparation and Submission of Inception Report (Ic/R)

The JICA Study Team prepared Inception Report to discuss basic principle of policy, methodology and schedule of the Study as well as staff assignment for the Study. The report was submitted to JICA and the counterpart agency in Cambodia.

(2) Review of Existing GREPTS and SREPTS on Thermal Power, and Transmission and Distribution Facilities

The JICA Study Team has reviewed the existing GREPTS and SREPTS on Thermal Power and Transmission and Distribution Facilities, and prepared the draft table of contents for the draft SREPTS for Hydropower within the framework of the existing GREPTS and SREPTSs in order to conduct discussion and studies in the first Field Work in Cambodia smoothly.

(3) Preparation and Submission of Questionnaire

The JICA Study Team prepared questionnaire for investigation on the current situation of power sector in Cambodia. The questionnaire was submitted to MIME, EAC and EDC in order to conduct the investigation work jointly with the counterpart agencies in the First Field Work in Cambodia.

6.3.2 First Field Work in Cambodia

(1) The First Workshop

The JICA Study Team held the First Workshop in two (2) sessions (main session and supplemental session) during the First Field Work period in order to discuss with the relevant counterpart members about the principle issues for preparation of the draft SREPTS for Hydropower including its framework. The representatives from MIME and EAC as well as EDC took part in the First Workshop.

The main session of First Workshop was held in the beginning of First Field Work period with the following agendas.

1) Presentation and discussion on content of Inception Report including;

- Purpose, scope, methodology, schedule, and staff assignment plan of the Study, and

- Roles of MIME, EAC and EDC in the Study in relation to provision of data and information, provision of counterpart engineers and officers, scope of works between JICA Study Team and MIME/EAC/EDC, etc.

2) Establishment of Working Group (Civil Work Group and Electrical Work Group)

The major objective of the main session of First Workshop was to clarify that the draft SREPTS for Hydropower shall be prepared by JICA Study Team in collaboration with MIME, EAC and EDC and, therefore, to clarify scope of works of the both parties in terms of role shearing. Since voluntary participation of EAC is essential in particular for the translation of the draft SREPTS for Hydropower and related products in English into Khmer, formation of the counterpart team for the translation work was confirmed in the First Workshop.

In the above connection, two (2) teams of Working Group (WG), namely Civil Work WG and Electrical Work WG have been formed among the JICA Study Team, MIME, EAC and EDC. Leader and co-leader of each working group were assigned from the JICA Study Team and the counterpart team respectively aiming to practical and effective technical transfer through the joint work.

The supplemental session of the First Workshop was held in the last stage of the First Field Work period in order to supplement the main session with the following agendas:

- i) Confirmation of framework of the draft SREPTS for Hydropower prepared based on all relevant information obtained through the First Field Work period
- ii) Confirmation of work schedule for the period until the commencement of the Second Field Work

(2) Grasping and Analyzing the Current Situation of Existing Hydropower Facilities

There are two major existing hydropower plants in Cambodia, which are Kirirom 1 (12 MW) and O'Chum 2 (1 MW). These hydropower plants were the major targets to conduct the investigations. In addition, JICA Study Team also reviewed the situation of Mondul Kiri Rural Electrification Project which involves two small-scale hydropower plants (0.185 MW each) recently implemented under the grant aid scheme of JICA.

The JICA Study Team visited the sites of Kirirom 1 (12 MW) and O'Chum 2 (1 MW) hydropower plants and grasped the current status and problems through the investigation on situation of plant operation, deterioration condition of plant facilities, records of operation and maintenance.

(3) Confirming Policies and Future Plans on Power Sector and Hydropower Development Plans including IPP

The JICA Study Team investigated policies and future plans on power sector and hydropower development plans including IPPs through data and information provided with mainly from MIME, EAC and EDC. The records of actual growth of domestic power consumption were reviewed in

order to confirm background of power development plan. Also, status of the power export plans and IPP projects were reviewed in relation to the policies and future plans on the power sector of Cambodia.

(4) Grasping and Analyzing the Current Situation of Approval and Licensing System on Hydropower Business

The ministerial ordinance and its detailed enforcement rules of “Policy on Private Participation in the Power Sector in Cambodia” have not been validated since its drafting by MIME in 2003. In this regard, the JICA Study Team reviewed the current status of approval and licensing system for IPP project focusing the procedures applied to the projects existing and under construction in Cambodia throughout each stage of MOU conclusion, project planning, design, construction and operation.

As the completion inspection of each hydropower plant by EAC is considered to be an important procedure in the licensing system, the JICA Study Team focused on the current status of inspection procedure.

(5) Grasping Enforcement Status of Existing GREPTS and SREPTS on Thermal Power and Transmission and Distribution Facilities

The JICA Study Team reviewed the enforcement status of the existing GREPTS and SREPTSs for Thermal Power and Transmission and Distribution Facilities and also reviewed the current status of the Electricity Law and related ministerial ordinances and enforcement rules.

(6) Preparation of Framework of Draft SREPTS on Hydropower

The JICA Study Team prepared the framework of draft SREPTS for Hydropower based on the conclusion of discussion with the counterpart agencies on the draft table of contents prepared in Preparatory Home Work in Japan and proposed in Inception Report so as to maintain consistency with the framework of the existing the Electricity Law, GREPTS and SREPTSs on Thermal Power and Transmission and Distribution Facilities. The following were the main points for preparation of the framework:

- Chapter 1 “General Provision” of the draft contents for SREPTS for Hydropower will contain stipulations closely related to the responsibility of electric power service providers stipulated in the Electricity Law. In this sense, the contents of the General Provisions shall be confirmed taking into consideration the conformity with provisions under the Electricity Law or the existing GREPTS or SREPTSs.
- It is necessary not to disturb development of rural electrification by small-scale hydropower projects. In this sense, scope and/or capacity range for application of the GREPTS and the SREPTS for Hydropower to small scale projects shall be confirmed.
- It is necessary not to disturb implementation or operation of hydropower projects under construction or operation for stable power supply. In this sense, scope for application of the

GREPTS and the SREPTS for Hydropower to the implementing or existing hydropower projects shall be confirmed.

- Section 2.1 “Fundamental Requirements” in Chapter-2 “Hydropower Project Facilities” of the draft contents for SREPTS for Hydropower will contain the same or similar stipulations with Clause 26 and Clause 27 of the existing GREPTS. In this sense, necessity of reiteration of such stipulations in the SREPTS for Hydropower shall be confirmed.
- Chapter-3 “Electrical Facilities” of the draft contents for SREPTS for Hydropower may contain the same or similar stipulations in the existing GREPTS and SREPTS on Transmission and Distribution Facilities. In this sense, composition and stipulations of the draft SREPTS for Hydropower shall be confirmed in view of conformability with the existing GREPTS and SREPTS.

(7) Preparation of Draft Glossary in English

The JICA Study Team prepared the draft Glossary for the terms used in draft SREPTS on Hydropower. The technical terms to be involved in the glossary were selected taking into account its importance as it was used for translation of the draft SREPTS for Hydropower and its Explanation Sheet.

6.3.3 First Home Work in Japan

(1) Review and Finding Issues on the First Field Work in Cambodia

The JICA Study Team checked necessary information to be further obtained for the Study and reanalyzed the existing problems to utilize such information in the Second Field Work in Cambodia.

(2) Preparation and Submission of Interim Report (It/R)

The JICA Study Team drafted the framework of the draft SREPTS for Hydropower based on the results of the First Field Work and prepared Interim Report by the end of December 2008. The report was submitted to JICA and the counterpart agency in Cambodia before commencement of the Second Field Work in Cambodia. The Interim Report contained the following issues:

- Current status and problems in the power sector of Cambodia
 - Policy and future strategy of power sector
 - Current status of hydropower development plans including IPP
 - Current status and problems of the existing hydropower plants
 - Current status and problems of the approval and licensing system and procedure for hydropower project
 - Current status of Electricity Law and relevant laws and ministerial regulations
 - Current enforcement status of the existing GREPTS and SREPTSs for Thermal Power and Transmission and Distribution Facilities
- Draft Framework of the SREPTS for Hydropower

➤ Draft Glossary in English for the draft SREPTS for Hydropower

(3) Translation of Glossary in English into Khmer (Cambodian side)

The draft Glossary in English prepared in the First Field Work in Cambodia was translated into Khmer. The translation work was conducted voluntarily by the counterpart team in Cambodia during the period of the First Home Work of JICA Study Team in Japan in order to proceed with the translation work efficiency.

6.3.4 Second Field Work in Cambodia

(1) The Second Workshop

The Second Workshop was held on January 22, 2009 in order to discuss the framework of the draft SREPTS for Hydropower with MIME, EAC and EDC. The major agendas of the Second Workshop were the following issues:

- 1) Presentation and discussion on contents of Interim Report (draft framework of SREPTS)
- 2) Arrangement and Agenda of First Seminar

It was confirmed in the discussion with the counterpart agencies that the IPP groups who already have implementation agreements in Cambodia such as the groups from China and Vietnam would be widely invited to the Seminar.

(2) The First Seminar

The First Seminar was held on February 17, 2009 in order to announce to and discuss with the relevant authorities of the Government of Cambodia and power supply service providers including IPPs concerning the content of draft framework of the SREPTS for Hydropower. The MIME, EAC and EDC voluntarily took part in the preparation of seminar documents and presentation in the Seminar as the Cambodian side counterpart agencies aiming to deepen the understanding of the draft SREPTS for Hydropower. The JICA Study Team took part in the Seminar supporting the counterpart agencies.

(3) Preparation of Draft SREPTS for Hydropower in English

The draft SREPTS for Hydropower was prepared by reinforcing and/or revising the first draft framework of the SREPTS for Hydropower based on comments and opinions provided in the First Seminar. Then, the JICA Study Team delivered the draft SREPTS for Hydropower to the counterpart agencies by February 20, 2009 as the first draft.

(4) Preparation of Draft Explanation Sheet of SREPTS for Hydropower in English

JICA Study Team prepared the draft Explanation Sheet which explains the detailed application of each Article in the draft SREPTS for Hydropower, and delivered it to the counterpart agencies by February 20, 2009. The draft Explanation Sheet of the SREPTS for Hydropower involves background information of figures such as strength and factor of safety, calculation formula and/or method of calculation and reference drawings and/or pictures.

(5) Providing Recommendations on Improvement of Approval and Licensing System on Hydropower Business

The JICA Study Team made studies for providing recommendations on the improvement of the current approval and licensing system for the hydropower development projects which would increase in the near future. Such recommendations are to be prepared based on the results of review and analysis on the current status of licensing system conducted in the First Field Work of the Study.

6.3.5 Second Home Work in Japan

(1) Preparation and Submission of Draft Final Report (Df/R)

The JICA Study Team prepared the Draft Final Report based on the results and outcomes until the Second Field Work. The report consisted of Main Report and Annex including the draft SREPTS for Hydropower in English, the draft Explanation Sheet in English and the draft Glossary in English. The report was submitted to JICA and the counterpart agency in Cambodia in June 2009 before commencement of the Third Field Work in Cambodia.

(2) Translation of Draft SREPTS for Hydropower and Explanation Sheet into Khmer (Cambodian side)

The translation work of the draft SREPTS for Hydropower and Explanation Sheet in English prepared in the Second Field Work into Khmer was voluntarily performed by the counterpart team in Cambodia. The JICA Study Team supported the translation work into Khmer by conducting 2.5th Field Work in Cambodia in order to improve the progress and quality of the work.

6.3.6 2.5th Field Work in Cambodia

The 2.5th Field Work in Cambodia was conducted by the JICA Study Team in June and July 2009 in order to support the translation work of the draft SREPTS for Hydropower and Explanation Sheet into Khmer performed by the counterpart team in Cambodia.

6.3.7 Third Field Work in Cambodia

(1) The Third Workshop

The Third Workshop was held on July 22, 2009 in order to discuss the contents of the draft SREPTS for Hydropower with MIME, EAC and EDC.

(2) The Second Seminar

The Second Seminar was held on August 06, 2009 in order to announce to and discuss with the relevant authorities of the Government of Cambodia and power supply service providers including IPP concerning contents of the draft SREPTS for Hydropower.

In the same manner of the First Seminar, MIME, EAC and EDC voluntarily took part in the preparation of presentation documents and presentation in the Seminar as the counterpart agencies aiming to deepen the understanding of the draft SREPTS for Hydropower.

(3) Supporting Translation into Khmer

The JICA Study Team supported the translation work by providing the translation team of counterpart agencies with detailed explanations concerning the unclear things and questions raised in the process of translation work into Khmer. These supporting will be made in each of the civil work Working Group and the electrical work Working Group separately aiming to provide the counterpart agencies with technical transfer from JICA Study Team effectively.

6.3.8 Third Home Work in Japan

(1) Preparation and Submission of Final Report (F/R)

The JICA Study Team prepared this Final Report by updating and revising the Draft Final Report based on the results and conclusions in the Second Seminar and discussions with the counterpart agencies on the contents of Draft Final Report..

The Khmer version of the SREPTS for Hydropower will be prepared by the Cambodian side based on the English version of the draft SREPTS for Hydropower, the draft Explanation Sheet and the draft Glossary proposed in the Study.

6.4 Technology Transfer through OJT

During execution of the Study, JICA Team provided the counterpart agencies with technology transfer aiming that the counterpart agency would fully understand the contents of the draft SREPTS for Hydropower to act for operating the approval and licensing system and procedure on hydropower business in Cambodia, and to execute required revisions on the SREPTS for Hydropower in the future. The technical transfer was executed mainly in the following manner;

- To provide technology transfer through OJT activities in the two (2) Working Groups formed for the civil works and electrical works separately both consisting of JICA staff and counterpart staff
- To deepen the understanding of the Cambodian side Working Group members about not only the SREPTS for Hydropower but also overall knowledge concerning the hydropower through their voluntary contribution to the translation work of the draft SREPTS for Hydropower, Explanation Sheet and Glossary into Khmer

CHAPTER 7
RECORD OF ACTIVITIES DURING FIELD WORKS
IN CAMBODIA

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Chapter 7 Record of Activities during Field Works in Cambodia

7.1 Activities during First Field Work in Cambodia (November 2008)

7.1.1 Outline of First Workshop and Working Group Meetings

(1) Main Session of First Workshop (on November 05, 2008)

The First Workshop was taken place on November 05, 2008 at MIME's Conference Room with the following agenda. The Minutes Meeting of the First Workshop is presented in Appendix-1 of this report.

1) Opening Address

H.E. Ith Praing, the Secretary of State for MIME, addressed an appreciation all the participants and also appreciated technical support from JICA for establishment of the SREPTS for Hydropower.

2) Introduction and Explanation of Inception Report

The JICA Study Team presented the introduction to the First Workshop and explained the outline and major points of Inception Report.

3) Discussion and Questions

After the explanation on Interim Report by JICA Study Team, the participants discussed the following issues:

- Scope of SREPTS for Hydropower in relation to the existing and ongoing hydropower projects
- Scope of SREPTS for Hydropower in relation to the inspection and examination standards
- Method of the technical transfer from JICA Study Team to the Counterpart Team
- Organization for the translation works of SREPTS for Hydropower and relevant documents into Khmer
- Establishment of Working Group
- Schedule and participants of Seminars

(2) Kick-Off Meeting for Working Group (on November 14, 2008)

Kick-Off Meeting of Working Group was held on November 14, 2008 at MIME's Meeting Room among the 16 members of Counterpart Team and JICA Study Team to establish Civil Working Group and Electromechanical Working Group. Eight (8) persons and seven (7) persons of the Counterpart Team were selected as the member of Civil Working Group and Electromechanical Working Group respectively. The Minutes of Working Group Meeting (Kick-Off Meeting) is presented in Appendix-2 of this report.

The members of each Working Group assigned from the Counterpart Team are listed as shown in **Table 7.1.1-1** below.

Table 7.1.1-1 Cambodian Side Member of Working Groups

Member of Civil WG	Member of Electromechanical WG
Mr. Theng Marith (EAC), Leader of C. WG	Mr. Ros Chenda (EDC), Leader of E. WG
Mr. Much Chhun Horn (MIME)	Mr. Chiv Hour (MIME)
Mr. Nong Sareth (MIME)	Mr. So Veasna (MIME)
Mr. Chea Narin (MIME)	Mr. Aun Hemrith (EDC)
Mr. He Sam Ol (MIME)	Mr. Phan Bunthoeun (MIME)
Mr. Leang Khemarith (MIME)	Mr. Pan Narith (MIME)
Mr. Heavf Chan Visal (EDC)	Mr. Teng Saroeun (EAC)
Mr. Suon Ponnarith (EAC)	

The major roles of Working Groups are expected as follows:

- To discuss any issues related to the preparation of draft SREPTS for Hydropower including the draft Glossary and the draft Explanation Sheet by JICA Study Team
- To translate the draft SREPTS for Hydropower and relevant documents into Khmer

(3) Working Groups Meeting No.1 (on November 14, 2008)

After the Kick-Off Meeting, the two sessions of Working Group Meeting No.1 were held for each of Civil Working Group and Electrical Working Group separately. The following were discussed in the First Working Group Meeting. The Memorandums of the Working Group Meeting No.1 are presented in Appendix-2 of this report.

- Draft table of contents of SREPTS for Hydropower
- Draft Glossary
- Activity schedule of Working Groups

(4) Supplemental Meeting for First Workshop (on November 20, 2008)

In order to discuss further the issues remained for further discussion in the main session of First Workshop on November 5, 2008, the Supplemental Meeting was taken place on November 20, 2008 at MIME's Meeting Room among the member of Working Group with the following agenda. The Minutes of Supplemental Meeting for First Workshop is presented in Appendix-1 of this report.

- Framework and scope of the draft SREPTS for Hydropower
- Schedule of the Second Workshop and the First Seminar
- Schedule of remaining major activities after November 2008

(5) Working Groups Meeting No.2 (on November 20, 2008)

After the Supplemental Meeting for First Workshop, two sessions of Working Group Meeting No.2 were held separately for each of Civil and Electromechanical Working Groups. The following were discussed in the Working Group Meeting No.2. The Memorandums of the Working Group Meeting No.2 are presented in Appendix-2 of this report.

- Framework of the draft SREPTS for Hydropower
- Revisions on the draft Glossary

7.1.2 Discussion and Conclusion of First Workshop (on November 05, 2008)

The following were concluded as the outcomes of the First Workshop based on the explanation of Inception Report by JICA Study Team and discussions among the participants in the Workshop:

- 1) The content of Inception Report was accepted by MIME, EAC and EDC.
- 2) MIME assigned Dr. Bun Narith, Deputy General Director of General Department of Energy, to be the leader of Counterpart Team for the Study on SREPTS for Hydropower.
- 3) The Working Groups are to be formed with 10 persons from MIME, 3 persons from EAC, 3 persons from EDC and JICA Study Team.
The Working Group members are to be arranged by MIME in cooperation with EAC and EDC.
- 4) The formation and leader/sub-leader of each of Civil Working Group and Electric Working Group and its activity program were confirmed in the Kick-off Meeting of Working Group held on November 14, 2008 at MIME.
- 5) Arrangement for collection of data and documents were confirmed in the Kick-off Meeting of Working Group in accordance with the Questionnaire submitted to MIME by JICA Study Team.
- 6) The draft of framework of the SREPTS for Hydropower was discussed in the Supplemental Meeting for the First Workshop held on November 20 as described in Minutes of Supplemental Meeting for the First Workshop.
- 7) The translation work of the draft Glossary, the draft SREPTS for Hydropower and the draft Explanation Sheet into Khmer is to be conducted in collaboration of MIME, EAC and EDC.
- 8) The schedule of the Seminars will be adjusted in a practical manner taking into account the time schedule required for announcement and preparation.
- 9) Participants of the Seminars will be arranged by MIME and EAC.

