11. Issues in Implementation of Project

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11.1. Fuel

In the Project, natural gas is planned as main fuel and diesel is as back-up fuel. However, as stated in Section 3.1, natural gas is not available at present in Cambodia. The Cambodian government is studying several options to make natural gas available, namely, development of gas resources offshore in the Cambodian territory and import from neighboring countries. However, every option has some issues respectively, then it seems to be difficult to get conclusion in a short time.

The most preferable option to realize utilization of natural gas would be a development in the Cambodian territory. That could be considered the most beneficial solution to Cambodia due to effective use of own natural energy resources, proceeding a plan by own decision without disturbance by others and saving of foreign currency.

Meanwhile, according to the information of the gas developer, Woodside Co., the development of natural gas in offshore Cambodia is not necessarily favorable in economic aspect because of relatively small reserved volume per well. This means that many wells should be drilled, then the development cost becomes higher. In addition, since, at present, there is no significant gas consumer other than this Sihanoukville power project in Cambodia, the construction cost of pipeline per unit volume of gas becomes more costly. Generally price of natural gas tends to become cheaper in proportion to increase of demand. It is said that the size of 180 MW power generation is rather small to ensure economical price of natural gas, and preferable size would be larger than 300 MW.

Therefore, attainable gas price counting such disadvantageous conditions in is a key point to realize this Project.

If the Cambodia government makes a policy that future power development is based on gas fired gas turbine combined cycles, and shows in his power development plan a planned size and commissioning time of specific power plant, that plan would accelerate strongly the development of natural gas.

11.2. Implementation Schedule

11.2.1. Relation with Transmission Line between Kampot and Sihanoukville

In the study of the optimum power development plan, the Sihanoukville power plant is concluded to commence Stage 1 in 2006 and Stage 2 in 2008. However, as shown in Fig. 9-1, the attainable commissioning time of Stage 1 depends on the schedule of transmission line between Kampot and Sihanoukville.

The concrete plan of this transmission line is not exist so far, and neither a feasibility study is commenced. The schedule shown in Fig. 9-1 is only an imaginary and not-confirmed schedule that can keep the required completion of the Sihanoukville power plant. Therefore, to ensure the schedule of completion time of the power plant, the feasibility study of transmission line is recommended to start as soon as possible without waiting the final decision of the power plant construction.

11.2.2. Relation with Available Time of Natural Gas

Meanwhile, another issue is a time that natural gas becomes available to the Plant if it is intended to use natural gas from the start of the Plant. The Plant is planned to use diesel oil as back-up fuel, therefore, the Plant can be operated by using diesel oil until natural gas comes with a demerit by high fuel cost in short period. However, even if diesel oil is used initially, the specific available time of natural gas needs to be confirmed at the time of decision of construction of the Project. Otherwise, it would become difficult to convince a lender to arrange a loan for the Project.

According to the information from the developer of natural gas, the expected time from a signing of production sharing contract (PSC) to commercial production of natural gas is about 5 years. However, so far the signing of PSC between CNPA and the developer is not yet done, therefore it is questionable whether natural gas becomes available in 2006. In addition, to conclude to supply natural gas to the Project it is required to agree the price of gas. Generally this kind negotiation requires so long period, so, to assure the commissioning time of the Project as required, the relevant parties, MIME and EDC, should take an initiative of the negotiation.

11.3. Structure of Power Generation in Cambodia

At present, the biggest power supply source is IPP1 with capacity of 37.1 MW, which is a independent power supplier. Other power plants are mostly of small diesel power plant with capacities between several thousand kW to 20 MW less. In addition to these, Kirirom hydropower (12 MW), which is also IPP, is planned to start in 2003, and the power trade with Vietnam is planned to start in 2004. And, excepting the Sihanoukville power plant, all planned power plants in future are of hydro power plant, namely Kamchay (47- 127 MW), Stung Atay (110 MW), St. Russei Chrum (125 MW) and Battambang (60 MW).

