The Socialist Republic of Vietnam

Phu My Thermal Power Plant Project (I) - (IV)

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Field Survey: November 2007, March 2008

1. Project Profile and Japan's ODA Loan

Map of the project area

Phu My Thermal Power Plant

1.1 Background

In Vietnam, under the "Doi Moi" (renovation) policy adopted at the 6th Party Congress in 1986, transition from a planned economy to a market economy has been promoted. The GDP growth rate which was 2.8% in 1986 and 5.1% in 1990 reached over 8% per annum between 1992 and 1994.

This rapid economic growth substantially boosted national power consumption which marked an approximately 2.9 fold increase in the 10 years from 1985 to 1995. In the southern region, in particular, power consumption increased about 3.6 fold over the same period, recording an increase rate higher than the national average. With completion of the 500 kV transmission line connecting the northern and southern regions in 1994, power shortage in the southern region was improved temporarily by power transmission from the northern region. However, power shortage was also feared in the northern region and power demand in the southern region was expected to continue to increase. Therefore, it was necessary to meet the increasing power demand and to ensure stable power supply in the southern region.

1.2 Objective

The project's objective is to meet the increasing power demand and to ensure stable supply of electricity in the southern region of Vietnam, by constructing a gas combined-cycle power plant and related transmission lines/substations in the Phu My area

in Ba Ria Vung-Tau Province near the Ho Chi Minh City; thereby contributing to the economic vitalization in the southern region.

1.3 Borrower/Executing Agency

Government of the Socialist Republic of Vietnam/Vietnam Electricity (EVN)

1.4 Outline of Loan Agreement

	Phase I	Phase II	Phase III	Phase IV
Loan Amount	26,942 million yen	10,262 million yen	11,638 million yen	13,090 million yen (Total: 61,932 million yen)
Loan Disbursed Amount	59,435 million yen			
Exchange of Notes / Loan Agreement	Jan. 1994 Jan. 1994	Apr. 1995 Apr. 1995	Jan. 1997 Mar. 1997	Mar. 1999 Mar. 1999
Terms& Conditions -Interest Rate -Repayment Period (Grace Period) -Procurement	1.0% 30 years (10 years) General untied	1.8% 30 years (10 years) General untied	2.3% 30 years (10 years) General untied	0.75% 40 years (10 years) General untied (consultant: bilateral tied)
Final Disbursement Date	July 2005			
Main Contractors	Kinden Corporation (Japan) and Itochu Corporation (Japan) (JV), PT. Schneider Indonesia (Indonesia), KEC International Ltd. (India), Mitsubishi Heavy Industries, Ltd. (Japan)			
Consulting Services	NEWJEC (Japan), Ewbank Preece (UK), PIDC2 (Vietnam) (JV)			
Feasibility Study (F/S), etc.	1993 Japan Consulting Institute 1993 JBIC (SAPROF) 1996 PIDC2			

2. Evaluation Result (Overall Rating: A)

2.1 Relevance (Rating: a)

This project has been highly relevant with Vietnam's national policies both at the time of appraisal and at the time of ex-post evaluation.

2.1.1 Relevance at the time of appraisal

At the time of appraisal of Phase IV of this project, rapid increase in power supply was stated in the industry development program under the 5-Year Socio-Economic Development Plan (1996–2000), and it was stated in the infrastructure development program under the same plan to ensure power supply in each region to meet the electricity demand. According to the 4th Power Development Master Plan (1996–2000), the power demand was estimated to have doubled from 14,640 GWh to 30,105 GWh between 1995 and 2000. In order to meet this demand increase, it was planned to build not only hydropower plants but also thermal power plants to achieve well-balanced electric power development.

As power demand in the southern region was also expected to almost double from 7,000 GWh to 15,560 GWh between 1995 and 2000, it was essential to ease the tight power supply situation and meet the growing power demand in order to support economic growth in Vietnam.