7.1.3 Discussion and Conclusion of Supplemental Meeting for First Workshop (on November 20, 2008)

The following issues, which remained pending in the main session of the First Workshop on November 05, 2008, were discussed and concluded or agreed among the participants of the meeting in the Supplemental Meeting for First Workshop held on November 20, 2008.

(1) Pending Issues in the Contents of the draft SREPTS for Hydropower

- 1) Articles for examinations and inspections

Articles for examination and inspection will be prepared in the draft SREPTS for Hydropower for civil works and electromechanical works separately in an additional independent chapter.

General provisions for examinations and inspections will be described in Articles of SREPTS and examples and major sample forms will be described in “Explanation Sheet”.

For the electromechanical work, provisions for “Commissioning Test” will be described in Articles of SREPTS and examples for other tests and inspections such as performance tests and material tests during construction and installation will be described in “Explanation Sheet”.

2) Exclusion of application for small hydropower projects

An Article of transitional provisions will be prepared in SREPTS for Hydropower for exclusion of application to small hydropower projects in view of preservation of safety, promotion of rural electrification without setting capacity limitation criteria.

3) Exclusion of application for existing hydropower projects

An Article of transitional provisions will be prepared in SREPTS for Hydropower for exclusion of application to the existing hydropower projects with recommendations regarding preservation of public safety.

4) Exclusion of application for hydropower projects under implementation

An Article of transitional provisions will be prepared in SREPTS for Hydropower for exclusion of application to hydropower projects under implementation with recommendations in view of preservation of public safety.

5) Provisions for requirements related to the existing environmental regulations

An Article of transitional provisions will be prepared in SREPTS for Hydropower for requirements related to the existing laws and/or regulations for environmental conservation.

6) Formation of SREPTS for hydropower regarding common provisions for electric facilities

JICA Study Team has found some inconvenience in relation to conformity of SREPTS for Hydropower with the existing GREPTS and SREPTS for Thermal Power and Transmission and Distribution Facilities particularly in the clauses for the electric facilities.

In the above regards, JICA Study Team will prepare the draft SREPTS for Hydropower with the following policies:

- To prepare and complete the draft SREPTS for Hydropower so as to conform to the existing GREPTS and SREPTS as much as possible but independently accepting some discrepancy with the existing provisions.
- To provide recommendation for adjustment or revision of the existing GREPTS and SREPTS in a report of the Study, if required, when an inconformity with them is unavoidable in the draft SREPTS for Hydropower

(2) Schedule of Second Workshop and First Seminar

JICA Study Team proposed the following schedule taking into account the request of MIME and EAC made in First Workshop concerning the schedule arrangement of Seminar.

- Second Workshop :Middle of January 2009
- First Seminar :Middle of February 2009

With respect to the Seminars, it was agreed among the parties that the Seminars would be organized by the Counterpart Team (MIME, EAC and EDC) with support of JICA Study Team.

(3) Schedule of Major Activities after November 2008

The schedule of major activities after the Supplemental Meeting of November 20, 2008 was confirmed as shown in the table below:

Table 7.1.3-1 Schedule of Major Activities after November 2008

Month	JICA Study Team	Counterpart Team (MIME, EAC, EDC)
Nov. 2008	<ol style="list-style-type: none"> 1. Preparation and submission of the draft Glossary 2. Preparation and submission of the draft Framework of SREPTS for Hydropower 3. Collection of data and information 4. Investigation of the existing hydropower projects 	<ol style="list-style-type: none"> 1. Collection and provision of data and information required in Questionnaire for JICA Study Team 2. Commencement of translation work of the draft Glossary into Khmer
Dec. 2008	<ol style="list-style-type: none"> 1. Preparation of Interim Report 	<ol style="list-style-type: none"> 1. Translation work of the draft Glossary into Khmer
Jan. 2009	<ol style="list-style-type: none"> 1. Submission of Interim Report 2. 2nd Workshop 3. Preparation of the draft SREPTS for Hydropower and the draft Explanation Sheet in English 	<ol style="list-style-type: none"> 1. Completion of translation work of the draft Glossary into Khmer 2. 2nd Workshop 3. Preparation of the 1st Seminar 4. Commencement of translation work of the draft SREPTS for Hydropower into Khmer
Feb. 2009	<ol style="list-style-type: none"> 1. Preparation and submission of the draft SREPTS for Hydropower and the draft Explanation Sheet in English 2. Participation in the 1st Seminar 	<ol style="list-style-type: none"> 1. Preparation and organizing of the 1st Seminar 2. Conducting translation work of the draft SREPTS for Hydropower into Khmer
Mar. 2009 to Jun. 2009	<ol style="list-style-type: none"> 1. Preparation of Draft Final Report 2. Supporting the translation work of the draft SREPTS for Hydropower and the draft Explanation Sheet by the Counterpart Team 	<ol style="list-style-type: none"> 1. Continuing translation work of the draft SREPTS for Hydropower into Khmer 2. Commencement of translation work of the draft Explanation Sheet into Khmer
Jul. 2009	<ol style="list-style-type: none"> 1. Submission of Draft Final Report 2. 3rd Workshop 3. Participation in the 2nd Seminar 	<ol style="list-style-type: none"> 1. Completion of translation work of the draft SREPTS for Hydropower and the draft Explanation Sheet into Khmer 2. 3rd Workshop 3. Preparation and organizing the 2nd Seminar

7.1.4 Discussion and Conclusion of Working Group Meeting No.1 (on November 14, 2008)

The following matters were agreed or discussed in Working Group Meeting No.1:

(1) Civil Working Group

- 1) JICA Study Team explained draft contents of the SREPTS for Hydropower and proposed that the parties should discuss and modify, if required, the contents so that those might be suited to circumstances in Cambodia.
- 2) JICA Study Team explained the draft Glossary of civil part and requested the Cambodian Civil WG members to translate the draft Glossary into Khmer by the middle of January 2009 and to list up such words that no equivalent words exist in Khmer.
- 3) JICA Study Team explained an example of provision in the draft SREPTS for Hydropower and stated that the Study Team would provide the Cambodian WG members with the final draft of SREPTS by the end of January 2009.
- 4) JICA Study Team explained the overall working schedule of the translation work into Khmer to be completed by the beginning of July 2009.

(2) Electrical Working Group

- 1) JICA Study Team presented the draft Glossary of electrical part and requested that Cambodian members of Electrical WG should study the draft and provide comments with JICA Study Team and commence the translation work into Khmer.
- 2) JICA Study Team explained the table of contents of electrical part of the draft SREPTS for Hydropower and proposed that an Article for Examination and Inspection” would be prepared only for the commissioning test of hydropower plants and the examination and inspection during construction stage of projects would be described in Explanation Sheet as examples.
- 3) The Cambodian WG members requested that the draft Explanation Sheet should be prepared in the same manner as the existing SREPTS on Thermal Power and Transmission & Distribution Facilities. JICA Study Team agreed to do so.

7.1.5 Discussion and Conclusion of Working Group Meeting No.2 (on November 20, 2008)

The following matters were agreed or discussed in Working Group Meeting No.2:

(1) Civil Working Group

The JICA Study Team explained the abstract of the draft SREPTS for Hydropower, and the following matters were discussed and agreed among the parties.

- 1) As for an Article of “Conformity to the Technical Standards” proposed in Chapter 1 “General Provisions”, the Cambodian Civil WG members requested JICA Study Team to reconsider the

provision of the Article so as to accept application of technical standards other than IEC and ISO according to a project owner.

- 2) The Cambodian Civil WG members requested JICA Study Team to move the Articles of “Nomination of Chief Engineers” and “Order of Remedy for Conformance to Technical Standards” from the Chapter of “Requirements for Project Implementation” to the Chapter of “Transitional Provisions”, because the regulations described in the said articles will be necessary in the future although they do not exist at the present and hasty enactment of these articles prevents the existing hydropower plants from operation.
- 3) The Cambodian Civil WG members requested JICA Study Team to modify the proposed provisions in the Article of “Transitional Provisions for Small Licensees” in the Chapter of “Transitional Provisions”, because the parties agreed to apply the SREPTS for Hydropower to the hydropower facilities without limitation of capacity but with exception when no harmful effect was expected in terms of public safety for the third parties.
- 4) The Cambodian Civil WG members requested JICA Study Team to move the Articles of “Environmental Protection”, “Requirements for Operation” and “Safety and Technical Training” from the Chapter of “Transitional Provisions” to the Chapter of “Requirements for Project Implementation”, because provisions relating to these Articles have already existed.
- 5) As for the Article of “Examination and Inspection” which was proposed in the Chapter of “Requirements for Project Implementation”, the Cambodian Civil WG members requested JICA Study Team to provide an independent Chapter for the issues of “Examination and Inspection”.
- 6) The Cambodian Civil WG members requested JICA Study Team to use pictures and/or illustrations in the Glossary for easy and better understanding of technical terms.

(2) Electrical Working Group

The following matters were discussed and agreed among the parties;

- 1) JICA Study Team submitted additional Glossary which is concerning testing.
- 2) JICA Study Team requested WG members to commence translation work into Khmer and to complete it by the end of January 2009.
- 3) JICA Study Team explained the revised policy of electrical part of the draft SREPTS for Hydropower that description of equipment in hydropower station is added in the additional Chapters of “Electrical Equipment in Hydropower Stations, Substations and Switching Stations”, “Mechanical Equipment in Hydropower Stations”, “Measuring Devices in Hydropower Stations, Substations and Switching Stations”, “Auxiliary Equipment in Hydropower Stations, Substations and Switching Stations” and “Examination on Hydropower Station”.
- 4) JICA Study Team explained that requirements for mechanical parts of the draft SREPTS for Hydropower would be prepared in an additional Chapter.
- 5) WG members requested to add color photos in the draft Glossary for clear explanation technical terms.

7.2 Activities during Second Field Work in Cambodia (January and February 2009)

7.2.1 Outline of Second Workshop and Working Group Meetings

(1) Working Group Meeting No.3 (on January 20, 2009)

Prior to the Second Workshop, Working Group Meeting No.3 was held on January 20, 2009 and the following were discussed in the meeting. The Memorandums of Working Group Meeting No.3 are presented in Appendix-2 of this report.

- Activities and schedule of Working Group during the Second Field Work of JICA Study Team
- Activities for preparation of the First Seminar
- Contents of revised framework of the draft SREPTS for Hydropower

(2) Main Session of Second Workshop (on January 22, 2009)

The Second Workshop was taken place on January 22, 2009 at MIME's Conference Room with the following agenda. The Minutes Meeting of the Second Workshop is presented in Appendix-1 of this report.

1) Opening Address

H.E. Ith Praing, the Secretary of State for MIME, addressed an appreciation all the participants and also appreciated technical support from JICA for establishment of the SREPTS for Hydropower.

2) Explanation of Interim Report

The JICA Study Team presented the introduction to the Second Workshop and explained the outline and major points of Interim Report.

3) Discussion and Questions

After the explanation on Interim Report by JICA Study Team, the participants discussed the following issues:

- Framework of the draft SREPTS for Hydropower
- Agenda, schedule and arrangements of the First Seminar
- Schedule of activities of the Second Field Work of JICA Study Team

(3) Working Group Meeting No.4 (on January 30, 2009)

Working Group Meeting No.4 was held on January 30, 2009 and the following were discussed. The Minutes of Working Group Meeting No.4 is presented in Appendix-2 of this report.

- Arrangements of the First Seminar and confirmation of the invitation list
- Discussion on the draft text of the SREPTS for Hydropower

(4) Working Group Meeting No.5 (on February 04, 2009)

Working Group Meeting No.5 was held on February 04, 2009 and the following were discussed. The Minutes of Working Group Meeting No.5 is presented in Appendix-2 of this report.

- Contents of the presentation documents for the First Seminar in English and of preparation of the presentation document in Khmer
- Schedule of the translation work of the draft SREPTS for Hydropower into Khmer by the counterpart team
- Discussion on the draft text of the SREPTS for Hydropower

(5) Working Group Meeting No.6 (on February 11, 2009)

Working Group Meeting No.6 was held on February 11, 2009 and the following were discussed. The Minutes Working Group Meeting No.6 is presented in Appendix-2 of this report.

- Contents of the presentation documents for the First Seminar and arrangement of presenters of the counterpart team
- Discussion on the draft text of the SREPTS for Hydropower

(6) The First Seminar (on February 17, 2009)

The First Seminar was held on February 17, 2009 based on the results of discussions in the Second Workshop and the following were presented by the counterpart team and discussed among the participants.

- Current status of Electricity Law and the existing GREPTS and SREPTS and expected promulgation schedule of the SREPTS for Hydropower
- Current status of the licensing system for electric power service providers
- Framework and outline of the draft SREPTS for Hydropower

(7) Working Group Meeting No.7 (on February 19, 2009)

Working Group Meeting No.7 was held on February 19, 2009 and the following were discussed. The Minutes of Working Group Meeting No.7 is presented in Appendix-2 of this report.

- Activities and schedule of Working Group after the Second Field Work of JICA Study Team
- Discussion on the draft text of the SREPTS for Hydropower

(8) Supplemental Meeting for Second Workshop (on February 19, 2009)

In order to discuss further the issues remained for further discussion in the main session of Second Workshop on January 22, 2009, the Supplemental Meeting was taken place on February 19, 2009 at MIME's Meeting Room among the member of Working Group with the following agenda. The Minutes of Supplemental Meeting for the Second Workshop is presented in Appendix-1 of this report.

- Activities and schedule of Working Group after March 2009 and in the Third Field Work of JICA Study Team
- Discussion matters related to recommendations for improvement of the approval and licensing system for hydropower business.

7.2.2 Discussion and Conclusion of Second Workshop (on January 22, 2009)

The following were confirmed and/or concluded as the outcomes of the Second Workshop based on the explanation of Interim Report by JICA Study Team and discussions among the participants in the Workshop:

- 1) The content of Interim Report was accepted by MIME, EAC and EDC.
- 2) JICA Study Team proposed a framework of the draft SREPTS for Hydropower which were prepared revising the draft framework tentatively proposed in Inception Report and further revising the second draft proposed in Interim Report. The proposed framework was agreed among the parties in principle subject to the final conformation in the Supplemental Meeting for the Second Workshop. The major points of the revisions are as follows:
 - i) To separate the draft SREPTS for Hydropower into four (4) Parts providing a independent part for provisions on examinations and inspections as follows:
 - Part 1: General Provisions
 - Part 2: Civil Structures and Hydromechanical Equipment
 - Part 3: Electrical Facilities
 - Part 4: Examination and Inspection
 - ii) To provide with articles for exemption of small hydropower projects, ongoing hydropower projects and the existing hydropower projects in Part 1
- 3) Regarding the First Seminar, the following were agreed among the parties;
 - i) The First Seminar is to be held on February 17, 2009
 - ii) The following parties will be invited to the First Seminar;
 - Representative of all related Ministries of the Government of Cambodia
 - Representative of the concerned DIMEs
 - Representative of IPP Groups who develop hydropower projects in Cambodia
 - Other authorities related to hydropower development such as Cambodian National Mekong Committee
 - iii) Agenda of the First Seminar are to be basically as follows:
 - Present status of the existing GREPTS and SREPTS
 - Present status of Electricity Law and licensing system for electric power businesses
 - Purpose and expected time frame for application of the SREPTS for Hydropower
 - Framework of the draft SREPTS for Hydropower

- iv) Presentation in the First Seminar is performed by MIME, EAC, EDC and JICA Study Team.
- v) The presentation documents are to be prepared both in English and Khmer.
- 4) JICA Cambodia Office recommended MIME to explain, in the First Seminar, the promulgation procedure of SREPTS for Hydropower and MIME agreed to do so.
- 5) MIME raised a query whether or not the criteria for screening of hydropower projects would be involved in the draft SREPTS for Hydropower. JICA Study Team answered to this query that the screening criteria for hydropower projects in planning stage was not scope of SREPTS which should cover specific requirements for technical standards for design, construction and operation stages in principle.
- 6) It was conformed that the Working Groups should perform the following activities during the Second Field Work of JICA Study Team
 - i) Discussions on the contents of the draft SREPTS for Hydropower and Explanation Sheet
 - ii) Preparation of presentation documents for the First Seminar
 - iii) Translation of the draft SREPTS for Hydropower into Khmer
- 7) To hold a Supplemental Meeting for Second Workshop on February 18, 2009 in order to confirm the following;
 - i) Final framework and contents of draft SREPTS for Hydropower
 - ii) Further activities until September 2009 when the submissions of Final Report and the final draft of SREPTS for Hydropower are scheduled

7.2.3 Discussion and Conclusion of Working Group Meeting No.3 (on January 20, 2009)

The following matters were agreed or discussed in Working Group Meeting No.3:

- 1) To hold the Working Group Meetings in weekly basis for the following activities;
 - i) To check and discuss provisions in the draft SREPTS for Hydropower
 - ii) To check and discuss results of translation work of the draft SREPTS for Hydropower
 - iii) To check and discuss contents of presentation documents for the First Seminar
- 2) To make the presentation in the First Seminar for the following subjects by representatives of each agency;
 - i) Present status of the existing GREPTS and SREPTS (by MIME)
 - ii) Present status of Electricity Law and licensing system for electric power businesses (by EAC)
 - iii) Purpose of the SREPTS for Hydropower (by MIME)
 - iv) Framework of the draft SREPTS for Hydropower (by MIME/EAC/EDC and JICA Study Team)
- 3) To proceed with the translation work in the following manner:
 - i) To have periodical co-working with JICA Study Team

- ii) To discuss and confirm results and progress of the translation work in the Working Group Meetings
- 4) To conclude the final framework of the draft SREPTS for Hydropower as follows;

Table 7.2.3-1 Framework of the draft SREPTS for Hydropower

Initial Draft in Inception Report	Final Framework
Part 1: Hydropower Facilities (including General Provisions, Provisions for Civil Structures, Hydromechanical Equipment and Turbine)	Part 1: General Provisions (including General Provisions, Transitional Provisions and Requirements for Project Implementation) Part 2: Civil Structures and Hydromechanical Equipment (including Provisions for Civil Structures and Hydromechanical Equipment)
Part 2: Electrical Facilities (including Provisions for Electrical Facilities in Hydropower Station (excluding Turbine))	Part 3: Electrical Facilities (including Provisions for Electrical Equipments in Hydropower Station (including Turbine), Substation and Switching Station)
Part 3: Particular Provisions (including Requirements for Project Implementation and Transitional Provisions)	Part 4: Examination and Inspection (for Civil Structures and Hydromechanical Equipment and Electrical Facilities)

7.2.4 Discussion and Conclusion of Working Group Meeting No.4 (on January 30, 2009)

The following matters were agreed or discussed in Working Group Meeting No.4;

- 1) Regarding the First Seminar to be held on February 17, 2009, MIME prepares a list of participants by February 2, 2009 and sent d out invitation letters on the same day.
- 2) To start the translation work of the draft SREPTS for Hydropower on February 02 for the civil engineering part and on February 04 for the electrical part.
- 3) Contents of “Part 1 General Provisions (Chapters 1 and 2)” of SREPTS for Hydropower were discussed in the meeting and agreed with some corrections except some pending issues to be discussed in the next WG Meeting.
 - i) Definition of “Owner” in study stages before obtaining license or development concession
 - ii) The usage of terms such as the word of “operation” to be used in combination with “maintenance” in principle
 - iii) Responsible authority shall be always in combination of MIME, EAC and EDC in principle subject to confirmation of the high ranking executives.
 - iv) Article 8 “Obligation of Reporting” is pending for further discussion.

