

**"Project Formulation Survey"
under the Governmental
Commission on the Projects
for ODA Overseas Economic
Cooperation in FY2012**

Summary Report

Cambodia

**Feasibility Study for
Power Control Systems Project**

March, 2013

**Joint Study Team
Tanahashi Electric Machinery Co. Ltd
Ernst & Young ShinNihon LLC**

Introduction

The target country for this study is Cambodia, where unstable and expensive electrical power has become a problem. A shortage of electrical engineers also adds impetus to the problem. In particular, a stable supply of electricity is necessary for facilities such as hospitals, which require machinery to operate reliably. However, in Cambodia, the power situation is unfavorable, with the commercial power supply being unstable. Additionally, electrical power from commercial sources in Cambodia is expensive compared to neighboring countries. The use of private generators running on fuel oil is prevalent, but this places a heavy burden on the environment.

With the situation described above as a background, the purpose of this study is to assist Cambodia through ODA by introducing power control systems. Specifically, by implementing Tanahashi Electric Machinery's power control systems in Cambodia, a stable supply of electricity for hospitals will be achieved. The environmental burden will also be reduced through linkage with solar power systems. Additionally, technical cooperation through dispatching experts from Japan and using the invitation program for local human resources can also be conducted. Furthermore, information will be gathered regarding the application of grant aid and other ODA for bringing solar power systems to hospitals. Possibilities for future business expansion into Cambodia for power control systems will also be investigated.

I. Description of the current situation and development needs of the concerned development issues in the surveyed country

1. Power Sector

Since many of the electrical power facilities were destroyed due to the civil war that continued in Cambodia until the early 1990s, several small-scale power plants using diesel generators were built by Independent Power Producers (IPP) to help meet the demand for power that rose suddenly during the post-war reconstruction period. However, with the domestic power demand subsequently rising more than 20% per year, the current supply of electricity does not adequately meet this demand. Additionally, a lack of water in dams during the dry season causes power generation capacity to drop at hydroelectric power facilities, further creating a shortage problem in the electrical power supply. In the future, the amount of power that can be supplied will increase upon the completion of new power plants, etc., and full coverage for demand is planned by around 2020.

Meanwhile, a power transmission and distribution grid is also being developed in Phnom Penh and running through urban areas and along major roads. However, the electrification rate in rural areas is still only 25-30%. Although Cambodian government continues to work on bringing electricity to rural areas, the frequency of power outages at rural hospitals visited during the survey was higher compared to hospitals in Phnom Penh. Also, the electricity charges are high in areas being supplied by IPPs, with electricity charges being three times those in Phnom Penh in some cases. Therefore, until the power grid is completed in 2030, it is possible that rural areas may not be able to receive adequate power supply due to an unstable supply and high electricity charges.

2. Health Sector

A referral system has been adopted as a healthcare system in Cambodia, with patients transferred from Health Centers (HC), CPA1 hospitals, and CPA2 hospitals to National hospitals or CPA3 hospitals, which are top-level referral hospitals. Although the medical equipment that should be placed at hospitals for each referral level is stipulated in referral hospital guidelines, medical equipment is insufficient at CPA1 and CPA2 hospitals due to an unstable supply of electricity, a shortage of medical staff and human resources who can manage the equipment, and/or a lack of budgetary resources. There are also many cases in which broken equipment has been left unrepaired. As a result, a large number of patients go directly to the CPA3 hospital, where the facilities are more comprehensive. However, residents of regions located away from urban areas may not be able to receive satisfactory medical services provided by lower level referral hospitals if the hospitals are not functioning adequately.

3. Vocational training

Universities and vocational training schools located in Phnom Penh and its suburbs are central to the development of engineering personnel in Cambodia. However, there is a shortage of lecturers and teaching materials due in part to the effects of the Pol Pot era. In addition to difficulties in developing human resources with specialized knowledge, there is a particular lack of engineers and technical personnel since the manufacturing industry is underdeveloped and the number of students receiving higher education in the sciences is insufficient. Another cause is the use of outdated teaching materials for practical training. Even if teaching materials are supplied by donor organizations or private companies, there are few instructors able to provide practical training using these materials. Therefore, courses are focused on classroom learning. Consequently, students are not able to acquire the practical skills that are required for use on job sites.