This project, which was to construct a thermal power plant that could support the base load in both dry and rainy seasons, was considered to be highly consistent with the national policy, the electric power sector development program, and the development needs in meeting the expected increase in power demand, and consequently it is considered to be relevant.

2.1.2 Relevance at the time of evaluation

At the time of evaluation, it is cited in the 5-Year Socio-Economic Development Plan (2006–2010) to balance supply and demand of electricity and ensuring stable power supply in the country. The electric power industry is listed among the priority industries for investment in infrastructure investment. According to the 6th Power Development Master Plan, the power demand is estimated to grow at 17–20% per annum between 2006 and 2015, and thus it is necessary to expand the country's power generation capacity to meet this ever-increasing demand.

The electricity sales volume of the southern region and that of the nation as a whole has increased on an average of about 15% per annum in the past 5 years, and total sales of

electricity in the southern region is estimated to increase by about 68% between 2007 and 2010. Therefore, it remains necessary to meet the expected increase in power demand.

Electricity sales volume of the southern region and that of the whole country is estimated to sustain the high economic growth. There remains the continuous need to meet the increasing electric power demand, which has not changed since the time of the appraisal. This project, which aims to contribute to stable electric power supply during both the dry and rainy seasons, is highly consistent with the national policy and the electric power sector development program, and the development needs; therefore it is highly relevant at the time of evaluation.

Table 1: Electricity Sales in Vietnam and the Southern Region

(GWh)

	2001	2005	2007[1]	2010	2015	2020
National	25,851	44,923	59,030	106,724	223,072	386,104
South	12,888	23,314	37,919	63,835	130,564	220,410

(Source) EVN

Note) Figures for 2007-2020 are estimates.

2.2 Efficiency (Rating: b)

The project period exceeded the planned period although the project costs were less than planned; therefore the evaluation for efficiency is “moderate”.

2.2.1 Outputs

The plan to construct a conventional thermal power plant at the time of appraisal of Phase I was replaced by the plan to build a gas combined-cycle power plant at the time of appraisal of Phase III based on the progress of the Nam Con Son gas field development. At the same time, common facilities shared by other power plants were to be constructed in the vicinity. Phu My Power Plant No. 1 forms the Phu My Power Complex along with neighboring power plants. In this project, common facilities of the complex such as the cooling water system and the switchyard were implemented. The Phu My Power Complex

Cooling Water Channel

is composed of the Plant No.1, PMTP's Plant No.2.1, extension of Plant No.2.1 and Plant No.4, and two BOT power plants, with a total capacity of 3,865 MW.

Comparing the actual outputs of the project with those planned at the time of the appraisal of Phase IV, the power plant and related facilities were constructed mostly as planned. With regard to the construction of related transmission lines, which was implemented as planned at first, a line was temporarily connected to the existing transmission line due to difficulty in land acquisition. Other transmission lines were installed almost as planned apart from some adjustments such as the shortening and extension of lines based on the actual survey and a change in a branch line to a substation due to the difficulty in land acquisition. As for the substation construction, the number of transformers was reduced by two at a substation considering the local power demand. Other substations were constructted as planned. The planned outputs of this project at the time of appraisal of Phase I and actual outputs are shown in Table 2 below.

Table 2: Summary of Outputs
(Planned outputs at the time of appraisal of Phase I and actual outputs)

Plan (Phase I)	Actual
(1) Boilers: 3 units (burning both heavy oil and gas) (2) Steam turbine generators (200 MW x 3 units) (3) Related transmission lines and substations (transmission lines: Phu My-Nha Be-Phu Lam 220 kV, etc., substations: construction of Nha Be Substation 220 kV, etc.) (4) Heavy oil related facilities including heavy oil tanks and piping between tanks and boilers (5) Other related facilities (6) Civil engineering works (7) Consulting services (engineering and management)	(1) Gas turbine generators (234 MW x 3 units) (2) Heat recovery boiler (3) Steam turbine generator (390 MW x 1 unit) (4) Power plant related facilities (cooling water system, fuel supply system, switchyard, etc.) (5) Related transmission lines and substations (transmission lines: 220 kV 180.4 km in total, 110 kV 90.8 km in total, related substations: 220 kV: 3 substation, 110 kV: 6 substations (construction and expansion) (6) Consulting services F/S review, D/D, preparation of bidding documents, support for procurement, construction supervision, preparation of environmental monitoring program, etc.