7.2.5 Discussion and Conclusion of Working Group Meeting No.5 (on February 04, 2009)

The following matters were agreed or discussed in Working Group Meeting No.5;

- 1) JICA Study Team prepared and delivered the English version of draft presentation documents for the First Seminar to the Counterpart Team. The Counterpart Team will prepare the Khmer

version of presentation documents based on the English version, and, at the same time, will review and make corrections, if necessary, on the contents of draft presentation documents.

2) The JICA Study Team delivered the draft text of SREPTS for Hydropower for the following portions:

Part 1: General Provisions

Chapter 1: General Provisions and Chapter 2: Particular Provisions
(corrected based on discussion in WG Meeting No.4)

Part 2: Civil Structures and Hydromechanical Equipment

Chapter 3 ~ Chapter 9

Part 4: Examination and Inspection

Chapter 17: General Provisions and

Chapter 18: Examination and Inspection on Civil Structures and Hydromechanical Equipment

3) JICA Study Team was once delivered the draft of SREPTS for Hydropower for the electrical part to the members of Electrical WG in the end of November 2008 for review by the members, and informed that the Study Team would deliver the latest revised version of the same on February 11, 2009

4) JICA Study Team requested the Counterpart Team to complete the translation work for the main text of draft SREPTS for Hydropower by the end of March 2009, and provide the JICA Study Team with questionnaire for the translation work in early April 2009, and the Counterpart Team agreed to do so. In this connection, the Counterpart Team requested JICA Study Team to dispatch the team members for discussions and supporting work of the translation work in May and/or June 2009.

5) The Counterpart Team requested the JICA Study Team to deliver the draft of Explanation Sheets as early as possible to use to as a reference documents for the translation of the main text of SREPTS. The JICA Study Team agreed to deliver the draft Explanation Sheet on or before February 20, 2009.

6) Regarding “Part-4 Examination and Inspection” of the drat SREPTS for Hydropower, a member of Working Group from EAC provided the JICA Study Team with the following comments;

i) MIME shall be responsible to organize an inspection committee, in which EAC will be a member, for the inspections to be performed before commissioning.

ii) Only EAC shall be responsible for inspections after commissioning as the rule in Cambodia under the Electricity Law.

7.2.6 Discussion and Conclusion of Working Group Meeting No.6 (on February 11, 2009)

The following matters were agreed or discussed in Working Group Meeting No.6;

- 1) The following are confirmed among the parties concerning the presentation documents for the First Seminar to be held on February 17, 2009;
 - i) Contents of revisions to be made on the draft prepared by JICA Study Team were confirmed in accordance of the request of the Counterpart Team.
 - ii) Responsible persons from each counterpart agency were confirmed for each part of the presentation in the First Seminar.
- 2) Regarding the revised draft text of SREPTS for Hydropower for “Chapter-1: General Provisions” and “Chapter-2: Particular Provisions” in “Part-1: General Provisions”, the Counterpart Team provided JICA Study Team with the following comments:
 - i) Concerning Article-8 “Obligation of Reporting”, the Counterpart Team requested to provide the sample contents of Reports to be submitted in the Explanation Sheet.
 - ii) The Counterpart Team requested to revise Article-11 “Exemption for Project under Implementation” as an exemption of a hydropower project from provisions of SREPTS shall be judged by MIME but not by MIME and EAC.
- 3) Revisions in “Part-2 Civil Structures and Hydromechanical Equipment,” “Part-3 Electrical Facilities” and “Part-4 Examination and Inspection” of the draft SREPTS for Hydropower were discussed and conformed in the Meeting.

7.2.7 Discussion and Conclusion of Working Group Meeting No.7 (on February 19, 2009)

The following matters were agreed or discussed in Working Group Meeting No.7;

- 1) The schedule of Working Group activities and schedule until the Third Field Work of JICA Study Team scheduled in July 2009 was confirmed as follows:
 - i) JICA Study Team would submit the revised first draft of SREPTS for Hydropower to the Counterpart Team on or before February 20, 2009.
 - ii) JICA Study Team would submit the revised first draft of Explanation Sheet of the draft SREPTS for Hydropower to the Counterpart Team on or before February 20, 2009.
 - iii) The Counterpart Team would complete the translation work of the revised first draft of the SREPTS for Hydropower by the end of April 2009.
 - iv) The Counterpart Team would complete the translation work of the first draft of the Explanation Sheet of the draft SREPTS for Hydropower by the end of June 2009.
- 2) The Counterpart Team requested JICA Study Team to reconsider deletion of the definition of “Small Scale Generating Equipment” from Article 1 (tentative number) in Part 3.
- 3) The Counterpart Team would provide JICA Study Team with the comments after reviewing the first draft of SREPTS for Hydropower and Explanation Sheets .

7.2.8 Discussion and Conclusion of Supplemental Meeting for Second Workshop (on February 19, 2009)

As agreed in the main session of Second Workshop on January 22, 2009, the Supplemental Meeting was held on February 19, 2009 for confirming the results of activities in the Second Field Work of JICA Study Team. The following were confirmed or concluded in the Meeting.

- 1) The schedule of the activities for preparation of the draft SREPTS for Hydropower was tentatively confirmed as follows:
 - Submission of the revised first draft of SREPTS for Hydropower on February 20, 2009
 - Submission of the first draft of Explanation Sheet on February 20, 2009
 - First stage translation of the draft SREPTS into Khmer by the end of April 2009
 - Delivery of questions and comments to JICA Study Team regarding the translation work by the end of April 2009
 - Dispatching JICA Study Team for supporting the translation work during the period from the middle of May to the end of June 2009
 - First stage translation of the draft Explanation Sheet into Khmer by the end of June 2009
 - Third Field Work of JICA Study Team in July 2009
 - Third Workshop in the first half of July 2009
 - Second Seminar in late July 2009
 - Supplemental Meeting for Third Workshop in the late July 2009
- 2) MIME requested JICA Study Team to prepare copies of the first draft SREPTS for Hydropower for delivering the document to the 21 participants of First Seminar. JICA Study Team agreed to the proposal subject to the consent of JICA Office.
- 3) MIME, EAC and EDC provided JICA Study Team with the requests to JICA Office for the following issues and JICA Study Team reported the requests to JICA Office;
 - i) Capacity building program for hydropower engineers
 - Supply of guidebooks or textbooks for hydropower civil works, hydromechanical works and electromechanical works as well as operation and maintenance guidebook
 - Training of hydropower engineering (particularly O&M) in Vietnam and/or Japan
 - Study tour to the hydropower project sites in Japan
 - Supply of measurement equipment such as current meter and related capacity building
 - ii) Follow-up Study after development of the SREPTS for Hydropower
 - Establishment of Examination and Inspection Manual for Hydropower Projects
 - Establishment of Safety Rules and Guideline
 - Establishment of Operation and Maintenance Management System (optimum or least cost O&M Planning)

- iii) Dispatching an expert from JICA (particularly to EAC and EDC)
- 4) The draft SREPTS shall be delivered to participants of the Second Seminar at least one month before. Presentation in the Second Seminar will be made in combination with the Counterpart Team and JICA Study Team.

7.2.9 Outline of First Seminar (on February 17, 2009)

The First Seminar was held in the manner as described below:

(1) Outline of the First Seminar

- 1) Date and Time: February 17, 2009 from 8:30AM to 12:30PM
- 2) Place: Conference Room at Phnom Penh Hotel
- 3) Participants: 76 persons from the following organizations (see Appendix-3)
 - Counterpart Agencies (MIME, EAC and EDC) and JICA
 - Ministries related to hydropower development
 - Provincial Department of Industry, Mines and Energy (DIME) related to hydropower development
 - Private groups related to hydropower development (IPP groups)
 - Other organizations related to hydropower development such as Cambodian National Mekong Committee
- 4) Major Agendas
 - Current enforcement status of the existing GREPTS and SREPTS
 - Current status of Electricity Law and Licensing System for Electric Power Business
 - Purpose of establishment of SREPTS for Hydropower
 - Framework of the draft SREPTS for Hydropower

(2) Program of the Seminar

- 1) Key Note Address by Mr. Yukiharu Kobayashi, Deputy Chief Representative, JICA Cambodia Office
- 2) Opening Address by H.E. Suy Sem, Minister of Ministry of Industry, Mines and Energy
- 3) Presentation by Counterpart Agencies
 - Introduction by Dr. Bun Narith, Deputy Director General, General Department of Energy, MIME
 - Present Status of GREPTS and the existing SREPTS by Mr. So Veasna, MIME
 - Present Status of Electrical Law and Licensing System by Mr. Theng Marith, EAC
 - Purpose of SREPTS for Hydropower by Mr. Much Chhun Horn, MIME
 - Framework of Draft SREPTS for Hydropower by Mr. Chea Narin and Mr. Pan Narith, MIME

- 4) Questions and Answers
- 5) Closing Address by H.E. Ith Praing, Secretary of State for MIME

(3) Major Discussions

The discussions were made among the participants of the Seminar after the presentation of the Counterpart Team under leading of H.E. Ith Praing of MIME and H.E. Ty Norin of EAC. The major topics of the discussions are summarized below;

- 1) In the First Seminar, the framework of the draft SREPTS for Hydropower was explained without delivering the draft SREPTS for Hydropower itself, to the participants because it was still under preparation. In this connection, it was pointed by some participants that the draft of the SREPTS shall be delivered for concrete discussion.

Accordingly, it was agreed that MIME would deliver the first draft of SREPTS for Hydropower to the participants of the First Seminar after it was prepared by JICA Study Team, and then the participants would send comments on the contents of draft to MIME.

- 2) Regarding the general provision of the draft SREPTS for Hydropower, the following were discussed.

- i) A participant pointed out that the two year might be too long as the period of exemption for a harmful existing project.

In reply to the above, MIME confirmed that the exemption period of two years was set in the SREPTS at its promulgation in 2004, so that there should be no harmful project after 4 years have past from the promulgation.

- ii) A participant queried what provisions are provided in the SREPTS for Hydropower concerning the environmental issues.

In reply to the above, JICA Study Team clarified that he would propose a provision in the draft SREPTS for Hydropower that requires a hydropower project to satisfy the requirements in the Environmental Law and regulations in Cambodia.

- iii) A participant stated that it was necessary to carefully consider the following points in application of the SREPTS for Hydropower;

- Conditions on exemption of a small scale project
- Regarding the IPP projects under implementation, application of the SREPTS shall not be of affecting the existing conditions in the Implementation Agreement (IA) and the Power Purchase Agreement (PPA).
- Application to the existing hydropower facilities under operation

JICA Study Team explained that the exemption provisions have been proposed in the draft SREPTS for Hydropower taking into consideration of the above points and based on the discussions with the Counterpart Agencies. The draft text of the related provisions will be confirmed in the Second Seminar.

- 3) A representative from MRD (Ministry of Rural Development) pointed out that a small scale hydropower plant may have a problem in term of sustainable operation due to relatively high electricity tariff.

In reply to the above, a representative of DIME answered that it is inevitable to set a relatively high electricity tariff for a small scale hydropower plant as a source of reinvestment cost for proper maintenance of the facilities to achieve sustainable power supply, and such a way would benefit local people.

In addition, EAC provided the supplemental comments as follows:

- Safety issues are the most important in the operation of a power plant
- It is also important to secure the quality and safety of facilities by applying the GREPTS and SRPETS and consequently to improve efficiency of power supply.
- It is important to balance the power development and environmental conservation including social effects.
- A reason of high electricity tariff of Cambodia compared with that of other countries might be the fact that the scale of power plants is small in general so that no scale merit can be enjoyed in Cambodia.

- 4) The following were discussed concerning the operation of the SREPTS

- i) JICA Study Team requested EAC to explain how the existing SREPTS are currently used in the Licensing System for electric power service providers.

EAC explained as follows:

“The existing SREPTS is used as a part of a License for electric power services by setting a condition that requests licensees to abide the electric power technical standards. Licensees shall abide two regulations for the electric power business; Technical Standards and Grid Code (rules for operating power grids).

- ii) An IPP group from China provided with a query that the framework of the SREPTS for Hydropower was explained in the presentation of this Seminar but what have been the policies in preparation of the technical standards relating to contents of specific requirements. Also, an IPP group from Vietnam provided with a comment that the SREPTS shall be of suitable for the situation in Cambodia and shall not be a copy of Japanese technical standards of which requirements are at a too high level.

In reply to the query, MIME explained as follows:

MIME also considers it is important to prepare technical standards suitable to the situation in Cambodia by not simply copying some foreign technical standards. In this regards, MIME will deliver a copy of the tentative version of draft SREPTS for Hydropower to the participants of this Seminar in order to collect opinions from the participants.

- 5) In the Closing Address of the Seminar, H.E. Ith Praing of MIME provided the participants with the statements including the following:

- MIME has prepared the GREPTS and the SREPTS for Transmission and Distribution Facilities and Thermal Power Facilities until now. However, there are still some fields for which SREPTS shall be prepared.
- The SREPTS for Hydropower is still under preparation but MIME appreciates the cooperation of JICA provided so far as well as in the future.
- Although the outline and framework of the SREPTS for Hydropower was announced in the First Seminar, detailed contents will be discussed in the Second Seminar scheduled in July 2009 and the final draft will be prepared by the end of September 2009.
- The draft of SREPTS for Hydropower will be delivered to the participants of the Seminar as soon as possible after the JICA Study Team has prepared the draft.
- In the preparation of the SREPTS for Hydropower, the aspects of safety, quality and sustainability including environmental conservation and dam safety are important. In this sense, it is desirable to have satisfactory results by studying the provisions of SREPTS for Hydropower from such important aspects.
- The power sector of Cambodia is giving a priority on the hydropower development by the private sector, so that participation of many IPP groups is expected in the Second Seminar.

7.3 Activities during the 2.5th Field Work in Cambodia (June and July 2009)

7.3.1 Outline of the 2.5th Field Work in Cambodia

The 2.5th Field Work in Cambodia was conducted during the period from June 15 to July 11, 2009 in order to support the translation work of the draft SREPTS for Hydropower and its Explanation Sheet to have been performed by the Counterpart Team since February 2009. The JICA Study Team arranged technical discussions to clarify and/or reply to the questions raised by the Counterpart Team during the course of translation work to complete the translation work on schedule before completion of the Third Field Work, which is the final field work of JICA Study Team in Cambodia. The progress of the translation work was checked from time to time in the Working Group Meetings No.8 to No.16 held during the 2.5th Field Work as well as during the third Field Work. The outline of the discussions is described below.

7.3.2 Outline of Working Group Meetings

(1) Working Group Meeting No.8 (on June 16, 2009)

Working Group Meeting No.8 was held on June 16, 2009 and the following were discussed in the meeting. The Minutes Working Group Meeting No.8 is presented in Appendix-2 of this report.

- Schedule of the 2.5th Field Work of JICA Study Team
- Confirmation of progress of the translation work of SREPTS and Explanation Sheet

(2) Working Group Meeting No.9 (on June 24, 2009)

Working Group Meeting No.9 was held on June 24, 2009 and the following were discussed in the meeting. The Minutes Working Group Meeting No.9 is presented in Appendix-2 of this report.

- Confirmation of progress of the translation work of Explanation Sheet
- Method to ensure quality of the translation work into Khmer

(3) Working Group Meeting No.10 (on June 29, 2009)

Working Group Meeting No.10 was held on June 29, 2009 and the following were discussed in the meeting. The Minutes Working Group Meeting No.10 is presented in Appendix-2 of this report.

- Confirmation of progress of the translation work of Explanation Sheet
- Activity schedule by the end of August 2009

The JICA Study Team delivered the 20 copies of Draft Final Report (Summary Report, Main Report and Annex) to MIME in the Meeting. In addition, 50 copies of Annex were prepared for delivery to the expected participants of the Second Seminar.

(4) Working Group Meeting No.11 (on July 06, 2009)

Working Group Meeting No.11 was held on July 6, 2009 and the following were discussed in the meeting. The Minutes Working Group Meeting No.11 is presented in Appendix-2 of this report.

- Confirmation of activity schedule by the end of August 2009
- Confirmation of progress of the translation work of Explanation Sheet

7.3.3 Discussion and Conclusion of Working Group Meetings in 2.5th Field Work

The following matters were agreed or discussed in Working Group Meetings No.8 to No.11:

- 1) The initial translation work of the draft SREPTS for Hydropower has been finished already by the members of Working Group by June 16, 2009.
- 2) MIME shall provide JICA Study Team with the comments from Ministry of Environment, Ministry of Water Resources and Meteorology and other parties made based on the first draft SREPTS for Hydropower delivered in February 2009 after the First Seminar held on February 17, 2009.
- 3) The Counterpart Team shall complete the translation work of Explanation Sheet by the end of July 2009 taking account of its role of technical transfer to the Cambodian engineers.
- 4) The Counterpart Team plans to check the result of initial translation work into Khmer by the leader of Counterpart Team and made corrections if necessary in order to ensure the quality of translation works.
- 5) The Counterpart Team requests JICA Study Team to prepare the final draft of SREPTS for Hydropower so as not to have discrepancies with other countries' technical standards.

- 6) The Counterpart Team and JICA Study Team agreed to hold the Second Seminar on August 6, 2009 and deliver invitation letter together with a copy of draft SREPTS and Explanation Sheet to the expected participants in the Second Seminar 10 days before at latest.
- 7) Presentation in the Second Seminar shall be made in both Khmer and English simultaneously.
- 8) The Counterpart Team confirmed that the opinions of participants of the Second Seminar requiring drastic or unreasonable change in the SREPTS shall not be necessary to be reflected in the final draft of SREPTS.

7.4 Activities during Third Field Work in Cambodia (July and August 2009)

7.4.1 Outline of Third Workshop and Working Group Meetings

(1) Working Group Meeting No.12 (on July 14, 2009)

Working Group Meeting No.12 was held on July 14, 2009 and the following were discussed in the meeting. The Minutes of Working Group Meeting No.12 is presented in Appendix-2 of this report.

