

Summary

1. Outline of the Project

Country: Kingdom of Cambodia

Project Title: Project for Building of Capacity and Institutions in the Electrical Sector

Issue/Sector: Improving Systems for Generation, Transmission and Distribution of Electric Power

Cooperation Scheme: Technical cooperation project

Division in Charge: JICA Cambodia Office

Total cost (as of the time of evaluation): 454.976 million Japanese yen

Period of Cooperation:

(R/D) September 19, 2004–September 18, 2007

(Extension):

(F/U):

(E/N): (Aid)

Partner Country's Implementing Organization: Ministry of Industry, Mines and Energy (MIME), Electricity Authority of Cambodia (EAC), Electricité du Cambodge (EDC)

Supporting Organization in Japan: Japan Electric Power Information Center, Inc. (JEPIC)

Related Cooperation:

1-1 Background of the Project

Electrification rate, generation and consumption of electricity in Cambodia are much lower than those in neighboring countries. Due to the civil war and other factors, the country has many problems, including the deterioration of power-transmission facilities and lack of engineers. On the other hand, demand for electric power has been rapidly increasing in recent years, mainly in cities, and it is necessary to enhance and improve the technology for maintaining and managing the ability to supply energy in order to cope with the further expansion of demand in the future. Under the circumstances, the Cambodian Government requested support from Japan for the development of legal systems to maintain and operate electric power facilities and for the technical cooperation related to the operation of the facilities.

1-2 Project Overview

(1) Overall Goal

Stable and safe supply of electric power in Cambodia

(2) Project Purpose

EAC: Effective and proper management of Electric Power Technical Standards by EAC

EDC: Effective and proper management of distribution system by EDC

(3) Project Outputs

<EAC>

1) Clarification of rules with respect to General Requirements of Electric Power Technical Standards

2) Smooth performance of work to authorize and approve licenses

3) Upgrading of knowledge and skills for guiding licensees

<EDC>

1) Development of knowledge and skills for the maintenance of the distribution system

2) Development of knowledge and skills for the recovery of the distribution system

3) Development of the capacity for designing and enhancing the distribution system

(4) Project Inputs (as of this evaluation)

Japanese side: 454 million yen

Long-term experts 2 persons (one each for EAC and EDC)

Equipment supply The text related to international standards, computers (software, hardware), GIS software, fault location system, electric voltage detector, etc.

Short-term experts 31 persons (23 for EAC, 8 for EDC)

Local cost EAC: 90,597 US dollar, EDC: 116,919 US dollar

No. of trainees received in Japan 10 persons (6 from EAC, 4 from EDC)

Cambodian side: About 8,000 US dollar

C.P. arrangement

EAC: 5 persons (7 from MIME and EDC for the WG to formulate Electric Power Technical Standards)

EDC: 18 persons

Project office for experts

2. Evaluation Team Overview

Member of the evaluation team

(Area in charge: name, title)

Leader: Yusuke Murakami, Deputy Resident Representative, JICA Cambodia Office

Improvement of the ability to permit and license for electric power industry: Hideki Narumi, Deputy Assistant Manager, Administration Dept., JEPIC International

Cooperation Center

C.P. training: Satoru Kobayashi, Program Officer, Economic Development Dept., JICA

PDM evaluation: Atau Kishinami, Permanent Expert, International Development Associates Ltd.

Operational management: Shigeki Miyake, JICA Cambodia Office

Evaluation Period

March 4–14, 2007

Evaluation type: Terminal evaluation

3. Overview of Evaluation Results

3-1 Achievements

Achievements of the indicators for project purposes are as follows. Both projects are proceeding favorably and all of the indicators are expected to be satisfied by September 2007, which is when the project is scheduled to end.

EAC

Indicator	Current conditions
1 Submission of Specific Requirements of Electric Power Technical Standards (SREPTS) to MIME	The final seminar on SREPTS was held in January 2007 as planned and the final version of SREPTS will be prepared by the end of April 2007.
2 The number of guidance to licensees concerning technical matters	Technical guidance has already been conducted as necessary. Technical guidance specifically pertaining to SREPTS was also carried out after the preparation of the first draft of SREPTS in July and August 2006 and the second seminars for local licensees will be conducted in July and August 2007. The “Seminar Participants List” is attached as a reference

EDC

Indicator	Current conditions
1 Proper management and analysis of facility database	A facility database for the Medium Voltage distribution system in Phnom Penh as well as ones for other provincial towns (13 provinces) under EDC control have been

	established as of March 2007. The indicator has been fulfilled.
2 Proper execution of EDC planning work	Geographic Information System (GIS) data, which is required for the preparation of planning work, has been arranged and some of the work has been executed in Phnom Penh and in provincial towns under EDC control. Standards showing the basic methodologies of the extension plan implementation will be modified in March 2007.