IPP1 and Kirirom can not be expected to take a role of load adjusting operation because of Take-or-Pay power purchase agreement. And other hydro power plants will be operated to generate power in correspondence to a utilizable water quantity without load adjusting. Therefore load adjustable power sources are only the Sihanoukville P/P, C-6 (18 MW) and the interconnection with Vietnam except the existing diesel power plants that are planned to retire in future.

The Sihanoukville power plant is a new and high efficiency plant, therefore, it is expected to operate on high base-load and supply cheap power. However, due to the above situations the Sihanoukville P/P could not operate at so high load as to perform the expected role.

Another problem related to hydropower is that the operation load of hydropower is significantly different by the seasons, namely, high-load operation in the wet season and low-load operation in the dry season. To compensate this load difference the thermal power plant has to operate on high load in the dry season and low load in the wet season. The capacity of such thermal power plant is determined considering the minimum load of hydropower in the dry season, that results in the low capacity factor and low economic performance of thermal power plant. In other words, higher reserve margin is required as a whole power generation system.

From the above mentioned points of view, it goes without saying that introduction of IPP with high power price should be avoided, but the power generation balance be-

tween hydropower and thermal power should also be studied in the power development plan with considering the investment cost and operation cost required in whole system.

Expansion of thermal power generation capacity in future power development would be beneficial to realize a cheaper price of natural gas.

11.4. Management, Operation and Personal Allocation

Most of power plants in Cambodia are of diesel generator power plant except one small capacity boiler-turbine power plant. They have never experienced of operation of gas turbine as well as gas turbine combined power plant. Therefore, it is recommended that the operators or staff to be assigned to the Sihanoukville power plant will have training immediately after the decision of construction, preferably actual operation training in a similar power plant outside the country. In addition, during the first 2 or 3 years operation of the Plant, for training EDC's operators, it is recommended to employ skillful expatriate engineers as temporary staffs who are assigned to the operation team leaders. For management and administration for a whole power plant, it is also recommended to employ expatriate staff for initial stage, who can manage and make plans for operation, maintenance & inspection, procurement of materials, etc.

The required number of staff for the Sihanoukville power plant is estimated 151 at the time of Stage 2 completion (refer to Chapter 8). Of them, the number of engineer is 115. While the total number of employee of EDC as of 2000 is 1,513, and the total number of personnel classified into "Engineer", "Vocational Technician" and "Skilled worker" is 858. And, the number of employees belong to the power plants is about 540 in total, about 330 in Phnom Penh area and about 210 in the regional power stations, respectively.

From the above data, the present staff capacity of EDC seems to be able to supply the required staff for the Sihanoukville power station on the condition that the existing old diesel power plants in Phnom Penh area will be closed down step by step. However, this needs relocation of a significant number of employees from the capital city Phnom Penh to the regional city Sihanoukville, of which distance is about 260 km. Therefore, some part of staff may be required to be hired newly in the Sihanoukville area.

11.5. Finance

In the course of the study, the project cost including the associated transmission line from the site to Kampot is estimated to be 265 Million US$ (or 31,800 Million Japanese Yen), in which an official soft loan will be applied amounted to 212 Million US$ (or 25,400 Million Japanese Yen).

The JBIC loan is also one of the candidates of the official soft loan. The latest loan amount financed by JBIC to the Government of Cambodia was 4,100 Million Japanese Yen, which was applied to "Sihanoukville Port Urgent Rehabilitation Project" in 1999.

Since the required finance amount of 25,400 Million Japanese Yen extremely exceeds the above actual finance amount, JBIC may not be able to afford the required finance by itself. Co-finance by JBIC and ADB is also one of the alternatives for the finance planning.

Stage 2 is planned to be constructed after 2 years since Stage 1 is constructed. However, the implementation of Stage 2 might be delayed in view of the finance procurement.