- Reconfirmation of the schedule of activities by the end of August 2009
- Confirmation of progress of the translation work of Explanation sheets

(2) Working Group Meeting No.13 (on July 21, 2009)

Prior to the Third Workshop, Working Group Meeting No.13 was held on July 21, 2009 and the following were discussed in the meeting. The Minutes of Working Group Meeting No.13 is presented in Appendix-2 of this report.

- Confirmation of progress of the translation work of Explanation sheets
- Activities and schedule of Working Group during the Third Field Work of JICA Study Team
- Activities for preparation of the Second Seminar

(3) Main Session of Third Workshop (on July 22, 2009)

The Third Workshop was taken place on July 22, 2009 at MIME's Conference Room with the following agenda. The Minutes Meeting of the Third Workshop is presented in Appendix-1 of this report.

1) Opening Address

H.E. Ith Praing, the Secretary of State for MIME, addressed an appreciation all the participants and also appreciated technical support from JICA for establishment of the SREPTS for Hydropower.

2) Explanation of Draft Final Report and the draft SREPTS for Hydropower

The JICA Study Team presented the outline and major points of Draft Final Report and the draft SREPTS for Hydropower.

3) Discussion and Questions

After the explanation of Draft Final Report and the draft SREPTS for Hydropower by JICA Study Team, the participants discussed the following issues:

- Major provisions of the draft SREPTS for Hydropower
- Agenda, schedule and arrangements of the Second Seminar
- Schedule of activities of the Third Field Work of JICA Study Team

(4) Working Group Meeting No.14 (on July 28, 2009)

Working Group Meeting No.14 was held on July 28, 2009 and the following were discussed. The Minutes of Working Group Meeting No.14 is presented in Appendix-2 of this report.

- Confirmation of contents of draft Minutes of the Third Workshop
- Confirmation of progress of the translation work of Explanation sheets
- Preparation of the Second Seminar
- Proposed revisions on the contents of draft SEPTS for Hydropower

(5) Working Group Meeting No.15 (on August 04, 2009)

Working Group Meeting No.15 was held on August 4, 2009 and the following were discussed. The Minutes of Working Group Meeting No.15 is presented in Appendix-2 of this report.

- Confirmation of contents of draft Minutes of the Third Workshop
- Confirmation of progress of the translation work of Explanation Sheets
- Preparation of the Second Seminar
- Proposed revisions on the contents of the draft SEPTS for Hydropower

(6) The Second Seminar (on August 06, 2009)

The Second Seminar was held on August 6, 2009 based on the results of discussions in the Third Workshop and the following were presented by the counterpart team and discussed among the participants.

- Purpose and outline of SREPTS for Hydropower
- Contents of the draft SREPTS for Hydropower (Part-1 to Part-4)

(7) Follow-up Meeting for Third Workshop (on August 07, 2009)

In order to discuss further the issues remained for further discussion in the main session of Third Workshop on July 22, 2009, the Follow-up Meeting was taken place on August 7, 2009 at MIME's

Meeting Room among the member of Working Group and the representative of JICA Cambodia Office with the following agenda. The Minutes of Follow-up Meeting for Third Workshop is presented in Appendix-1 of this report.

- Revisions on the draft SREPTS for Hydropower agreed in the Third Workshop
- Revisions on the draft SREPTS for Hydropower and Explanation Sheet agreed in the WG Meetings held after the Third Workshop
- Revisions on the draft SREPTS for Hydropower suggested in the Second Seminar
- Schedule after the Follow-up Meeting

(8) Working Group Meeting No.16 (on August 11, 2009)

Working Group Meeting No.16 was held on August 11, 2009 and the following were discussed. The Minutes of Working Group Meeting No.16 is presented in Appendix-2 of this report.

- Confirmation of the agreed post revisions on the draft SREPTS for Hydropower and the draft Explanation Sheet
- Recommendations proposed in Draft Final Report (Chapter 12)
- Request of Follow-up Activities for execution of GREPTS and SREPTSs,

7.4.2 Discussion and Conclusion of Third Workshop (on July 22, 2009)

The following were confirmed and/or concluded as the outcomes of the Third Workshop based on the explanation of Draft Final Report and the draft SREPTS for Hydropower by JICA Study Team and discussions among the participants in the Workshop:

- 1) The content of Draft Final Report was accepted by MIME, EAC and EDC.
- 2) JICA Study Team proposed the provisions of the draft SREPTS for Hydropower which were prepared revising the first draft tentatively proposed at the end of Second Field Work in February 2009. The proposed contents of the draft SREPTS for Hydropower were agreed among the parties in principle subject to some revisions discussed in the Workshop and conformation in the Follow-up Meeting for the Third Workshop. The major points of the revisions are as follows:
 - i) To state clearly the responsible agencies for required actions stipulated in Part 1 of the draft SREPTS for Hydropower such as Article-5 “Assignment of Chief Engineers”, Article-7 “Order of Remedy for Conformance to Technical Standards”, Article-8 “Obligation for Reporting”, etc.
 - ii) To maintain the proposed provision of Article 6 “Environmental Protection” and state the relevant law and regulations in the explanation for Article 6 in Explanation Sheet.
 - iii) To reconsider the proposed criteria of dam classification proposed in Article 21 “Design Flood” to suit to the condition of Cambodia and also taking into account international practices
- 3) Regarding the Second Seminar, the following were agreed among the parties;

- i) The Second Seminar is to be held on August 6, 2009.
 - ii) The following parties will be invited to the Second Seminar;
 - Representative of all related Ministries of the Government of Cambodia
 - Representative of the concerned DIMEs
 - Representative of IPP Groups who develop hydropower projects in Cambodia
 - Other authorities related to hydropower development, such as Cambodian National Mekong Committee
 - iii) Agenda of the Second Seminar are to be basically as follows;
 - Purpose of SREPTS for Hydropower
 - Explanation of the proposed draft SREPTS for Hydropower
 - iv) Presentation in the First Seminar is performed by MIME, EAC and JICA Study Team.
 - v) The presentation documents are to be prepared both in English and Khmer.
- 4) It was conformed that the Working Groups should perform the following activities during the Third Field Work of JICA Study Team;
- i) Translation of the draft SREPTS for Hydropower into Khmer by the end of July 2009
 - ii) Translation of the draft Explanation Sheet into Khmer by the middle of August 2009
- 5) To hold a Follow-up Meeting for Second Workshop on August 07, 2009 in order to confirm the following;
- i) Results of activities during the Third Field Work including further modifications on the proposed provisions in the draft SREPT for Hydropower
 - ii) Settlement of all queries and comments made by participants in the Second Seminars and the Cambodian Counterpart Team for finalizing the contents of the draft SREPTS for Hydropower

7.4.3 Discussion and Conclusion of Working Group Meetings in Third Field Work

The following matters were agreed or discussed in Working Group Meetings No.12 to No.16;

- 1) The details of Third Workshop to have been held on July 22 were discussed and confirmed in the Working Group Meeting No.12 on July 14, 2009.
- 2) Progress of the translation work of the draft SREPTS for Hydropower and the draft Explanation Sheet was monitored in each Working Group Meeting.
- 3) Preparation of documents for the Second Seminar to be held on August 6, 2009 was discussed and executed in the Working Group Meetings No.13 to 15.
- 4) Contents of the Minutes of Third Workshop was confirmed and agreed in the Working Group Meeting No.14 held on July 28, 2009.

- 5) JICA Study Team proposed the revisions on the content of the draft SREPTS for Hydropower and the revisions were agreed after discussion as shown in Attachment-1 and Attachment-2 of the Minutes of Working Group Meeting No.14 respectively.
- 6) Further post revisions on the draft SREPTS for Hydropower and Explanation Sheet including those in Article 8 “Obligation of Reporting” were presented by JICA Study Team and confirmed by the Counterpart Team in the Working Group Meeting No.15 on August 4, 2009.
- 7) Contents of the final revisions on the draft SREPTS for Hydropower and the draft Explanation Sheet were confirmed among the Counterpart Team and JICA Study Team in the Working Group Meeting No.16 on August 11, 2009.

7.4.4 Outline of Second Seminar (on August 06, 2009)

The Second Seminar was held in the manner as described below:

(1) Outline of the Second Seminar

- 1) Date and Time: August 6, 2009 from 8:30AM to 16:30PM
- 2) Place: Conference Room at Phnom Penh Hotel
- 3) Participants: 90 persons from the following organizations (see Appendix-3)
 - Counterpart Agencies (MIME, EAC and EDC) and JICA
 - Ministries related to hydropower development (MOE, MOWRAM, MRD, etc.)
 - Provincial Department of Industry, Mines and Energy (DIME) related to hydropower development
 - Private groups related to hydropower development (IPP groups)
 - Other organizations related to hydropower development such as Cambodian National Mekong Committee
- 4) Major Agendas
 - Purpose of the SREPTS for Hydropower
 - Contents of the draft SREPTS for Hydropower

(2) Program of the Seminar

- 1) Welcome Address by Dr. Bun Narith, Deputy General Director, General Department of Energy, MIME
- 2) Key Note Address by Mr. Yusuke Murakami, Senior Representative, JICA Cambodia Office
- 3) Opening Address by H.E. Ith Praing, Secretary of State for MIME
- 3) Presentation by Counterpart Agencies
 - Introduction and purpose of SREPTS by Dr. Bun Narith, Deputy Director General, MIME
 - Outline of the draft SREPTS for Hydropower by Mr. Much Chhun Horn, MIME
 - Explanation of the draft SREPTS (Part-1) by Mr. Chea Narin, MIME

- Explanation of the draft SREPTS (Part-2) by Mr. Theng Marith, EAC
 - Explanation of the draft SREPTS (Part-3) by Mr. So Veasna, MIME
 - Explanation of the draft SREPTS (Part-4) by Mr. Suon Ponnarith and Mr. Teng Saroeun, EAC
- 4) Questions and Answers
 - 5) Comment of JICA Study Team
 - 6) Summary and Conclusion (MIME/EAC)
 - 7) Closing Remarks by H.E., Say Phirum, Under Secretary of State, MIME

(3) Major Discussions

The discussions were made on the contents of draft SREPTS for Hydropower among the participants of the Second Seminar after the presentation of the Counterpart Team for each part. The major topics of the discussions are summarized below;

- 1) Regarding Article-2 “Purpose”, a participant from a Vietnamese group of power sector made a comment that it is impossible to develop a hydropower project if we have to follow strictly the provisions stipulated in Article-2 of the draft SREPTS for Hydropower, which require no adverse effect to surrounding environment. In response to this comment, it was agreed among the participants to add the following sentence at the end of Article-2 respecting the purpose of Article-2;

“The owner shall proceed with a project in its planning, design, construction and operation giving the utmost respect to the above purposes.”

- 2) Regarding Article-5 “Assignment of Chief Engineers”, a participant made a comment who would be a chief engineer at the design stage and the other stages if a consulting company implements them instead of the project owner. In response to this comment, JICA Study Team explained for clarification that an owner shall nominate a chief engineer on his own responsibility at each stage of a project and such chief engineer may be employed from a consultant company, and it is required for a chief engineer at a stage to handover his work to another chief engineer at the next stage in an appropriate manner.
- 3) Regarding Article-6 “Environmental Protection”, a participant from MOE made a comment that the actual law and regulations to be followed by owners shall be clarified in Article-6. In response to this comment, a member of the Counterpart Team explained that such clarifications are to be provided in Explanation Sheet but not in the SREPTS for Hydropower itself because such laws and regulations are under control of the other ministries but not by MIME or EAC.

Also a participant from MAFF made comment that more attention shall be paid to the environmental issues in hydropower development. In response to this comment, JICA Study Team explained for clarification that the draft SREPTS for Hydropower requires an owner to follow the existing environmental laws and regulations and also the owner shall take appropriate measures for environmental conservation in accordance with conditions suggested by the approved EIA report.

- 4) A participant from MOWRAM made a comment that reservoir water shall be utilized more effectively in terms of the fishery and other natural resources. In response to this comment, a member of the Counterpart Team explained that such matters are out of the scope of SREPTS for Hydropower and shall be discussed in IEA.
- 5) Regarding Article-24 “Loads” in Part-2, a participant from a relevant Ministry made a comment that application of international standards such as standards for earthquake sometimes push up the project cost as no earthquake occurs in Cambodia. In response to this comment, JICA Study Team explained that SREPTS for Hydropower stipulates the minimum technical requirement against earthquake taking into account the seismic conditions in Cambodia and the international practice, and such minimum requirement does not affect so much to the project cost.
- 6) Regarding Article-155 “Maintaining for Telecommunication Equipments in case of Disasters” in Part-3, a participant made a comment whether the wind velocity of 60 m/s is applied only for telecommunication line or both for overhead electrical lines and telecommunication line. In response to this comment, JICA Study Team explained that the wind velocity of 60 m/s, which is 1.5 times of the maximum wind velocity criteria for overhead electrical lines, shall be applied for the telecommunication equipment in order to maintain telecommunication function in case of disasters.
- 7) Regarding the entire Articles in SREPTS for Hydropower, a participant from a IPP group made a comment asking whether American, European and Chinese consulting companies can understand and follow technical standards established by the Japanese study team. In response to this comment, JICA Study Team explained that SREPTS for Hydropower was established refereeing the internationally recognized standards used in other countries.

After the above discussions, it was confirmed that all of the participants basically agreed to the contents of draft SREPTS for Hydropower at the end of the Seminar.

CHAPTER 8
FRAMEWORK OF DRAFT SREPTS
FOR HYDROPOWER

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Chapter 8 Framework of Draft SREPTS for Hydropower

8.1 Outline of Discussions regarding Framework of Draft SREPTS for Hydropower

The parties agreed on the composition of a draft SREPTS for Hydropower as follows in the Second Workshop held on January 22, 2009 in the Second Field Work in the Kingdom of Cambodia;

(1) The draft SREPTS for Hydropower consists of four parts of which Part-4 covers provisions regarding examinations and inspections;

Part-1 : General Provision

Part-2 : Civil Structures and Hydromechanical Equipment

Part-3 : Electrical Facilities

Part-4 : Examination and Inspection

(2) Part-1 includes provisions of exemptions for small hydropower projects and projects under implementation and the existing projects.

Based on the agreement, the parties have held Working Group (WG) meetings in weekly basis in the Second Field Work in the Kingdom of Cambodia at the MIME meeting room, and confirmed the following regarding the contents of the draft SREPTS for Hydropower through discussions in Civil WG and Electrical WG between the JICA Study Team and the counterpart team members.

- 1) Provisions regarding examinations and inspections
- 2) Application of SREPTS for Hydropower to small hydropower projects
- 3) Application of SREPTS for Hydropower to hydropower projects under operation
- 4) Application of SREPTS for Hydropower to hydropower projects under implementation
- 5) Relation with laws and regulations regarding environmental protection and conservation
- 6) Conformance with existing GREPTS, SREPTS for transmission and distribution facilities and SREPTS for thermal power generating facilities

The JICA Study Team prepared a draft SREPTS for Hydropower and its Explanation Sheet considering the above discussion results, and submitted them to the Cambodian side counterpart team on February 19 regarding the part of electrical equipment and on February 20 regarding the part of civil engineering structures.

In a follow-up meeting for the second Workshop held on February 19, 2009, MIME requested the JICA Study Team to distribute the draft SREPTS for Hydropower to the 21 organizations which participated in the First Seminar and the JICA Study Team submitted 21 copies of the draft SREPTS for Hydropower on February 23, 2009.

8.2 Items discussed and confirmed in Working Group Meetings

The six items which have been discussed and confirmed in the working group meetings are as follows.

8.2.1 Articles for Examination and Inspection

It was agreed among the parties that a new part titled “Examination and Inspection” is to be established as Part 4 to describe provisions for examinations and inspections.

As for civil engineering facilities, Part-4 of SREPTS for Hydropower stipulates the provisions for “in-progress inspection”, “completion inspection” and “periodical inspection”.

As for electromechanical facilities, Part-4 only provides provisions for tests to be performed during installation work and at commissioning, because the maintenance work of electrical facilities after commissioning shall be performed in accordance with the provisions stipulated in “Safety Policy” in General Provision of Part-3 “Electrical Facilities”

8.2.2 Application of SREPTS for Hydropower to Small Hydropower Projects

It was pointed out in the discussion that application of SREPTS for Hydropower to a small scale hydropower project would cause difficulty in project implementation and, consequently, disturb the promotion of rural electrification. Accordingly, exemption of small scale hydropower projects from application of SREPTS for Hydropower was studied.

The MIME’s classificatory criterion stipulates that hydropower facilities with total output of 10 MW or less should be classified as a small scale hydropower. On the other hand, one of the purposes of SREPTS for Hydropower is to prevent hydropower facilities from threatening public safety and, this purpose shall be maintained any hydropower projects regardless of their development scale. In this context, the JICA Study Team prepared a draft provision in the Second Field Work in the Kingdom of Cambodia to exempt small scale hydropower facilities from the subject of SREPTS for Hydropower based on the following two conditions and the Cambodian side counterpart team agreed to the proposal:

- Construction, operation and failure of a hydropower station shall not affect the public safety.
- Failure of a hydropower station shall not seriously affect to the connected power grid or a hydropower plant is separated from the existing power grid.

8.2.3 Application of SREPTS for Hydropower to Existing Hydropower Station

The parties agreed to exempt the existing hydropower facilities from the application of SREPTS for Hydropower in principle because its application will require improvement of the facilities and consequently prevent the facilities from operation, which may hinder stable supply of electricity. The JICA Study Team prepared a draft of such exceptional provision that permits operation of existing hydropower facilities till the time of those renewal or replacement unless they are harmful to public

safety. This draft provision was discussed in the meeting during Second Field Work and agreed by the Cambodian side counterpart team.

8.2.4 Application of SREPTS for Hydropower to Projects under Implementation

The parties agreed to exempt the hydropower projects under implementation from the application of SREPTS for Hydropower in principle because its application will require a change of specifications and, consequently delay a construction schedule and/or increase construction costs, which may affect conditions in existing agreements and may cause delay in electric power development schedule. On the other hand, a restriction is required in view of the public safety. Accordingly, the JICA Study Team prepared a draft of such exceptional provision that may exempt any hydropower facilities under implementation from the application of this SREPTS at the time of its enforcement on condition that the owner shall try to do his utmost so that such hydropower facilities conform to this SREPTS as much as possible. This draft provision was discussed in the meeting during Second Field Work in the Kingdom of Cambodia, and agreed by the Cambodian side counterpart team.

However, the JICA Study Team added a provision which stipulates that the owner shall be always responsible for reporting, and monitoring and inspections regardless of any exemptions described in **Clauses 8.2.2, 8.2.4 and 8.2.4.**

8.2.5 Provisions for Requirements related to Existing Environmental Regulations

In the Kingdom of Cambodia, MOE established the Environmental Law to regulate handling of waste materials, water quality, deforestation and an environmental impact assessment. Accordingly, the JICA Study Team prepared a draft of such provision that instructs owners to implement studies, investigations, construction and operation of a hydropower facility complying with the requirements set by the Environmental Law and other related laws and regulations. This draft provision was discussed in the meeting during Second Field Work in the Kingdom of Cambodia and agreed by the Cambodian side counterpart team.