As described above, three outputs are set for respective projects. As of March 2007, the Specific Requirements of Electric Power Technical Standards for the EAC is almost complete and the preparation for MIME's approval and promulgation is underway. At the EDC, all equipment has been installed and system management has been implemented. Therefore, the project purpose is nearly achieved.

Achievements of the indicators for project outcomes are as follows. Both projects are proceeding favorably and all of the indicators are expected to be satisfied by September 2007, which is when the project is scheduled to end.

EAC

Outcome 1

Indicator	Current conditions
1-1 Preparation of SREPTS of three major fields	The final draft of SREPTS was presented in the final seminar held in January 2007 in Phnom Penh. SREPTS are currently being modified/revised and will be prepared in April 2007.
1-2 Clarification of SREPTS contents on behalf of officials/staff of Electricity Regulation Department (Target level of clarification: 80%)	Counterpart personnel have gained thorough understanding of SREPTS by way of making presentations at six seminars and also through translations. A questionnaire regarding the level of understanding will be carried out before the Project's completion.
1-3 Awareness of the SREPTS by licensees (Target level: 100%)	A total of 112 out of 132 licensees participated in the first seminar on SREPTS held in July 2006. A total of 110 out of 132 licensees participated in seminars at four locations in August 2006. In addition, a seminar was held with 114 out of 137 licensees in January 2007. Other licensees who

	did not participate in either seminar have been provided with the SREPTS, including the explanation sheet.
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Outcome 2

Indicator	Current conditions
2-1 Enabling of quick and easy access to licensees' supply areas	Supply area data regarding existing licensees has already been collected. It can already be accessed with ease via intranet, which is more effective compared to the conventional management system based on written documents.
2-2 Management of licensees' facilities data within EAC.	The data on the facilities have been acquired and are managed by GIS, except on the companies that are updating the facilities.
2-3 Collection of data on faults and accidents	The EAC standards are under reexamination to appropriately collect data from each electricity company. The implementation is scheduled for December 2007.
2-4 Public disclosure of data on electrified areas via the website	A trial was made by the intranet within the EAC. It This is expected scheduled to for disclosure to the public by the end of March 2007.

Outcome 3

Indicator	Current conditions
3-1 Technical materials and texts are prepared.	Some materials, such as the "Explanation Sheet for Specific Requirements of Electric Power Technical Standards", "Voltage Management" and a DVD on "Safety Work" have been prepared.
3-2 Enabling of officials/staff of Electricity Regulation Department of EAC to use instruments provided in this project	A manual has been made. The ability of core staff has improved as far as being able to use measuring instruments by themselves.
3-3 Provision of guidance and training to all licensees	Guidance and training are given to licensees when problems occur as well as when licensees receive visits. Technical guidance and training sessions were carried out in July and August 2006 at SREPTS seminars and will also be conducted at local seminars to be held in July and August 2007.

EDC

Outcome 1

Indicator	Current conditions
1-1 The database for the maintenance of the distribution system is made.	The database using GIS was completed by March 2007.
1-2 The manual for the repair of the distribution system is made.	As manuals for repairs, the “Manual for repairing underground cables” and the “Manual for patrol, inspection and measuring (underground cable)” were completed in November 2006.
1-3 Conducting of periodic checks for preventive maintenance.	It is recognized that measuring the electric current of an LV underground cable is effective as preventive maintenance. Periodic checks have been conducted properly in accordance with the maintenance manuals since the beginning of 2007. “Measuring Low Voltage Underground Cables” is attached as a reference.
1-4 Shortening of time fault recovery (Target level: 20% reduction from present time)	The time was shortened from the average 1,004 minutes/case in 2005 to the average 654 minutes/case in 2006 (about a 35% reduction).

Outcome 2

Indicator	Current conditions
2-1 Impedance map is made.	Impedance map has been made in December 2006.
2-2 Quick and easy ascertainment of areas and number of household affected by faults	Training courses related to GIS were introduced in February 2007 for system operators. The areas and the numbers of households affected by faults will be able to be determined in a short time and with ease after the completion of the training courses in April 2007. Booklets providing map information will be distributed to the relevant personnel in March 2007.
2-3 Preparation of manuals for relay setting	The “Manual for relay protection work” was prepared together with a short-term expert dispatched in October 2006. It will be officially approved in April 2007.
2-4 Recovery time from electric	The time was shortened from the average 1,004

power outage is shortened by 20%.	minutes/case in 2005 to the average 654 minutes/case in 2006 (about a 35% reduction).
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Outcome 3