II. Possible applicability of the SME's products and technologies, and prospects for future business development

For this survey, a survey team investigated the business possibilities for power control systems using solar power. For the distribution and sales of this system, a joint venture company will be formed between Tanahashi Electric Machinery and a Cambodian company. This joint venture company will conduct sales for the system as a local agent.

In terms of business development specifics, the system will first be installed at model hospitals within an ODA project. Then, issues relating to actual system installation and future business opportunities will be examined in regard to project implementation in Cambodia. Additionally, while working to further secure ODA projects, the local joint venture company will conduct sales of the system once business feasibility is confirmed.

The proposed power control system has the following characteristics.

- Alternative energy source during power outages: During power outages, the power control system automatically switches to the solar power system, thereby making a stable supply of electrical power possible. (Partial backup for generators (10kW or less) and generator linking also possible).
- A stable supply of power from the current low-quality power from unstable sources:

While continuing to receive commercial power as the primary source of electricity, the power control system will automatically switch when power quality drops temporarily, thereby making it possible for stable power to be supplied at all times. This makes it possible to prevent a situation in which the operation of medical equipment becomes unstable.

III. Expected development impact and effect on business development of the proposing SMEs in the surveyed country through proposed ODA projects

1. Expected development impact

(1) Development impact for hospitals

- Overcoming the situation of unstable and expensive electrical power: In Cambodia, electrical power has been shown to be unstable and expensive, especially in rural areas. For the proposed system, commercial power will continue to be used as the primary source of electricity, which can be automatically controlled with the power control systems linked to solar systems and generators. Consequently, the problem of unstable power can be overcome.
- Improvement of regional healthcare services: Ideally, using local healthcare services is the most preferable in terms of convenience for local residents. Currently, although local Health Centers are used on an everyday basis, patients tend to go to the national hospital in Phnom Penh or large regional CPA3 hospitals for emergencies or operations. Therefore, the mid-level CPA2 hospitals are not functioning properly. Implementing this project at a CPA2-level hospital will also lead to an improvement in regional health care services.

(2) Development impact in the growth of human resources for industry

- Alleviating the shortage of engineers: In Cambodia, there is a general lack of engineers. A particular shortage of engineering personnel in electrical power-related fields has also been indicated. Supporting the development of electrical engineers at vocational training schools will contribute to the alleviation of this shortage of engineers in Cambodia.
- Alleviating the shortage of lecturers: Although the study of electrical engineering has become more popular in recent years, with the number of students increasing, there are not enough lecturers for these students. Therefore, dispatching experts from Japan will contribute to alleviating the shortage of lecturers in Cambodia.
- Improving the quality of education (enhancing practical training): Even in vocational training schools, classroom learning is the current focus in Cambodia, with only a small amount of practical training given. Therefore, the experts dispatched from Japan will conduct practical education and training in Cambodia, which is helpful in efforts toward resolving this problem. Additionally, even if advanced equipment and machinery is available, the low quality of the local lecturers makes it difficult for them to teach. Thus, by providing practical training to lecturers within Cambodia or by

inviting them to Japan, an improvement in the quality of education can also be expected.

(3) Development Impact for Tonlé Sap Lake

- Supplying electrical power to non-electrified regions: In providing electricity for people living in non-electrified areas such as the floating villages of the Tonlé Sap, installing panels in each home is unrealistic, considering the structure of the buildings. Additionally, that much electrical power is unnecessary for the residents there. Therefore, placing a solar-powered battery charging station (battery charger boat) on the lake through ODA will allow residents to use batteries they have charged there in their respective homes, making it possible for more households to be supplied with electricity.

2. Effects pertaining to business development for the SME through ODA project implementation

In terms of introducing solar power systems in Cambodia, most companies have not reached the level of implementing them as a part of their businesses, with most projects being handled through ODA. For Tanahashi Electric Machinery as well, the feasibility of going forward with independent business expansion in Cambodia without an ODA project is low. Thus, by first implementing a pilot project using ODA, we will be able to study future business possibilities and the sectors which may be utilized. In addition, basic information pertaining to solar power generation in Cambodia can be gathered. A base can also be built for expanding business there through networking, etc.