8.2.6 Conformance with existing GREPTS and SREPTS

In the Kingdom of Cambodia, the GREPTS and SREPTS for Thermal Power Generating Facilities and for Transmission and Distribution Facilities have been established and enforced already. Although the provisions in the SREPTS for Hydropower will be prepared so as to conform to the provisions in the existing GREPTS and SREPTS, there may be such cases that a provision of the SREPTS for Hydropower contradicts the existing provisions. In this regard, it was agreed with Cambodian side that the JICA Study Team will prepare a draft SREPTS for Hydropower accepting some discrepancies with the provisions of existing GREPTS and SREPTS for such case that a contradiction is inevitable.

In the above regard, the JICA Study Team would propose revisions on the existing GREPTS and SREPTS if it is found necessary as the result of study in preparation of the draft SREPTS for Hydropower.

CHAPTER 9

POLICY AND OUTLINE OF DRAFT

GLOSSARY OF SREPTS FOR

HYDROPOWER

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Chapter 9 Policy and Outline of Draft Glossary of SREPTS for Hydropower

9.1 Basic Policy

The draft Glossary for SREPTS for Hydropower was prepared in accordance with the basic policy explained below:

There are not so many existing hydropower facilities in the Kingdom of Cambodia, so Cambodian engineers and/or technicians do have abundant experiences in design, construction, operation and maintenance of these facilities. Considering this situation, brief explanations are attached to the technical terms which appear in the SREPTS for Hydropower so that the Cambodian side counterpart team may understand names, contents of design standards of hydropower facilities and phenomena which occur in those facilities, and may translate those terms into Khmer more easily. At the request of the Cambodian side counterpart team, figures and photographs are attached to some technical terms to help them understand forms and functions of structures.

The JICA Study Team prepared a draft Glossary in the First Field Work in the Kingdom of Cambodia as attached in the Appendix-3 of Interim Report and discussed its contents with the Cambodian side counterpart team. Then, during the period of Second Field Work in the Kingdom of Cambodia, the JICA Study Team and the Cambodian side counterpart team held meetings in the presence of a program officer of JICA Cambodia Office, on January 29 and February 4, 2009 to confirm technical terms regarding civil structures and hydromechanical equipment and regarding electrical equipment respectively. At the request of the Cambodian side counterpart team, technical terms, numerical formulae and explanations were added to the glossary.

9.2 Glossary for Civil Structures and Hydromechanical Equipment

Brief explanations were attached to the technical terms which appeared in the draft SREPTS for Hydropower and/or the JICA Study Team judged necessary according to the following criteria;

- 1) Technical terms which mean structures and phenomena peculiar to hydropower facilities and are not explained in a general dictionary, and
- 2) Technical terms which require explanations as they have different meanings from ones generally used.

The glossary for civil structures and hydromechanical equipment were arranged alphabetically entirely in one without categorizing as it was difficult to classify them into categories.

9.3 Glossary for Electrical Equipment

Regarding the technical terms of the electrical facilities, the terms of which an explanation is indispensable were selected among the technical terms used in Part 3 of the draft SREPTS for Hydropower. The technical terms were classified into the following five (5) categories and arranged in alphabetical order.

- 1) General Terms
- 2) Physical Terms
- 3) Mechanical Terms
- 4) Electrical Terms
- 5) Electric Wires and Cable Terms

Terms which are out of the above categories of items 2) to 5) above are classified into the category 1) General Terms.

Some important mechanical terms of the turbine, which is the major equipment in hydropower plants, are added to the draft Glossary with explanation and photographs, even if such terms are not used in the draft SREPTS for Hydropower.

CHAPTER 10

POLICY AND OUTLINE OF DRAFT SREPTS

FOR HYDROPOWER

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Chapter 10 Policy and Outline of Draft SREPTS for Hydropower

Based on the result of discussion with Cambodian side counterpart team described in **Chapter 8** of this report, the draft SREPTS for Hydropower consists of the following four (4) parts as follows;

- Part 1 : General Provisions
- Part 2 : Civil Structures and Hydromechanical Equipment
- Part 3 : Electrical Facilities
- Part 4 : Examination and Inspection

The JICA Study Team prepared provisions of the draft SREPTS for Hydropower as shown in Annex of this report (separate volume) considering the following manners as basic policies;

- referring electric power technical standards of Lao PDR and Vietnam, for which JICA has conducted the studies, as well as those of Japan, the USA, and European developed countries and the international standards such as IEC; and,
- conforming to the provisions in existing GREPTS and SREPTS.

10.1 Part 1: General Provisions

General requirements related with hydropower development were collected in “Part 1: General Provisions”. Part 1 describes the following contents based on the result of discussions with the Cambodian side counterpart team regarding the framework of the draft SREPTS for Hydropower as explained in Chapter 8.

“Chapter 1: General Provisions” describes definitions of technical terms used in the draft SREPTS for Hydropower, purposes of the SREPTS for Hydropower, scopes of its application, and conformity with other standards and codes as general terms. Regarding the latter two items, the following matters were considered.

- 1) Generally, national standards and codes are for stipulating fundamental requirements regarding safety and performance of facilities but not for defining technical applications. In this context, this chapter refers to possibility of alternative technical approaches.
- 2) This chapter stipulates that specific items shall comply with internationally recognized standards and codes or any other equivalent ones so as to satisfy the requirements of the SREPTS for Hydropower.

“Chapter 2: Particular Provisions” was prepared to stipulate requirements for implementation of hydropower projects and conditions for exemption of the SREPTS for Hydropower as follows:

- 1) The five provisions are provided in “Section 1: Requirements for Project Implementation” in Chapter 2 as follows;
 - i) Assignment of chief engineers responsible for the technical matters in the fields of design, construction, installation, operation and maintenance

- ii) Obedience to the existing laws and regulations prescribing environmental protection and conservation
 - iii) Order of remedy for conformance to requirements in the SREPTS for Hydropower to be issued by EAC
 - iv) Obligation of reporting by project owners
 - v) Obligation of an owner to providing engineers and/or technicians with safety and technical training by project owners
- 2) Exemption clauses are prepared to exempt small scale hydropower projects from the provisions in the SREPTS for Hydropower in order not to disturb rural electrification, and also for hydropower projects under implementation and under operation in order not to disturb electric power supply provided that such projects are not harmful for the public safety.

10.2 Part 2: Civil Structures and Hydromechanical Equipment

Part 2 stipulates technical requirements regarding civil structures and hydromechanical equipment and consists of the following seven chapters;

- Chapter 3 : General Provisions
- Chapter 4 : Fundamental Requirements
- Chapter 5 : Dams
- Chapter 6 : Waterways
- Chapter 7 : Powerhouse and Other Facilities
- Chapter 8 : Reservoirs
- Chapter 9 : Downstream Areas

Outline of the provisions in each chapter of Part 2 are described as follows.

10.2.1 General Provisions

Prior to describing technical standards for specific structures, “Chapter 3: General Provisions” was provided to define technical terms used in “Part 2: Civil Structures and Hydromechanical Equipment.”

“Chapter 4: Fundamental Requirements” describes provisions regarding fundamental requirements for preventing civil structures and hydromechanical equipment from threatening public safety such as;

- 1) prevention of overtopping at the non-overflow section of dams;
- 2) dam stability;
- 3) prevention of failure of waterways, powerhouse and other facilities;
- 4) prevention of damage to ground surrounding a reservoir; and
- 5) prevention of damage to upstream and downstream areas.

Requirements for individual structures described in Chapter 5 and after were established from the following viewpoints;

- Structures and equipment shall be safe against disasters;
- Structures and equipment shall be safe against loads, the flow of water and a change in the flow rate; and
- Structures and equipment shall fulfill their function.

The draft Explanation Sheet describes detailed explanations of each provision and give users information to interpret and use the SREPTS for Hydropower.

10.2.2 Dams

(1) Basic Requirements for Dams

Firstly, the following technical requirements by which basic dimensions of a dam shall be determined are described in Section 1 “Common Rules” of Chapter 5 “Dams”.

1) Design flood

This section classifies dams into three categories according to the combination of dam height and gross reservoir capacity, and provide with the applicable range of the design flood of dams for each category.

American and Chinese technical standards and codes for dams classify dams into several categories considering the reservoir capacity and influence on communities and the social infrastructure in the lower reaches, and establish a probability level of design flood for each category. The more a dam influences downstream areas, the larger design flood is applied. It is noted that the Lao Electric Power Technical Standards which was established in cooperation with JICA also adopts the same method.

As the result of discussion with the Cambodian side counterpart team, the draft SREPTS for Hydropower was prepared so as to classify dams into three categories, “Large,” “Medium” and “Small” based on the combination of dam height and gross reservoir capacity, but not on the levels of influence to downstream areas which are generally difficult to evaluate quantitatively, and to provide criteria of design flood for each category of dams.

2) Basic water levels

Basic water levels such as the normal high water level, flood water level and low water level which are essential to the design of a dam body and related structures and to the reservoir operation are defined in this section.

3) Freeboard

The crest level of the non-overflow section of a dam body is important to the dam safety and, therefore, it shall be determined by providing a freeboard above the basin water levels mentioned in 2) above. The provisions to establish a freeboard are described in this section.

4) Loads

This section provides requirements in terms of loads to be considered in the dam design and the methods to establish them. The draft SREPTS for Hydropower considers the three kinds of status, “usual”, “unusual” and “extreme”, which is used in the USA and other countries, and sets the loading combinations and conditions for each status taking into account the event probability on each status. The draft SREPTS for Hydropower provides that the design seismic loads which are important for the safe design of a dam body shall be established for each dam based on seismic records and geology of each dam site. On the other hand, regarding the seismic coefficients to be used in the pseudo static analyses, which may be performed in the feasibility study stage, a set of the coefficient values to be applied to the planned dams in the Kingdom of Cambodia is proposed based on the seismic activity research of the Southeast Asia region and explained in Explanation Sheet as a reference but not as the technical standards to be applied to the final design for construction.

5) Dam foundations

This section establishes provisions regarding the general requirements for dam foundations to ensure dam safety.

6) Monitoring and inspections

This section describes monitoring and inspection items of a dam body for each dam type required in both normal and emergency conditions.

(2) Basic Requirements for Dams

Secondly, the requirements for embankment materials, foundations, allowable stress, stability conditions and structural details to each dam type, concrete gravity dams, arch dams and fill dams, are described in Section 2 “Concrete Dams” and Section 3 “Fill Dams” in Chapter 5 “Dams”.

Safety factors for each dam type are established as follows referring to the existing design standards of the USA, Japan, the PR of China and the neighboring countries of the Kingdom of Cambodia;

1) Concrete gravity dams

The levels of safety factor for sliding are selected to be 2.0 or more under the usual condition, 1.7 or more under the unusual condition, and 1.3 or more under the extreme condition based on a manner in the modern technical standards in the USA.

The safety requirements for overturning are so established that a crossing point of resultant force vector at the bottom of a dam body would be within the middle third under the usual condition, within the middle half under the unusual condition and within the base under the extreme condition also based on a manner in the modern technical standards in the USA.

The levels of foundation bearing capacity are selected to be the allowable bearing capacity or below under the usual and unusual conditions and 1.33 times as much as the one or below under the extreme condition also based on a manner in the modern technical standards in the USA.

2) Arch dams

The levels of safety factor for sliding are selected to be 2.0 or more under the usual condition, 1.3 or more under the unusual condition, and 1.1 or more under the extreme condition based on a manner in the modern technical standards in the USA.

3) Fill dams

The levels of safety factors for dam body and its foundation against sliding are selected to be 1.5 or more under the usual condition, 1.3 or more just after completion, 1.4 or more under the design flood, 1.1 to 1.3 or more under the rapid drawdown condition and 1.0 or more under the operating basis earthquake condition based on a manner in the technical standards in the USA. Furthermore, it is required for the safety of a dam body to evaluate liquefaction potential and deformations of dam body and foundation materials due to strong ground motions under the maximum credible earthquake (MCE) for the extreme condition.

(3) Requirements for Spillway and Other Discharge Facilities

Then, the requirements for Spillways and other discharging facilities to be constructed as ancillary facilities of dams are described in Section 4 “Spillways and Other Discharging Facilities” in Chapter 5 “Dams”.

1) Spillways

This section describes technical requirements for spillway facilities and spillway gates so that the design flood can be discharged from the dam safely.

2) Other discharge facilities

This section describes technical requirements for the discharging facilities other than the spillways such as ones for discharging river maintenance flow and ones for lowering the reservoir water level for inspection and repair of a dam body (low level outlet valve).

10.2.3 Waterways and Powerhouses

Common rules for “Waterways and Powerhouses” related to the following respects are described in “Article 42.”

- Expected functions for facilities
- Requirements for the safety of the facilities and their surrounding areas
- Design conditions
- Loads to be considered
- Requirements for materials

Then specific requirements for each facility are described as follows.

(1) Waterways

The fundamental requirements are prescribed for waterway facilities, such as Intakes, Settling Basins, Headraces, Head tanks, Surge Tanks, Penstocks, Tailraces, and Gates, Valves and Auxiliaries,

The main entries are as follows

1) For all facilities

- Stability against expected load

2) Intakes

- Installation of hydraulic gates or stoplogs for the inspection and the repair of waterways
- Design of the location and structure to prevent the inflow of sediments and garbage from rivers
- Prevention of air intrusion to pressure conduits

3) Settling Basins

- Allocation of the capacity for sediments
- Installation of sediments flushing device

4) Headraces

- Prevention of the damage to surrounding grounds caused by leakage from headraces
- Prevention of the damage to downstream waterways or turbines caused by slitting
- Consideration of hydraulic gradient line in the case of pressure conduits

5) Head tanks

- Keeping adequate water capacity to prevent air intrusion to penstocks
- Construction of spillway to control the maximum discharge when the full load is rejected
- Prevention of damages to surrounding facilities or river courses caused by spilled water
- Prevention of the inflow of garbage and sediments into penstocks and turbines

6) Surge Tanks

- Keeping equilibrium of water level

- Prevention of water overflow from the crest of surge tanks

7) Penstocks

- Stability of penstock shell with respect to vibration, buckling and erosion
- Prevention of serious water leakage
- Stability of anchor blocks and saddles

8) Tailraces

- Prevention of the damage to surrounding ground caused by leakage from tailraces
- Prevention of the damage to downstream waterway caused by collapse

9) Gates, Valves, and Auxiliaries

- Keeping of water-tightness
- Keeping of operability
- Prevention of the harmful vibration
- Prevention of the gate leaf buckling

(2) Powerhouses

The fundamental requirements for Powerhouses and other facilities such as maintenance roads are prescribed.

The main entries are as follows.

- Stability against expected loads
- Structures' stability around a turbine against vibration
- Defense against flood and landslide

(3) Other facilities

- Structural stability of permanent facilities
- Structural stability of temporary facilities during construction period
- Prevention of causing serious turbid water

10.2.4 Reservoirs and Downstream Areas

The requirements related to the impacts on reservoirs and downstream areas are described as follows.

(1) Reservoirs

As reservoirs have a tendency to pose a serious impact on public safety and surrounding environment, the requirements expecting reservoir facilities to ensure public safety are described. Specifically, the requirements related to leakage from reservoir, landslide of surrounding slope, sedimentation and

water quality, the obligations to “preliminary investigation and study at the planning phase” and “application of necessary measures” are prescribed.

(2) Downstream Area

As the impacts of the construction of dams and reservoirs are serious to the safety and the surrounding environment in the downstream areas, the requirements to be considered when a reservoir discharges the water to the downstream areas are described. Specifically, the requirements relating to preventions and the countermeasures against the damage caused by the water level fluctuation in the downstream areas and the excessive discharge during flood are prescribed. The necessity of river maintenance discharge to the downstream areas affected by river diversion is also prescribed.

10.3 Part 3 : Electrical Facilities

“Part 3: Electrical Facilities” has been prepared in order to stipulate technical requirements of electrical equipment in the draft SREPTS for Hydropower, In Part 3 of the draft SREPTS for Hydropower, the required technical and safety provisions are prepared in a manner employing concrete numerical values as much as possible taking basic strategy and the results of discussions with the counterpart mentioned in Chapter 6 and Chapter 8 of this report into consideration. The following are stipulated in Part 3;

- Required technical standard, safety policy and prevention of pollutions
- Definitions which are to be used in “Part 3: Electrical Facilities” of the draft SREPTS for Hydropower
- Insulation level, thermal strength, structure, performance and installation
- Grounding work and pressure oil and compressed air supply system
- Prevention of electrical shock, fire, risk to the other facilities, protective measure against abnormal condition, electrical/magnetic interferences and restriction of installation at special locations of the station service
- Prevention of electrical shock, fire, hazard to other electrical wires, hazard by collapse of supporting structure, hazard by high pressure gas, prohibition of installation for dangerous facilities, electrical/magnetic interferences and prevention of electric power outage of the outgoing line
- Measuring device and protective device

“Part 3: Electrical Facilities” of the draft SREPTS for Hydropower consists of following provisions..

(1) General Provision

Definition of the technical terms to be used in “Part 3: Electrical Facilities” of the draft SREPTS for Hydropower is stipulated, and also safety policy and prevention of pollution are stipulated and described.

(2) Electrical Equipment for Hydropower Station

Technical requirements required for major electrical equipment such as insulation level, thermal strength, structure, performance and installation are stipulated and described.

(3) Auxiliary Equipment

Technical requirements required for grounding facilities, pressure oil and compressed air supply system to be installed as auxiliary equipment are stipulated and described.

(4) Electrical Facilities for Station Service

Technical requirements required for station service for prevention of electrical shock, fire, risk to other electrical wires, protective measure against abnormal condition, electrical/magnetic interferences and restriction of installation at special locations are stipulated and described.

(5) Electrical Facilities for Outgoing Line

Technical requirements required for outgoing line for prevention of electrical shock, fire, hazard to other electrical wires, hazard by collapse of supporting structure, hazard by high pressure gas, prohibition of installation for dangerous facilities, electrical/magnetic interferences and prevention of electric power outage are stipulated and described.

(6) Measurement and Protective Device

Technical requirements required for measurement device and protective device of turbine, generator are stipulated and described.

10.4 Part 4: Examination and Inspection

10.4.1 General

As explained in **Chapter 8**, “Part 4: Examinations and Inspections” is established to describe purposes, items and procedure of examinations and inspections accepting the results of discussions with the Cambodian side counterpart team.

This part consists of three chapters; “Chapter 16: General Provisions,” “Chapter 17: Civil Structures and Hydromechanical Equipment,” and “Chapter 18: Electrical Equipment.”

Items of examinations and inspections are described in the following three phases; “in-progress inspection”, “completion inspection”, and “periodical inspection”.

10.4.2 General Provisions

“Chapter 16: General Provisions” describes as follows.

The definition of the Authority, Owner and Inspector, and the role, authorities and responsibility of each party are described.

“The Authority” is defined to be MIME or an organization with which MIME charged qualifications for examinations and inspections. “The Owner” is defined as described in Article 1 in Chapter 1 of Part 1. “The Inspector” is a person who belongs to MIME or nominated by MIME.