Indicator	Current conditions
3-1 The database for the planning of a distribution system is made.	The system input of the information on the facilities and on each village (number of households, etc.) has been completed, and the database for the planning is ready. (GIS is used.)
3-2 Revised Technical Standards of EDC is prepared.*1	The first draft was prepared in January 2007. It is currently being modified/revised according to the relevant personnel's opinions and will be approved by the EDC Director by the end of March 2007.
3-3 Preparation of future plans for extension	Future plans for extension have been prepared for the following areas and sections: <ul style="list-style-type: none"> -Kampong Cham -Siemreap -Siemreap -Sihanouk Ville -Phnom Penh—Kampong Speu -Kandal—Takeo -Kampot Chhuk -Battambang -Banteay Meanchay

*1 The Cambodian evaluation team thought that it should be called the "EDC Technical Guidelines" instead of "EDC Technical Standards."

3-2 Summary of Evaluation Results

(1) Relevance

The relevance of this project is high.

National and sector policies of the Cambodian government, such as the "National Poverty Reduction Strategy," the "Energy Sector Development Policy," and the "Cambodia Power Sector Strategy," emphasize the electric power sector and human resource development of the sector, and this project is highly coherent with the policies. The EAC was concerned with its hindrance on the electric power administration to cope with the rapid increase in the future demand for electric power and of deterioration on

the reliance and stability of the power supply, and immediate measures were required. At the same time, one of the EDC's pressing needs was fostering of an organized group of engineers, since the EDC's ability to cope with these issues was low due to the lack of human resources, technology, experience, and funding. Therefore, the project accords with the needs of the EAC and EDC, who are the beneficiaries. Japan has made its assistance priority area in accordance with National Strategic Development Plan and Rectangular Strategy of the Cambodian Government, and this project contributes to the "building of an economic and social infrastructure" in the plan and the strategy.

By achieving two project purposes, the electric power supply sector is enhanced in both system and facility, and improvement is made for a stable and safe supply of electric power, which is the overall goal of this project.

(2) Effectiveness

The effectiveness of this project is high.

Regarding the EAC, the activities related to "technical guidance to electricity companies are implemented," which is one of the indicators of the project target level, are practiced at the time when a problem occurs at an electricity company and when a visit to an electricity company is made. In addition, a seminar for electricity companies was held in July and August 2006, after the completion of the first draft of SREPTS. Technical guidance is also scheduled after SREPTS is promulgated as a ministry ordinance of MIME, and more substantial technical guidance will be given after the (scheduled) promulgation in June 2007 until the project completion.

As for the EDC, the indicators for two project targets have been nearly satisfied. With the revision of design standards related to the expansion plan and the formal launch of the organization for GIS in the future, the target levels are expected to be achieved completely by the project deadline.

Three respective outcomes of this project are all essential conditions for the achievement of the project targets, and the achievement would be difficult if any one of the outcomes is not satisfied. External conditions are nearly satisfied too.

(3) Efficiency

The efficiency of this project is relatively high.

The delivery of a probing vehicle for fault location was a little delayed, but inputs have been made almost as scheduled on both the Japanese and Cambodian sides. Because the indicators for outcomes have nearly been achieved, the quality, quantity and timing of inputs are considered to have been appropriate. Especially, the training in

neighboring countries of Cambodia was efficient when considering similar situations in those countries and the cost-effectiveness in comparison with the training in Japan. All the outcomes could not have been practiced and disseminated if the input of this project had not been made.

(4) Impact

The following positive impacts have appeared.

- > The indicator of the overall goal is the "stable and safe supply of electric power in Cambodia." The number of electric power outages per customer has been improved from 3.769×10^{-3} times/household p.a. before starting the project to 2.311×10^{-3} times/household p.a. in 2006. A part of this effect is produced by a factor not directly owing to this project, such as the increase in power generation, but it is also a fact that the activity of this project, such as relay setting, has made a direct contribution.
- > Seminars to introduce GIS were given for various related organizations, which resulted in some organizations installing GIS and some sharing information (satellite photographs).

(5) Sustainability

Sustainability of this project is high.

In regard to organization and system, the enhancement of the electric power sector coincides with national policy and this tendency is expected to continue in the future. When MIME promulgates SREPTS as the ordinance, the EAC will have strong measures and validity to give instructions to electricity companies. At the same time, the EDC is making efforts to strengthen the organization by establishing the department related to relay setting and problem analysis and by approving the establishment of a section related to the activities on GIS. By these efforts, the C.P. is expected to be able to continue to use the knowledge and technology gained by the project after the project completion. Sustainability is high in the technical aspect, since technology transfer has been implemented smoothly, and supplied equipments are appropriately maintained and managed by the C.P. As for the financial aspect, the EAC has ample funds from its income from the activities on licensing. Although the budget of the EDC is limited, Deputy Managing Director Yim Norson has stated that the EDC would maintain efforts to secure the budget for establishing the above new section, and the concern at the time of the mid-term evaluation is nearly cleared up. Financial sustainability of the EAC and EDC are high and somewhat high respectively.