In this way, Tanahashi Electric Machinery will be able to examine the possibilities for our first business expansion in Cambodia through the implementation of an ODA project. Additionally, this proposed model to be used for business expansion in Cambodia can also be used to resolve development problems common to other developing countries. This makes the model highly versatile, giving to possibilities of horizontal expansion in the future. From the points described above, it is thought that implementing this system as an ODA project is highly significant.

IV. Proposals for formulating ODA projects

1. Hospitals

For the formulation of an ODA project, the implementation of a technical cooperation is proposed. The assistance package will consist of providing equipment to hospitals and developing human resources at vocational training schools and universities. Details of the assistance are as follows.

- CPA2 hospitals in rural areas such as Kampong Speu and Kampot have facilities including operating rooms and birthing rooms that require a stable supply of electricity. In order to achieve a stable supply of electricity to electrical facilities such as medical equipment and lights, power control systems using solar systems will be provisionally installed at a number of hospitals using ODA (provision of equipment). For staff members that will actually be operating the equipment at the hospitals, a short-term training program of approximately one week will be implemented so that they may acquire the basic knowledge needed for operations.

- At vocational schools and universities, experts dispatched from Japan will conduct lectures on solar systems for students and teachers for a period of 1~3 months. Additionally, a simplified version of the solar system interconnection model (equipment for educational purposes) will be provided for vocational schools and universities.
- Students will conduct on-site training and assist in the maintenance of the systems installed at model hospitals. By doing so, a sustainable maintenance structure will be created and an opportunity for practical training will be given to teachers and students.
- Since there is a shortage of teachers in the electrical field that are able to provide practical instruction in particular, experts from Japan will be brought in to implement practical training sessions for 2.5 weeks to 1 month.

2. Tonlé Sap Lake

For the formulation of an ODA project for Tonlé Sap Lake, the provision of equipment to the village through grant aid for grassroots organizations is proposed. Furthermore, supposing that the aforementioned hospital model is implemented concurrently, this may also be linked to the development of human resources at vocational training schools. Details of the assistance for Tonlé Sap are as follows.

- A battery charger boat will be placed in the floating villages of the Tonlé Sap.
- For staff members that will actually be conducting operations at Tonlé Sap, a short-term training program of approximately one week will be implemented so that they may acquire basic knowledge needed for operations.

Project Formulation Survey

Cambodia – Feasibility Survey for Power Control Systems Project

SMEs and Counterpart Organization

- Name of SME: Tanahashi Electric Machinery Co., Ltd.
- Location of SME: Osaka, Japan
- Survey Sites: Kampong Speu Province, Kampot Province, Pursat Province.
- Counterpart Organizations: Ministry of Health, Ministry of Labor and Vocational Training, Ministry of Education

Concerned Development Issues in Cambodia

- Unstable and expensive electrical power
- Frequent power outages, especially in rural areas
- Extension of power grid while some villages remain non-electrified
- Shortage of engineers in electrical fields
- Low quality of services and functionality at rural hospitals

Products and Technologies of SMEs

- Power Control Systems
By linking solar systems to existing commercial power sources and private generators, stable electrical power will be supplied during power outages, and to supplement the low quality of commercial power.

Proposed ODA Projects and Expected Impact

- By introducing power control systems at CPA2 hospitals where the rural power supply is unstable, the power supply can be stabilized and electricity can be provided during power outages.
- Placing a battery charger boat in non-electrified villages of the Tonlé Sap Lake will contribute to supplying power to non-electrified villages.
- Implementing practical training in cooperation with vocational schools and universities will help build a sustainable system for maintenance and provide practical training opportunities for students and teachers.

Future Business Development of SMEs

- A joint venture company will be established between a Cambodian partner company and Tanahashi Electric Machinery, and expansion into Cambodia will be conducted first through an ODA project.
- Subsequently, further development will be conducted with expansion into other ODA projects and the development of business in fields with possibilities.