In-progress inspection, completion inspection, and periodical inspection are defined, and provisions regarding an independent inspection conducted by the owner and on-the-spot inspection by the authority are described. Purposes of examinations and inspections in each phase are described.

10.4.3 Civil Structures and Hydromechanical Equipment

The scales of the civil structures and hydromechanical equipment are large and the construction of them requires long period of time in general. And, the designs and construction work of the facilities tend to be affected by natural conditions such as topography, geology and weather. Consequently, it is often that repair works of the facilities have much difficulty when serious defect is identified after the completion of the facilities. In addition, the lifetime of hydropower plants are long once it has been constructed. Hence, examinations and inspections of not only the facilities but also the natural conditions such as geological condition of foundations should be implemented timely at each development stage (construction stage, completion stage and operation stage) in order to evaluate and ensure the function and safety of the facilities.

The purposes, items and procedures of the following three inspections required at each stage of a project are stipulated;

- 1) Section 1 : In-progress Inspection
- 2) Section 2 : Completion Inspection
- 3) Section 3 : Periodical Inspection

1) As the “in-progress inspection,” the “examination for commencement of construction,” “inspection on dam foundation” and the “inspection prior to initial reservoir impounding” are defined as follows;

- The examination for commencement of construction is to be conducted to confirm if the plans and designs of civil structures and hydromechanical equipment concerned conform to the provisions of the SREPTS for Hydropower.
- The inspection on dam foundation is to be conducted to confirm appropriateness of foundation for construction of a dam which is classified as “Large” or “Medium,” or has difficult foundation problems and/ or is of unusual design even if the dam is classified as “Small.”
- The inspection prior to initial reservoir impounding is to be conducted to confirm appropriateness of constructed facilities and a dam or dams which is/are classified as

“Large” or “Medium,” or has/have difficult foundation problems and/ or is of unusual design even if the dam is classified as “Small.”

- 2) As the “completion inspection”, the “dry test” and the “wet test” are defined and their scopes are provided as follows;
 - The completion inspection is to be conducted to confirm appropriate completion of construction work in terms of quality and safety for acceptance of each civil structures and hydromechanical equipment to be put into operation, and the inspection is performed in the two stages, the first one is dry test conducted before operation and the other is wet test conducted under operation condition.
- 3) The “periodical inspection” is to be conducted to confirm appropriateness of maintenance and operation works during operation period in terms of quality and safety as follows;
 - The periodical inspection consists of two parts, one is the examinations on documents of the operation and maintenance and the monitoring records by an inspector and the other is visual inspections of facilities;
 - The official periodical inspection shall be carried out every three years or more in principle for each hydro power station.

10.4.4 Electrical Equipment

As discussed in **8.2.1** of **Chapter 8**, the requirements of the examinations and inspections for the electrical facilities are stipulated only for during installation work or before commercial operation. The periodical examinations and inspections to be performed after commencement of commercial operation are out of scope in the draft SREPTS for Hydropower.

As for the examinations and inspections for the electrical facilities to be performed before commercial operation, purpose, procedures and criteria for measurement of grounding resistance, insulation resistance, dielectric strength test, operation test and load test are stipulated.

CHAPTER 11

POLICY AND OUTLINE OF DRAFT EXPLANATION

SHEET OF SREPTS FOR HYDROPOWER

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Chapter 11 Policy and Outline of Draft Explanation Sheet of SREPTS for Hydropower

The draft Explanation Sheet of the SREPTS for Hydropower is to be prepared to explain meanings and backgrounds of provisions in the draft SREPTS for Hydropower to promote its understanding and to use it properly. The draft SREPTS for Hydropower has been prepared to stipulate specific technical requirements which shall be satisfied by any hydropower facilities. Generally, it is popular now, as a result of the leadership of World Trade Organization (WTO) for elimination of non tariff barrier on international trades, that national technical standards of each country may provide only performance requirements as the mandatory ones and specific numerical requirements may be stipulated in a separate guideline as the voluntary ones. In this context, also the JICA Study Team has prepared the draft SREPTS for Hydropower basically stipulating the performance requirements, although it includes specific numerical requirements as much as possible taking into account the situation in the Kingdom of Cambodia. Under these circumstances, the draft Explanation Sheet of the SREPTS for Hydropower was prepared in the following manner.

The draft Explanation Sheet of the SREPTS for Hydropower describes backgrounds of main standards, technical terms which require an explanation to illustrate the point of the draft SREPTS for Hydropower, and the process in which numerical values in the draft SREPTS for Hydropower were selected, while an explanation of technical terms which the JICA Study Team judged unnecessary was omitted.

The composition of the draft Explanation Sheet is the same as the main body of the draft SREPTS for Hydropower so that its users can easily understand its contents considering users' convenience.

11.1 General Provisions

In "Part-1: General Provisions," the draft Explanation Sheet describes purposes and reasons for establishment of the text of the draft SREPTS for Hydropower, and a background referring to related provisions of the GREPTS. The draft Explanation Sheet describes the following items;

- 1) Concrete purpose of the SREPTS for Hydropower and items regarding safety;
- 2) Method for applying the SREPTS for Hydropower;
- 3) Policy regarding application of existing technical standards and codes;
- 4) Concrete case regarding assignment of chief engineers;
- 5) Explanation of requirements in the existing laws and regulations prescribing environmental protection and conservation;
- 6) Policy regarding an order of remedy;
- 7) Concrete case regarding an obligation for reporting;
- 8) Proposal regarding safety and technical training;
- 9) Background of exemptions for the SREPTS for Hydropower; and

10) Purpose of exception of exemptions for the SREPTS for Hydropower.

To promote understanding of difficult technical terms and sentences, explanations are attached to them and reference documents such as relevant provisions in the existing GREPTS are referred to.

11.2 Civil Structures and Hydromechanical Equipment

In “Part 2: Civil Structures and Hydromechanical Equipment” of the draft Explanation Sheet, the scope of application for the text of “Part 2: Civil Structures and Hydromechanical Equipment” of the draft SREPTS for Hydropower is explained by showing grounds for numerical values, carrying figures and photographs which express concrete concepts and examples, and comparing the draft SREPTS for Hydropower with foreign standards and codes.

For example, several cases of the design flood in other countries which plays an important role in dam safety are shown in this section as references to establish design flood. As for seismic coefficient provided in “Article 24 : Design Loads” of the draft SREPTS for Hydropower, a seismic map in the Kingdom of Cambodia and neighboring countries are shown to explain a background and grounds for establishing recommended seismic coefficient to be applied to dams in the Kingdom of Cambodia as estimated seismic intensity varies with the area.

As for waterway, numerical formulae for a settling basin, head tank, surge tank and penstock are shown as a reference of design and inspection for major waterway structures.

As for steel materials, a scope of application for technical standards and codes are explained by listing industrial standards to be applied to the steel materials used for hydromechanical equipment.

11.3 Electrical Facilities

In “Part 3: Electrical Facilities” of the draft Explanation Sheet, detailed explanations for applied technical standards in Part 3 “Electrical Facilities” of the draft SREPTS for Hydropower are described with illustrations, drawings, tables and pictures as much as possible for easy understanding of technical contents.

For instance, as for the article concerning safety measures for high voltage facilities, safety distance is described in drawings and in tables by voltage classification in the draft Explanation Sheet, while the requirements for prevention of touching the electrical facilities is described in just writings in the draft SREPTS for Hydropower.

11.4 Examination and Inspection

“Part 4: Examination and Inspection” of the draft Explanation Sheet explains provisions regarding a purpose, item and procedure of examination and inspection which are stipulated in “Part 4: Examination and Inspection” of the draft SREPTS for Hydropower.

As for “Chapter 16: General Provisions,” the explanations of the following matters are described.

- A role of an owner, a developer, an operator and operator according to progress in a project is clarified.
- A relation between an inspection and an inspector according to a progress in a project is clarified.

As for “Chapter 17: Examination and Inspection on Civil Structures and Hydromechanical Equipment,” the explanations of the following matters are described.

- Concrete items to be explained in an application form, drawing to be attached to the form and judgment standards for in-progress inspection - examination for commencement of construction, inspection on dam foundation and inspection prior to initial reservoir impounding - which an owner shall undergo as an in-progress inspection, are provided.
- Concrete items to be explained in an application form, drawing to be attached to the form and judgment standards for a completion inspection which an owner shall undergo are provided.
- Inspection items of each structure and judgment standard for a periodical inspection conducted after completion of hydropower stations are provided.

As for “Chapter 18: Examination and Testing on Electrical Facilities,” items and methods of inspection are explained by using illustrations, and important points and judging process in the examination and testing as well as calculation procedures of standard values are described.

CHAPTER 12
RECOMMENDATIONS ON IMPROVEMENT
OF APPROVAL AND LICENSING SYSTEM
ON HYDROPOWER BUSINESS

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Chapter 12 Recommendations on Improvement of Approval and Licensing System on Hydropower Business

12.1 Current Situation and Problems in Approval and Licensing System

As mentioned in **Chapter 4** of this report, the current status of the licensing system for electric power business is described as follows:

Each electricity service provider is required to have a license issued by EAC and to abide by the provisions of the Electricity Law and those of its license, regulations and procedures set by EAC. The licenses for electric power services are to be issued by EAC to individual or legal entities giving the right to provide electric services as per the provisions defined in the license as “the Conditions of License.”

On the other hand, the development of hydropower projects are going to be implemented as the IPP projects with the following procedures;

- (1) IPP investor proposes a project plan for obtaining a concession agreement for its development and providing electric power service with the Government of Cambodia. MIME, CDC (Cambodia Development Council) and MEF are responsible for this step.

There are two (2) steps in this procedure as follows:

- Implementation Agreement (IA)
- Power Purchase Agreement (PPA)

After initial agreement on PPA between the IPP and EDC who is the off-taker for IPP business, EDC will submit a draft PPA to EAC indicating power tariff and purchase conditions (take or pay condition).

- (2) After the agreement on PPA between a developer of hydropower project (IPP) and EDC, EAC will issue licenses of power generation business to IPP to generate and sell electricity to EDC. The power generation license issued by EAC includes the provision that requires the licensees to abide the technical standards. In this sense, it is understood that the GREPTS and SREPTS are incorporated in the licensing system.
- (3) Prior to the commencement of commercial operation of a power generating project including IPP project, project owner (project operator) and EDC jointly develop operating procedures addressing operational interfaces between two parties including the method of day to day communication, notification of key personnel list, clearances and switching practices, outage schedule, capacity and energy reporting, operation logging, procedures in relation to dispatch of the electricity. The operation procedures shall be established properly so as to be consistent with the design of the project and the interconnection facility, the Grid Code of EDC and the technical limits of operation.

It is required to pay attention to the following issues when we apply the current approval and licensing system for electric power businesses to the development of hydropower projects:

- 1) Even at the preparation stage for project implementation from a proposal of a hydropower development plan by an IPP investor until starting the construction through an Implementation Agreement (IA) with the Government of Cambodia, it is important for the Government to conduct examination on the results of Feasibility Study (F/S) and Environmental Impact Assessment (EIA) in order to monitor the status of project preparation and to evaluate viability of the project. In particular, the pre-examination and evaluation are important for the hydropower projects with a reservoir because it affects to the surrounding areas and downstream areas.
- 2) On the other hand, the draft SREPTS for Hydropower provides the provisions related to technical requirements and the contents of examinations and inspections for safety and quality in each of the design, construction and operation stages, but does not cover required procedures at the project preparation stage including conducting F/S and EIA and their reporting.
- 3) Furthermore, it is necessary to develop engineers who are capable for technical examination and evaluation since hydropower projects vary in plan and design depending on the conditions at development sites and, consequently, sufficient experiences are required for technical judgment.
- 4) The current hydropower development plan in Cambodia includes large scale projects with reservoirs. In addition to the technical issues, many other critical issues including land acquisition, resettlement of people and environmental impact in the reservoir area and downstream areas are involved in the hydropower project with a reservoir in general, and there shall be many governmental agencies related to these issues.
- 5) In addition, a drastic decreasing of river discharge was pointed out at the existing O' Chum 2 hydropower station. This is considered due to environmental conservation issue of the upstream river basin.

12.2 Recommendations

Based on the information and results of discussions obtained through the Study, the following recommendations are proposed against the current status and issues of the approval and licensing system for electric power businesses mentioned in **12.1** above:

- (1) Development of a guideline for the procedures for development and operation of hydropower projects from investigation to operation and maintenance including the following aspects:
 - Procedures for execution, reporting, examination and approval of F/S
 - Procedures for execution, reporting, examination and approval of EIA
 - Procedures for pre-examination, approval and monitoring on action plans of environmental conservation measures, compensation for affected people, resettlement
 - Procedures for submission, examination and approval of detailed design of hydropower facilities
 - Procedures for examination and inspection on hydropower facilities and reporting during construction/installation stage

- Procedures for examination/inspection and reporting of monitoring results on hydropower facilities during operation and maintenance stage
- Procedures for submission, examination and approval of reservoir operation plan for power generation and flood control
- Procedures for submission, examination and approval of operation rules for spillway gates and other discharge gates and valves

As the items listed above include the contents for which laws and regulations are already exist such as ones for execution of EIA, and plural number of governmental agencies are related to these issues, an inter-organizational coordination is required among the related agencies for preparation of a procedure guideline.

On the other hand, the issues related to environmental conservation of upstream basin is an area-wide issue beyond responsibility of hydropower developers. For this issue, it is necessary to take integral policy measures by setting regulations and control systems in view of basin-wide environmental conservation measures, and such measures are beyond the extent of recommendation in the field of hydropower development.

(2) Development of a manual for examination and inspection

In order to properly operate the provisions of examination and inspection in Part-4 of the draft SREPTS for Hydropower, it is recommended to develop a manual which clarifies the detailed procedures and methods of examination and inspection on hydropower facilities.

(3) Development of safety and security guideline for workers of operation and maintenance at hydropower stations

The draft SREPTS for Hydropower stipulates the requirements for safety of hydropower facilities in principle. On the other hand, regarding the personal safety, it is common way that each electric power company prepares an own safety work manual for securing and improving safety of workers. In this regard, it is recommended for the public sector to prepare a safety guideline as a standard document for proper preparation and operation of safety manual by individual power companies.

(4) Capacity building for hydropower engineers of regulatory agencies (MIME, EAC, EDC)

As mentioned above, sufficient experiences are required for technical judgments for hydropower stations and, therefore, qualified engineers who have capability in technical examination and evaluation. However, the number of hydropower engineers, particularly in the field of civil engineering, is very limited in Cambodia. Therefore the capacity building for hydropower engineers of the regulatory agencies would be an issue to be solved under the situation of expected progress of hydropower development.

(5) Establishment of certification and registration system of qualified engineers

The general provisions in the draft SREPTS for Hydropower provides with an Article of assignment of chief engineers. This Article stipulates the obligation of the owner to assign the chief engineers. In this connection, it is desirable to establish a system of registered engineers

which determine procedures and conditions for registration and assignment of chief engineers. Also, an Article of the draft SREPTS for Hydropower stipulates the obligation of owner to provide his engineers and technicians with safety and technical training to be arranged by the owner by himself. However, it is desirable to establish a public system of qualification, certification and registration of engineers in order to maintain or improve technical level of the maintenance and operation staff and to maintain safety conditions of power stations continuously. In particular, hydropower projects to be developed in the near future may have dams with spillway gates, and it is required that the operation of spillway gates, which are strongly related to the safety of downstream area, shall be done by a qualified operators in a responsible manner.

Appendix-1

Minutes of Meeting for Workshops

1. 1st Workshop
2. Supplemental Meeting for 1st Workshop
3. 2nd Workshop
4. Supplemental Meeting for 2nd Workshop
5. 3rd Workshop
6. Follow-up Meeting for 3rd Workshop

Minute of Meeting of the First Workshop

Date: November 5, 2008

Place: Ministry of Industry, Mines and Energy, Conference Room

Participants: MIME
H.E Ith Praing, H.E Khlaut Randy, Dr. Bun Narith,
Mr. Heng Kunleang, Mr. Much Chhun Horn,
Mr. So Veasna, Mr. Chiv Hour, Mr. Nong Sareth, Mr. On Vuthy,
Mr. He Sam Ol, Mr. Chea Narin, Mr. Hean Veasna, Mr. Chea Pisith,
Mr. Son Davin, Mr. Seng Kimrithy, Mr. Chy Chanrasmey, Mr. Chhorb Synoeurn,
Mr. Kim Nhan Chan Amrin

EAC
H.E. Ty Norin, Mr. Hul Kunnak Vuth, Mr. Theng Marith,
Mr. Teng Saroeun, Mr. Suon Ponnarith

EDC
Mr. Nou Sokhon, Mr. Aun Hemrith

JICA Tokyo Office
Mr. Satoshi Kobayashi (JICA Tokyo Office),

JICA Cambodia Office
Mr. Shigeki Miyake, Mr. Mewg Chomvidol

JICA Expert
Mr. Takeshi Washizawa (JICA Expert to MIME)

JICA Study Team
Mr. Shigeru Nakamura, Mr. Yutaro Mizuhashi, Mr. Hajime Butsuhara,
Mr. Tatsuya Kunishi, Mr. Masafumi Iori, Mr. Eiji Tsuchiya, Ms. Hitomi Sugimachi

1. Opening Address

H.E. Ith Praing, the Secretary of State for MIME, addressed an appreciation all the participants and also appreciated technical support from JICA for establishment of SREPTS on Hydropower.

2. Introduction and Explanation of Inception report

Mr. Nakamura, the leader of JICA Study Team, introduced the member of study team and explained the inception report in accordance with the resume attached hereto.

3. Discussion and Questions

- A) EAC expressed his concern with the method how the JICA Study Team would conduct the technical transfer to the Cambodian side Counterpart Team who did not have any experience in hydropower and the translation work into Khmer which would have to be done by Counterpart Team.
JICA Study Team explained that the technical transfer and translation work in to Khmer would be

Follow-up Study on Establishment of SREPTS on Hydropower

performed through co-working between the Counterpart Team and the JICA Study Team as the members of Working Groups to be established in this Workshop.

- B) JICA Expert asked whether or not the SREPTS on Hydropower should be applied to the existing and ongoing hydropower projects.

MIME replied that it should be discussed later after careful study.

- C) EAC insisted, referring to Policy-2 in Slide No.31 in the attached resume, that not only EAC but also MIME and EDC should be involved in the translation work into Khmer.

- D) EAC requested, referring to Slide No.32, that the Project Leader of Working Groups should not be representative of EAC but should be of MIME.

- E) EAC expressed his concern, referring to Slide No.35, how the JICA Study Team would support and conduct the translation work during the 2nd Home Work Period from March to June 2009 when the Study Team would be absent from Cambodia, because the translation work into Khmer would require direct communication between the Cambodia side counterpart and JICA Study Team in accordance with the previous experience in the translation work into Khmer for GREPTS and SREPTS on Thermal Power and Transmission and Distribution System.

- F) EAC asked the JICA Study Team, referring to Slide No.37, whether such understanding is correct or not that the Workshops were internal meetings among the JICA Study Team and the counterpart agencies and the Seminars were meetings among participants from external agencies such as independent power producer.