3-3 Factors that Contributed to the Production of Effect

(1) Planning

As a contributing factor, the content of the plan accorded with the policies of the state and the sector and was the priority issue of MIME, EAC and EDC; so these organizations were very much interested in the plan, and it was quite timely.

(2) Implementation Process

Regarding the EDC, it was effective in enhancing sustainability to have promptly approved the establishment of the section related to GIS in accordance with the "proposal" in interim evaluation.

3-4 Problems and Factors that Raised Problems

(1) Planning

Nothing specifically

(2) Implementation Process

Since several implementing and related organizations exist for the project, it is necessary to share information on the project progress and problems. In the Joint Coordinating Council (JCC) held in May 2006, a report on the activities was presented and the Project Design Matrix (PDM) was discussed, but such meeting was not held again until March 13, 2007.

3-5 Conclusions

Since the degree of achievement of indicators written in PDM is high, project outcomes and project purposes are expected to be achieved by the project expiration. In addition, the effect of a part of the overall goal has appeared as described above. Evaluations by five items (Relevance, Effectiveness, Efficiency, Impact, Sustainability) are all "high" or "relatively high," and the project has been progressing smoothly. Therefore, the project is scheduled to finish in September 2007 as originally planned.

3-6 Recommendations (Specific Measures, Recommendations and Advice on this Project)

A joint evaluation team made the following recommendations.

(1) Establishment of an office in charge of GIS in the EDC

According to the proposal in the interim evaluation, the EDC has decided to establish an office exclusively in charge of GIS to strengthen the activity of GIS, and the approval process is currently underway with the Board of Directors. From the viewpoint of concentrating the C.P., who were transferred the technology by the project, and of using them effectively, the evaluation team has proposed to accelerate the preparation of the establishment of the section related to GIS and to secure the budget to manage the experienced personnel and the section.

(2) Revision of EAC standards

Indicator 2-3, "collection of data on faults and accidents" prescribed in PDM (EAC) is also important for knowing the progress of this project. "Collection of data on the accidents of electric facilities and electric shocks, etc. (Proposal)," which is scheduled to be included in the EAC Standards, of which revision is underway, has already been submitted by this project, and the Electric Power Technical Standards of this time should be promulgated immediately to check the real situations of electrical accidents.

(3) Training based on SREPTS

Though SREPTS has not been promulgated as of March 2007, it is recommended to practice for the EAC C.P. the inspection training that uses SREPTS, under the guidance of Japanese experts, by continuing it until the end of the project. This training is absolutely imperative for stronger certainty of the C.P.'s smooth implementation of inspections after the promulgation of SREPTS and for the enhancement of sustainability.

3-7 Lessons Learned (Matters Helpful for Discovering/Forming Similar Projects Derived from this Project and Implementation, Operation and Administration Thereof)

(1) Training course suitable for actual circumstances of the region

There was a statement from the C.P. that the training in neighboring countries of Cambodia was quite useful for the improvement of knowledge and technology because the situations in the countries were similar to those in Cambodia. When planning training at phase 2 of the project and others in the future, it is necessary to consider cost-effectiveness in comparison with the training in Japan by checking whether or not there are resources in neighboring countries.

(2) Implementation of baseline survey

When measuring the achievement of indicators in the PDM of this project, there was an indicator of which production of effect was unclear due to the lack of

quantitative data. To clearly and quantitatively measure the achievement of "effectiveness," "efficiency" and "impact" in the future, a baseline survey needs to be systematically implemented.

(3) Enhancement of abilities of existing facilities and personnel

For this project, an approach to enhance the capacity of existing organizations and personnel was taken, instead of newly securing facilities and personnel to implement the project. Generally speaking, in developing countries that have financial and organizational vulnerability, the method to newly secure organizations and personnel to implement a project is not appropriate in light of "sustainability," and problematic cases were found here and there in the past. From this point of view, the approach of this project will serve as a good example for other projects.

(4) Factors necessary for the organization implementing a project

This project is smoothly progressing based on PDM. One of the reasons is that the implementing organization has the following characteristics:

- Strong commitment to the project activities by high-ranking personnel;
- Devotion to the project activities by counterpart personnel;
- Sufficient funding for local costs;
- Sufficient funding for salaries for counterpart personnel allowing said personnel to devote themselves to the project's activities;
- High level of similarity between project activities and daily work;
- Presence of personnel with high levels of technical skill; and
- Existence of good ICT environment.

When setting plans for future projects, the above factors need to be taken into consideration.