The JICA Study Team confirmed that the EAC's understandings of Workshop and Seminars were correct and also that the Workshops were mainly for discussions and the Seminars were mainly for announcements in principle.

- G) EAC stated, referring to Slide No.42, that Ministry of Environment should be one of the participants in the Seminar.

- H) EAC expressed his concern that it would be hard to prepare the Seminar only just one month period in December 2008 after the First Field Work, because it would be necessary to announce invitation to participants with documents to 30 days prior to the Seminar.

- I) EAC expressed his concern with the matter who would be responsible and how to arrange the counterpart agencies' activities while JICA study team was absent from Cambodia.

- J) MIME stated his opinion that application of SREPTS on Hydropower should be from the next project but not from the currently on-going project.

- K) MIME expressed his concern that time interval between the 2nd Workshop and the 1st Seminar and also between the 3rd Workshop and the 2nd Seminar were too tight for preparation of Seminars.

The JICA Study Team explained that the schedule of Seminars was tentative and would be adjusted in a practical manner.

- L) MIME asked JICA Study Team what would be the contents of examination and inspection standards.


The JICA Study Team answered that it was necessary to investigate and study the current status of inspection and examination activities at the existing hydropower projects in order to propose a practical standards.

4. Conclusions


Follow-up Study on Establishment of SREPTS on Hydropower

The following were concluded in the 1st Workshop based on the explanation of Inception Report by JICA Study Team and discussions among the participants of the Workshop:


- A) The content of Inception Report was accepted by MIME, EAC and EDC.
- B) MIME assigns Dr. Bun Narith to be the leader of Counterpart Team for the Study on SREPTS on Hydropower.
- C) The Working Groups will be formed with 10 persons from MIME, 3 persons from EAC, 3 persons from EDC and JICA Study Team.
The Working Group members will be arranged by Dr. Bun Narith and the member list will be delivered to each party on November 7.
- D) Kick-off Meeting of Working Group for SREPTS on Hydropower would be taken place on November 14 to discuss and confirm the formation and leader/sub-leader of each of Civil Working Group and Electric Working Group and its activity program.
- E) Arrangement for collection of data and documents will be confirmed in the Kick-off Meeting of Working Group for SREPTS on Hydropower in accordance with the Questionnaire submitted to MIME by JICA Study Team.
- F) The Supplementary Workshop will be held on November 20 to discuss and confirm the framework of SREPTS on Hydropower.
- G) The translation work of Technical Glossary, SREPTS on Hydropower and its Explanation Sheet (Guideline) into Khmer will be conducted in collaboration of MIME, EAC and EDC.
- H) The schedule of the Seminars will be adjusted in more practical manner taking into account time schedule required for announcement and preparation.
- I) Participants of the Seminars will be arranged by MIME and EAC.
- J) Application of SREPTS on Hydropower to the existing and on-going hydropower projects will be discussed and confirmed after submission of its framework by JICA study team.



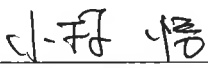
MIME
Secretary of State
For H.E. Ith Praing




EAC
Chairman, Secretary of State
H. E. Ty Norin



EDC
for Director, Transmission Dept.
Mr. Nou Sokhon



JICA
Tokyo Office
Mr. Satoshi Kobayashi



JICA Study Team
Leader
Mr. Shigeru Nakamura

Minutes of Supplemental Meeting for First Workshop

1. Date/Time : November 20, 2008 / 9:00am to 11:00pm
2. Place : Meeting Room of MIME
3. Participants
MIME : Dr. Bun Narith (Leader of Counterpart Team),
Mr. Much Chhun Horn, Mr. Chiv Hour, Mr. So Veasna,
Mr. Phan Bunthoeun, Mr. Chea Narin, Mr. He Sam Ol,
Mr. Phan Narith, Mr. Leang Khemarith
EAC : Mr. Theng Marith, Mr. Teng Saroeun, Mr. Suon Ponnarith
EDC : Mr. Ros Chenda, Mr. Aun Hemrith, Mr. Heav Chanvisal
JICA : Mr. Takeshi Washizawa (Expert to MIME)
JICA Team : Mr. Shigeru Nakamura, Mr. Yutaro Mizuhashi, Mr. Msasafumi Iori,
Mr. Eiji Tsuchiya
4. Contents

The following matters were discussed and agreed among the parties;

1) Contents of SREPTS for Hydropower

(1) Articles for Examinations and Inspections

Articles for examination and inspection will be prepared in SREPTS for Hydropower for civil works and electromechanical works separately in an additional independent chapter.

General provisions for examinations and inspections will be described in Articles of SREPTS and examples and major sample forms will be described in "Explanation Sheet".

For the electromechanical work, provisions for "Commissioning Test" will be described in Articles of SREPTS and examples for other tests and inspections such as performance tests and material tests during construction and installation will be described in "Explanation Sheet".

JICA Study Team will prepare a draft of Articles for the above and submit it in January 2009 based on the aforesaid policy.

(2) Inspection Manual

The Counterpart Team (MIME and EAC) requested JICA Study Team to prepare "Inspection Manual" for Hydropower in the Study.

JICA Study Team answered that "Inspection Manual" is out of scope in the Contract of the Study with JICA, but the Team will report the request to JICA.

(3) Exclusion of application for small hydropower projects

An Article of transitional provisions shall be prepared in SREPTS for Hydropower for exclusion of application to small hydropower projects in view of preservation of safety, promotion of rural electrification but not in view of capacity limitation criteria.

Follow-up Study on Establishment of SREPTS for Hydropower

JICA Study Team will prepare a draft of Article for the above and submit it in January 2009 based on the aforesaid policy.

(4) Exclusion of application for existing hydropower projects

An Article of transitional provisions shall be prepared in SREPTS for Hydropower for exclusion of application to the existing hydropower projects with recommendations regarding preservation of safety.

JICA Study Team will prepare a draft of Article for the above and submit it in January 2009 based on the aforesaid policy.

(5) Exclusion of application for hydropower projects under implementation

An Article of transitional provisions shall be prepared in SREPTS for Hydropower for exclusion of application to hydropower projects under implementation with recommendations in view of preservation of safety.

JICA Study Team will prepare a draft of Article for the above and submit it in January 2009 based on the aforesaid policy.

(6) Provisions for requirements related to the existing environmental regulations

An Article of transitional provisions shall be prepared in SREPTS for Hydropower for requirements related to the existing laws and/or regulations for environmental conservation.

The Counterpart Team will provide JICA Study Team with necessary information related to the existing environmental laws and /or regulations and other relevant issues in Cambodia.

JICA Study Team will prepare a draft of Article for the above and submit it in January 2009 based on the aforesaid policy.

(7) Formation of SREPTS for Hydropower regarding common provisions for electric facilities

JICA Study Team has found some inconvenience in relation to conformity of SREPTS for Hydropower with the existing GREPTS and SREPTS for Thermal Power and Transmission and Distribution Facilities particularly in the clauses for electromechanical facilities.

In the above regards, JICA Study Team will prepare the draft SREPTS for Hydropower with the following policies:

- To prepare and complete SREPTS for Hydropower so as to conform to the existing GREPTS and SREPTS as much as possible but independently accepting some discrepancy with the existing provisions.
- To provide recommendation for adjustment or revision of the existing GREPTS and SREPTS in a report of the Study, if required.

JICA Study Team will prepare a draft of Articles in SREPTS for Hydropower related to the above issue and submit it in February 2009 based on the aforesaid policy.

2) Schedule of 2nd Workshop and 1st Seminar

JICA Study Team proposed the following schedule.

- (1) 2nd Workshop: January 15, 2009 (Thu)
- (2) 1st Seminar: February 16, 2009 (Mon)

Follow-up Study on Establishment of SREPTS for Hydropower

MIME will confirm and inform of the schedule of the 2nd Workshop and 1st Seminar by the middle of December.

With respect to the Seminars, it was agreed among the parties that Seminars shall be organized by the Counterpart Team (MIME, EAC and EDC) with support of JICA Study Team.

3) Schedule of remaining major activities after November 2008

The schedule of major activities after this meeting was confirmed as shown in the table below:

With

Month	JICA Study Team	Counterpart Team (MIME, EAC, EDC)
Nov. 2008	<ol style="list-style-type: none">1. Preparation and submission of draft Technical Glossary2. Preparation and submission of draft Framework of SREPTS for Hydropower3. Collection of data and information4. Investigation of the existing hydropower projects	<ol style="list-style-type: none">1. Collection and provision of data and information required in Questionnaire for JICA Study Team2. Commencement of translation work of the draft Technical Glossary into Khmer
Dec. 2008	<ol style="list-style-type: none">1. Preparation of Interim Report	<ol style="list-style-type: none">1. Translation work of the draft Glossary into Khmer
Jan. 2009	<ol style="list-style-type: none">1. Submission of Interim Report2. 2nd Workshop3. Preparation of draft SREPTS for Hydropower and Explanation Sheet in English	<ol style="list-style-type: none">1. Completion of translation work of the draft Technical Glossary into Khmer2. 2nd Workshop3. Preparation of the 1st Seminar4. Commencement of translation work of the draft SREPTS for Hydropower into Khmer
Feb. 2009	<ol style="list-style-type: none">1. Preparation and submission of draft SREPTS for Hydropower and Explanation Sheet in English2. Participation in the 1st Seminar	<ol style="list-style-type: none">1. Preparation and organizing of the 1st Seminar2. Conducting translation work of the draft SREPTS for Hydropower into Khmer
Mar. 2009 to Jun. 2009	<ol style="list-style-type: none">1. Preparation of Draft Final Report2. Supporting the translation work of the draft SREPTS for Hydropower and Explanation Sheet by the Counterpart Team	<ol style="list-style-type: none">1. Continuing translation work of the draft SREPTS for Hydropower into Khmer2. Commencement of translation work of Explanation Sheet into Khmer
Jul. 2009	<ol style="list-style-type: none">1. Submission of Draft Final Report2. 3rd Workshop3. Participation in the 2nd Seminar	<ol style="list-style-type: none">1. Completion of translation work of the draft SREPTS for Hydropower and Explanation Sheet into Khmer2. 3rd Workshop3. Preparation and organizing the 2nd Seminar

Follow-up Study on Establishment of SREPTS for Hydropower



MIME
Leader of Counterpart Team
Dr. Bun Narith



EAC
Deputy Team Leader
(Civil WG)
Mr. Theng Marith



EDC
Deputy Team Leader.
(Electromechanical WG)
Mr. Ros Chenda



JICA Study Team
Team Leader
Mr. Shigeru Nakamura

Minute of the Second Workshop

Date: January 22, 2009
Place: Ministry of Industry, Mines and Energy, Conference Room
Participants: MIME
H.E Ith Praing, H.E Khlaut Randy, H.E. Sat Sammy, H.E. Tun Lean
Dr. Bun Narith, Mr. Much Chhun Horn,
Mr. So Veasna, Mr. Nong Sareth, Mr. He Sam Ol, Mr. Chea Narin,
Mr. Leang Khemarith, Mr. Pan Narith
EAC
H.E. Ty Norin, Mr. Hul Kunnak Vuth, Mr. Theng Marith,
Mr. Teng Saroeun, Mr. Suon Ponnarith
EDC
Mr. Ros Chenda, Mr. Aun Hemrith, Mr. Heav Chanvisal
JICA Cambodia Office
Mr. Shigeki Miyake, Mr. Heng Salpiseth
JICA Expert
Mr. Takeshi Washizawa (JICA Expert to MIME)
JICA Study Team
Mr. Shigeru Nakamura, Mr. Yutaro Mizuhashi, Mr. Tatsuya Kunishi,
Mr. Eiji Tsuchiya

1. Opening Address

H.E. Ith Praing, the Secretary of State for MIME, addressed an appreciation for all the participants of the second Workshop and also appreciated holding the workshop to have discussions for establishment of SREPTS on Hydropower.

2. Introduction and Explanation of Interim Report

Mr. Nakamura, the leader of JICA Study Team, introduced the member of study team and explained the contents of Interim Report.

3. Discussions and Conclusions

The following were concluded in the Second Workshop based on the explanation of Interim Report by JICA Study Team and discussions among the participants of the Workshop:

- A) The contents of Interim Report were accepted by MIME, EAC and EDC except for some inaccurate or incorrect descriptions pointed out by MIME.
- B) JICA Study Team explained the revised framework of draft SREPTS for Hydropower which were made on the previous version of framework tentatively proposed in Inception Report and further on

Follow-up Study on Establishment of SREPTS on Hydropower

the one proposed in Interim Report. The major points of the revisions are as follows:

- 1) To separate the SREPTS for Hydropower into four (4) Parts as follows:
 - Part 1: General Provisions
 - Part 2: Civil Engineering and Hydromechanical Facilities
 - Part 3: Electrical and Electromechanical Facilities
 - Part 4: Examination and Inspection
- 2) To provide with an separate Part for provisions on examinations and inspections
- 3) To provide with articles for exemption of the small hydropower projects, ongoing hydropower projects and the existing hydropower projects in Part 1

In the above regard, the JICA Study Team reported that the revisions were discussed and accepted by Counterpart Team in principle in the Working Group Meeting held on January 20, 2009 at MIME subject to further adjustment during finalization of draft SREPTS for Hydropower.

The policy of revisions was accepted by MIME, EAC and EDC in the Workshop in principle subject to further discussions in Working Group Meetings and final confirmation in a Supplemental Meeting for the Second Workshop.

- C) The agenda and schedule of the First Seminar were discussed among the parties based on the proposal of JICA Study Team and concluded as follows:

- 1) The First Seminar on SREPTS for Hydropower will be held on February 17, 2009 at an appropriate conference room in Phnom Penh.
- 2) The following parties will be invited to the First Seminar
 - Representative of all related Ministries of the Government of Cambodia including
 - Ministry of Economy and Finance
 - Ministry of Environment
 - Ministry of Rural Development
 - Ministry of Water Resources and Meteorology
 - Ministry of Agriculture, Forestry and Fisheries
 - Ministry of Land Management, Urban Planning and Construction
 - Representative of the concerned DIMEs
 - Representative of IPP Groups who develop hydropower projects in Cambodia
 - Other authorities related to hydropower development, if any

The list of participants will be prepared and confirmed by MIME.

The letter of invitation will be prepared and delivered to nominated participants by the end of January 2009 by MIME.

- 3) Agenda of the First Seminar will be basically as follows:
 - Present status of GREPTS and SREPTS
 - Present status of Electricity Law and Licensing System for Power Businesses
 - Purpose and expected time frame for application of SREPTS for Hydropower
 - Framework of drat SREPTS for Hydropower
- 4) Presentation in the First Seminar will be performed by MIME, EAC, EDC and JICA Study Team.

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- 5) The presentation documents shall be prepared both in English and Khmer and the presentation will be performed with simultaneous interpretation.
- D) JICA Cambodia Office recommended MIME to announce, to IPP Groups in the First Seminar, the promulgation procedure of SREPTS for Hydropower by PROKAS or ministerial Sub-Decrees and its schedule so that illegal hydropower develop activities would be restrained.
- H.E. Ith Prain, Secretary of State for MIME, stated that MIME would explain in the Seminar the expected promulgation procedure to be taken after submission of the Final Draft of SREPTS for Hydropower by JICA Study Team in September 2009.
- E) H.E. Khlaut Randy, Secretary of State for MIME, raised a query whether or not the criteria for screening of hydropower projects such as power density would be involved in SREPTS for Hydropower.
- JICA Study Team confirmed and the participants agreed that the screening criteria for hydropower projects was not scope of SREPTS which should cover specific requirements for technical standards for design, construction and operation stages in principle.
- F) It was conformed that the Working Groups should perform the following activities during the Second Field Work of JICA Study Team:
- 1) Discussions on the contents of draft SREPTS for Hydropower and Explanation Sheet to be proposed by JICA Study Team
 - 2) Preparation of presentation documents for the First Seminar
 - 3) Translation of draft SREPTS for Hydropower into Khmer
- G) The Supplemental Meeting for Second Workshop will be held on February 18, 2009 in order to confirm results of activities during the Second Field Work of JICA Study Team including the final framework and contents of draft SREPTS for Hydropower and further activities until the submission of Final Report and the final draft of SREPTS for Hydropower scheduled in September 2009.



MIME
Secretary of State
H.E. Ith Praing



EAC
Chairman, Secretary of State
H. E. Ty Norin



EDC
Director, Generation Dept.
Mr. Ros Chenda



JICA
Cambodia Office
Mr. Shigeki Miyake



JICA Study Team
Leader
Mr. Shigeru Nakamura

Minutes of Supplemental Meeting for Second Workshop

Date and Time: February 19, 2009 (Thu) at 16:00PM

Place: Meeting Room at Ministry of Industry, Mines and Energy

Participants: Members of Working Groups (Civil and Electrical) from MIME, EAC, EDC and JICA Study Team

MIME : Dr. Bun Narith (Leader of Counterpart Team),
Mr. Much Chhun Horn, Mr. Cha Narith, Mr. So Veasna,
Mr. Non Sareth, Mr. Leang Khemarith, Mr. Heav Chanvisal
EAC : Mr. Theng Marith, Mr. Teng Saroeun, Mr. Suon Ponnarith
EDC : Mr. Ros Chenda, Mr. Aun Hemarith
JICA Team: Mr. Shigeru Nakamura, Mr. Yutaro Mizuhashi,
Mr. Hajime Butsuhara, Mr. Hideaki Morishita, Mr. Eiji Tsuchiya,
Ms. Hitomi Ohashi

Contents:

1. General Issues

- 1) Confirmation of Minutes of Work Shop Meeting on January 16, 2009
Minutes of the Second Workshop, of which the draft was delivered in the WG Meeting No.4 on Jan.30, 2009, will be signed by the representatives of Counterpart Agencies by February 20, 2009.

2. Confirmation of the schedule of Activities for the period from March to July 2009

The schedule of the activities for preparation of Draft SREPTS for Hydropower until the end of July 2009 was tentatively confirmed as follows:

- 1) Submission of the draft of SREPTS for Hydropower on Feb, 19 and 20, 2009
- 2) Submission of draft of Explanation Sheet of SREPTS on Feb, 19 and 20, 2009
- 3) First stage translation of the draft SREPTS into Khmer by the end of April 2009
- 4) Delivery of questions and comments regarding the translation work in April 2009
- 5) Dispatching JICA Study Team for supporting the translation work during the period from the middle of May to the end of June 2009 (pending for approval of JICA)
- 6) Third Field Work of JICA Study Team in July 2009 (tentative: 06-31 July, 2009)
- 7) Third Workshop on final draft of SREPTS for Hydropower in the first half of July 2009 (proposal: 10 July, 2009 (Fri.) subject to confirmation by high ranking executives)
- 8) Second Seminar on the final draft of SREPTS for Hydropower in late July 2009 (proposal: July 22, 2009 (Wed) subject to confirmation by high ranking executives)
- 9) Supplemental Meeting for Third Workshop in the late July 2009.

3. Other Issues

- 1) Delivery of the first draft of SREPTS to the Seminar Participants
MIME requested JICA Study Team to prepare 21 copies of the draft SREPTS for Hydropower

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additionally for delivering the document to the participants of First Seminar.

JICA Study Team will prepare the required copies subject to the consent of JICA Office for delivery to the private groups.

- 2) Recommendations for follow-up activities for SREPTS for Hydropower (examples)
MIME, EAC and EDC provided JICA Study Team with the requests to JICA Office for the following issues relating to the capacity building for handling the SREPTS for Hydropower in the future:
 - (1) Capacity building program for hydropower engineers
 - Supply guidebook or textbook for hydropower civil works, hydromechanical works and electromechanical works as well as operation and maintenance guidebook
 - Training of hydropower engineering (particularly O&M) in Vietnam and/or Japan
 - Study tour to the hydropower project sites in Japan
 - (2) Follow-up Study by JICA
- Measurement equipment
Studies for the following with priority in the order
Priority-1: Establishment of Examination and Inspection Manual for Hydropower Projects
Priority-2: Establishment of Safety Rules and Guideline
Priority-3: Establishment of Operation and Maintenance Management System
(optimum or least cost O & M Planning)
 - (3) Dispatching an expert from JICA
The member of WG from EAC and EDC expressed their opinion to JICA Study Team that JICA expert will be useful for capacity development for hydropower engineering.
- 3) Recommendation for holding the Second Seminar
Draft SREPTS shall be delivered to participants of the Seminar at least one month before.
Presentation in the Second Seminar will be made by both of the Counterpart Team and JICA.




MIME
Leader of Counterpart Team
Dr. Bun Narith



EAC
Deputy Team Leader
(Civil WG)
Mr. Theng Marith



EDC
Deputy Team Leader.
(Electromechanical WG)
Mr. Ros Chenda



JICA Study Team
Team Leader
Mr. Shigeru Nakamura

Minute of the Third Workshop

Date: July 22, 2009

Place: Ministry of Industry, Mines and Energy, Conference Room

Participants: MIME

H.E. Ith Praing, H.E. Sat Sammy, H.E. Say Phirum, Dr. Bun Narith,
Mr. Chhim Theaneam, Mr. So Veasna, Mr. Nong Sareth, Mr. He Sam Ol,
Mr. Chea Narin, Mr. Phan Bunthoeun, Mr. Leang Khemarith, Mr. Pan Narith,
Mr. Chea Piseth, Mr. Son Davin, Mr. Hean Veasna, Mr. Thay Piseth,
Mr. Chy Chanrasmey,

EAC

Mr. Theng Marith, Mr. Teng Saroeun, Mr. Chheang Bunthy, Mr. Suon Ponnarith

EDC

Mr. Chea Sinhel, Mr. Ros Chenda, Mr. Aun Hemrith, Mr. Heav Chanvisal,
Mr. Randy Vang,

JICA Cambodia Office

Mr. Murakami Yusuke, Mr. Shinoda Takanobu, Mr. Heng Salpiseth

JICA Study Team

Mr. Nakamura Shigeru, Mr. Mizuhashi Yutaro, Mr. Irie Akira,
Mr. Morishita Hideaki, Mr. Eiji Tsuchiya

1. Welcome Address by MIME

H.E. Ith Praing, the Secretary of State for MIME, addressed an appreciation for all the participants of the Third Workshop and the technical assistance from JICA and the Study Team also appreciated holding the workshop to have discussions for establishment of SREPTS on Hydropower addressing the necessity of technical standards for the hydropower development and efficiency, security and safety of power generation, transmission and distribution as key issues for national economy and upgrading living standard in Cambodia.

2. Introduction of the 3rd Workshop by JICA Study Team

Mr. Nakamura, the leader of JICA Study Team, introduced the purposes and program of the 3rd Workshop.

3. Opening Address by JICA

Mr. Murakami Yusuke, Deputy Chief Representative of JICA Cambodia Office, provided the participants with Opening Address for the 3rd Workshop expressing the background of the JICA study for establishment of the SREPTS for Hydropower referring to the current status of the electric power technical standards, necessity of hydropower development, importance of environmental conservation, security and safety for hydropower development and expected role of this 3rd Workshop for preparation of the final draft of SREPTS for Hydropower.

4. Discussions and Conclusions

The following were concluded in the Third Workshop based on the explanation of the contents of Draft Final Report and the draft SREPTS for Hydropower by JICA Study Team and discussions among the participants in the Workshop:

- A) The contents of Draft Final Report were accepted by MIME, EAC and EDC except for some inaccurate or incorrect descriptions pointed out by MIME.
- B) JICA Study Team explained detailed contents of the draft SREPTS for Hydropower submitted as the Annex of the Draft Final Report for the following four (4) Parts including the revisions made on the first draft of SREPTS and Explanation Sheet delivered to the Counterpart Team in February 2009:

Part 1: General Provisions

Part 2: Civil Structures and Hydromechanical Equipments

Part 3: Electrical and Electromechanical Facilities

Part 4: Examination and Inspection

As the result of discussion, the following are confirmed and agreed concerning the contents of the draft SREPTS for Hydropower.

- 1) The term of “civil engineering and hydromechanical facilities” defined in Article-1 and used in the other Articles of the draft SREPTS and Explanation Sheet shall be changed to “civil structures and hydromechanical equipments”.
- 2) Concerning Article-5 “Assignment of Chief Engineers”, the agencies to which the owner shall report the contents of the handover shall be MIME and EAC in general and also EDC when EDC is the signer of PPA”. The proposed provision of Article-5 shall be modified accordingly.
- 3) Concerning Article-6 “Environmental Protection”, the proposed sentences were agreed without modification in spite of the recommendation of the Ministry of Environment to indicate the relevant environmental laws and regulations in Article-6 because such laws and regulations may be changed or restructured in the future. The Counterpart Team will explain this decision to the Ministry of Environment in the Second Seminar.
- 4) Concerning Article-7 “Order of Remedy for Conformance to Technical Standards”, the responsible agency on this matter shall be only EAC. The proposed provision of Article-7 shall be modified accordingly.
- 5) Concerning Article-8 “Obligation for Reporting”, the responsible agencies to receive the reports of each reporting category shall be as follows.
 - i) Construction Commencement Report
The report shall be submitted to MIME (the signer of IA) and EDC (only when it is signer of PPA) with copy to EAC.
 - ii) Operation Commencement Report
The report shall be submitted to EAC (the licensor) and EDC (only when it is signer of PPA) with copy to MIME.
 - iii) Accident Report
The report shall be submitted to EAC (the licensor) and EDC (only when it is signer of PPA) with copy to MIME.

Follow-up Study on Establishment of SREPTS on Hydropower

iv) Flood Management Rules

The report shall be submitted to EAC (the licensor) with copy to MIME and EDC (only when it is signer of PPA).

v) Report of Regular Monitoring and Inspection Results

The report shall be submitted to EAC (the licensor) and EDC (only when it is signer of PPA) with copy to MIME.

vi) Report of Emergency Inspection Results

The report shall be submitted to EAC (the licensor) with copy to MIME and EDC (only when it is signer of PPA).

The proposed provisions of Article-8 shall be modified according to the above conclusions.

- 6) Concerning Article-9 “Safety and Technical Training”, the responsible agency on this matter shall be EAC and EDC (only when it is signer of PPA). The proposed provision of Article-9 shall be modified accordingly.
- 7) Concerning Article-10 “Exemptions for Small Projects”, the responsible agency on this matter shall be only MIME and EAC. The proposed provision of Article-10 shall be modified accordingly.
- 8) Concerning Article-11 “Exemptions for Projects under Implementation”, the responsible agency on this matter shall be only MIME and EAC. The proposed provision of Article-11 shall be modified accordingly.
- 9) Concerning Article-12 “Exemptions for Projects under Operation”, no modification is required on the proposed provision.
- 10) Concerning Article-13 “Exception of Exemptions”, the Report of Regular Monitoring and Inspection Results shall be submitted to EAC (the licensor) with copy to MIME and EDC (only when it is signer of PPA). No modification is required on the proposed provision of Article-10.
- 11) Concerning Article-20 “Prevention of Damage to Upstream and Downstream Areas”, no modification is required on the proposed contents of the provisions in spite of the comments from Ministry of Water Resources and Meteorology. The JICA Study Team will explain this decision to the Ministry of Water Resources and Meteorology in the Second Seminar.
On the other hand, JICA Study Team will prepare some clarifications to add to the Explanation Sheet for Article-20 from the view point of climatology and hydrograph as suggested by Ministry of Water Resources and Meteorology.
- 12) Concerning Article-21 “Design Flood”, the Ministry of Water Resources and Meteorology proposed that not only hydrograph but also climatology should be analyzed to prevent damage to upstream and downstream areas. The JICA Study Team will modify the sentence of Article-21 accordingly.

In addition, the Cambodian Counterpart Team recommended that the Classification of dams show in Tables 21-1 and 21-2 of the draft SREPTS and Table 21-1 of Explanation Sheet shall be reconsidered to fit more to the condition of Cambodia and also taking into account international practices. JICA Study Team will prepare a draft for this and confirm in the Follow-up Meeting.

Follow-up Study on Establishment of SREPTS on Hydropower

- 13) Concerning Article-41 “Other Discharge Facilities”, no modification is required on the proposed contents of the provisions in spite of the comments from Ministry of Water Resources and Meteorology as the issues recommended by the Ministry are related to the provisions in Article-20 “Prevention of Damage to Upstream and Downstream Areas” and Article-56 “Facilities to Discharge to Downstream Areas” of the draft SREPTS for Hydropower and such issues shall be determined in Feasibility Study and/or EIA. The JICA Study Team will explain this decision to the Ministry of Water Resources and Meteorology in the Second Seminar.
 - 14) Concerning Article-54 “Sedimentation and Water Quality”, the second sentence of the proposed provision of Article-54 shall be modified taking into account the comments from Ministry of Environment concerning the cleaning of reservoir area before inundating. The modification will be made by adding the words “such as cleaning of reservoir area” to the original proposed sentence of Article-54. The JICA Study Team will explain this decision to the Ministry of Environment in the Second Seminar.
On the other hand, JICA Study Team will add explanations in the Explanation Sheet for Article-54 from the view point of requirements resulted in EIA.
 - 15) Concerning Part-2 “Civil Structures and Hydromechanical Equipments“, the proposed contents of provisions including modifications on the first draft of SREPTS for Hydropower delivered in February 2009 mainly made for the issues related to dam classification and safety were agreed in principle with adjustments on some provisions including Article-21 “Design Flood” subject to the final confirmation in the Follow-up Meeting of the Third Workshop.
 - 16) Concerning Article-58 “Classification of Voltage” in Chapter 10 of Part-3 “Electrical Facilities”, a note shall be added to Table 58-1 “Voltage Classification” as the same note is applied to the table of voltage classification in GREPTS.
 - 17) The participants of the Workshop appreciated the comments from Cambodia National Mekong Committee concerning promotion of use of national resources including manpower, technical transfer from foreign IPP groups, attention to fish migration and navigation, etc. in the hydropower development. However, no modification is required on the proposed contents of the provisions in the draft SREPTS for Hydropower.
- C) The agenda and schedule of the Second Seminar were discussed among the parties based on the proposal of JICA Study Team and concluded as follows:
- 1) The Second Seminar on SREPTS for Hydropower will be held on August 06, 2009 in the conference room at Phnom Penh Hotel.
 - 2) The following parties will be invited to the Second Seminar
 - Representative of all related Ministries of the Government of Cambodia including
 - Ministry of Economy and Finance
 - Ministry of Environment
 - Ministry of Rural Development
 - Ministry of Water Resources and Meteorology
 - Ministry of Agriculture, Forestry and Fisheries
 - Ministry of Land Management, Urban Planning and Construction

Follow-up Study on Establishment of SREPTS on Hydropower

- Ministry of Public Work and Transport

- Representative of the concerned DIMEs
- Representative of IPP Groups who develop hydropower projects in Cambodia
- Other authorities related to hydropower development such as Cambodian National Mekong Committee

The list of participants was prepared and the invitation letters were delivered together with the copy of the draft SREPTS for Hydropower to around 80 nominated participants by MIME last week already.

3) Agenda of the Second Seminar will be basically as follows:

- Purpose of SREPTS for Hydropower (by MIME)
- Outline of the final draft SREPTS for Hydropower (by MIME)
- Explanation of the final draft SREPTS for Hydropower (Part-1 by MIME)
- Explanation of the final draft SREPTS for Hydropower (Part-2 by EAC)
- Explanation of the final draft SREPTS for Hydropower (Part-3 by MIME)
- Explanation of the final draft SREPTS for Hydropower (Part-4 by EAC)

4) Presentation in the Second Seminar will be performed mainly by MIME and EAC with support of JICA Study Team.

5) The presentation documents shall be prepared both in English and Khmer and the presentation will be performed with simultaneous interpretation.

D) It was conformed that the Working Group including Counterpart Team and JICA Study Team shall perform the following activities during the Third Field Work of JICA Study Team:

- 1) Translation of the final draft SREPTS for Hydropower into Khmer by the end of July 2009
- 2) Translation of the final draft Explanation Sheet into Khmer by the middle of August 2009
- 3) Preparation of presentation documents for the Second Seminar

E) The Follow-up Meeting for the Third Workshop will be held on August 07, 2009 in order to confirm results of activities during the Third Field Work of JICA Study Team including some modifications on the proposed provisions in the draft SREPT for Hydropower and to settle all queries made by participants in the Second Seminars and the Cambodian Counterpart Team for finalizing the contents of the draft SREPTS for Hydropower for preparation of the Final Report and the final draft of SREPTS for Hydropower to be submitted to JICA in October 2009.



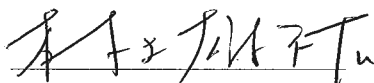
MIME
Secretary of State
H.E. Ith Praing



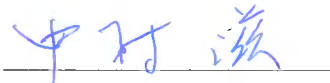
EAC
Director, Electricity Regulation Dept.
Mr. Theng Marith



EDC
Director, Generation Dept.
Mr. Ros Chenda



JICA Cambodia Office
Deputy Chief Representative
Mr. Murakami Yusuke



JICA Study Team
Leader
Mr. Nakamura Shigeru

Minutes of Follow-up Meeting for 3rd Workshop

Date and Time: August 07, 2009 (Fri) at 10:00PM
Place: Meeting Room at Ministry of Industry, Mines and Energy
Participants: Members of Working Groups (Civil and Electrical) from MIME, EAC, EDC and JICA Study Team

MIME : Dr. Bun Narith (Leader of Counterpart Team),
Mr. So Veasna, Mr. Chea Narin,, Mr. Pan Narith, Mr. Phan Bun Hocum,
Mr. Leang Khemarith
EAC : Mr. Theng Marith, Mr. Teng Saroeun
EDC : Mr. Ros Chenda, Mr. Heav Chamvisal
JICA Cambodia: Mr. Takanobu Shinoda, Mr. Heng Salpiseth
JICA Tokyo: Ms. Chiyoko Miyata
JICA Team: Mr. Shigeru Nakamura, Mr. Yutaro Mizuhashi, Mr. Hajime Butsuhara
Mr. Hideaki Morishita .Mr. Ryuichi Shinoda

Contents:

The following are confirmed in the Follow-up Meeting:

1. Revisions on the draft SREPTSHP agreed in the 3rd Workshop

The revisions were agreed in the 3rd Workshop for the following as confirmed in the Minutes of 3rd Workshop:

- 1) The term of “civil engineering and hydromechanical facilities” is changed to “civil structures and hydromechanical equipments”.
- 2) Responsible agencies related to Article-5 “Assignment of Chief Engineers”, Article-6 “Environmental Protection”, Article-7 “Order of Remedy for Conformance to Technical Standards”, Article-8 “Obligation for Reporting”, Article-9 “Safety and Technical Training”, Article-10 “Exemptions for Small Projects”, Article-11 “Exemptions for Projects under Implementation” and Article-13 “Exception of Exemptions” are clarified as confirmed in the Minutes of 3rd Workshop.
- 3) A note is added to Table 58-1 “Voltage Classification” in Article-58 “Classification of Voltage” as the same note is applied to the table of voltage classification in GREPTS.

2. Revisions on the draft SREPTSHP and Explanation Sheet agreed in the WG Meetings

The revisions were agreed in the WG Meetings for the following as confirmed in the Minutes of WG Meetings:

- 1) Change of the term of “this SREPTS” to “SREPTSHP”
- 2) Addition of paragraphs to Explanation Sheet for Article-6 “Environmental Protection”
- 3) Addition of paragraphs to Explanation Sheet for Article-20 “Prevention of Damage to Upstream and Downstream Areas”
- 4) Change of the criteria for dam classification in Article-21 “Design Flood”
- 5) Addition of definitions of “ha” and “hi” in Article-22 “Freeboard”
- 6) Modification and addition of sentences related to cleaning of reservoir area in Article-54 “Sedimentation and Water Quality”
- 7) Modifications of sentences in Article-171 “General Provisions” for In-progress Inspection and the related parts of Explanation Sheet according to change of criteria for dam classification in Article-21 “Design Flood”
- 8) Modifications of sentences in Article-177 “General Provisions” for Periodical Inspection according to change of criteria for dam classification in Article-21 “Design Flood”
- 9) Minor revisions in Part-3

3. Revisions suggested in the 2nd Seminar


- 1) Modification of Article-2 “Purpose” suggested in the 2nd Seminar was proposed by the JICA Study Team and agreed among by the Counterpart Team as shown in Attachment of this Minutes.
- 2) Other Articles were accepted in the 2nd Seminar without modifications in principle.

4. Schedule after the Follow-up Meeting


- 1) The Counterpart Team will provide JICA Study Team with no further comments on the draft SREPTSHP and Explanation Sheet for preparation of Final Report and Final draft of SREPTSHP and Explanation Sheet.
- 2) The Counterpart Team will provide JICA Study Team with the draft translation of SREPTSHP, Explanation Sheet and Glossary into Khmer by August 13, 2009.
- 3) The Counterpart Team requested JICA Study Team to prepare and submit at least 30 copies of Draft SREPTSHP including Explanation Sheet and Glossary to MIME for its promulgation procedure.
JICA will consider whether JICA can respond this request or not.

Follow-up Study on Establishment of SREPTS for Hydropower


- 4) In the above regards, JICA Study Team requested the Counterpart Team to complete and provide JICA Study Team with the final Khmer version of Draft SREPTSHP, Explanation Sheet and Glossary by the middle of September 2009.
- 5) JICA Study Team will submit the Final Report to JICA by 07 October 2009.
- 6) JICA will send the Final Report including the Final Draft SREPTSHP, Explanation Sheet and Glossary to MIME in November 2009.
- 7) MIME/EAC will take action for promulgation of the SREPTSHP soon after receiving the Final Report from JICA.



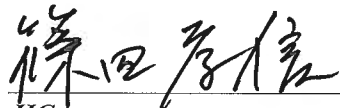
MIME
Leader of Counterpart Team
Dr. Bun Narith




EAC
Deputy Team Leader
(Civil WG)
Mr. Theng Marith



EDC
Deputy Team Leader.
(Electromechanical WG)
Mr. Ros Chenda



JICA
Cambodia Office
Mr. Takanobu Shinoda



JICA Study Team
Leader
Mr. Shigeru Nakamura