2.2.2 Project period

The planned project period at the time of appraisal of Phase IV was 84 months from

January 1994 to December 2000, while it took 100 months from January 1994 (signing of Loan Agreement for Phase I) to April 2002 (taking over[1]), a little longer than planned (119% of the planned project period as of appraisal of Phase IV[2]).

The main reasons for the delay are, the delay in the procurement procedure, the plant construction (delays in subcontractor approval, electricity/fuel supply, installation of cooling water system, etc.), and the construction of transmission lines and substation facilities (mainly due to the delay in land acquisition), and the change in power generation method (from the conventional type to that of a gas-combined cycle).

2.2.3 Project cost

The project cost was estimated at 77,480 million yen at the time of appraisal of Phase IV, while the actual cost was 69,498 million yen, below the estimate (89.7% of the estimate). The main reasons for cost reduction are the decrease in tax/administration costs and the change in scope of the transmission line-related portion, etc.

2.3 Effectiveness (Rating: a)

The power plant has been operated with at a generally high availability factor and the total outage hours caused by machine trouble is generally decreasing. Electric power production at the plant exceeds the estimate at the time of appraisal, accounting for approximately 21% of total electric power production in the southern region and approximately 11% of the national electric power production as of 2006. Therefore, this project has largely achieved its objectives, and effectiveness is highly satisfactory.

2.3.1 Operational status

(1) Power plant

Table 3 shows the operational status of the power plant after the taking over. The maximum output is almost as planned. The availability factor has been maintained high except for the slight decrease in the year when the overhaul was conducted (2005 for GT13 and 2006 for others). The annual electric power production exceeds the estimate at the time of appraisal and the auxiliary power ratio has been maintained below 2%. As for outage hours and times by cause (Figure 1), there has been no power outage due to

[1] In this project, operation continued until July 2002 at the request of EVN in order to address the power shortage in the dry season and consequently the completion of the performance test of the combined cycle was delayed to September 2002. Therefore, it was agreed between EVN and the contractors to consider the formal taking over to have taken place in April 2002.

[2] Since the project period was planned to be 60 months from January 1994 to December 1998 at the time of appraisal of Phase I, the actual project period is 167% of the period planned at the time of appraisal of Phase I.

human errors, and total outage hours have been decreasing. The frequency of outage caused by machine trouble has been stable at 5 times or less a year since 2004.

Control Room

Table 3: Operation and Power Generation of Phu My Thermal Power Plant

	Availability Factor				Maximum Output	Annual Electric Power Production	Auxiliary Power Ratio
Plan at the Time of Appraisal[1]	Around 83–90%				1090 MW	5,450 GWh	Around 3-5%
	GT 11	GT 12	GT 13	ST 14			
2002	85.0	78.7	76.6	74.5	1091	5,795	1.54
2003	90.2	86.7	90.6	84.5	1091	6,398	1.77
2004	92.6	85.0	88.1	94.9	1091	6,521	1.88
2005	89.6	92.5	85.7	99.0	1091	7,170	1.91
2006	77.1	75.7	88.8	83.5	1071	6,416	1.87
2007 (Jan.–Oct.)	90.5	92.5	91.0	99.9	1071	6,744	1.78

(Source) PMTP

Note 1) As the planned figures for the availability factor and auxiliary power ratio at the time of appraisal are not available, these figures are the targets for JBIC operation/effect indicators.

Note 2) Availability factor (%) = (hours of operation per year/hours per year) x 100
Auxiliary power ratio = (annual auxiliary power consumption / net electric power production) x 100

Figure 1 Outage Hours/Time by Cause

(Source) PMTP

(2) Transmission lines and substation facilities

The availability factor of major transmission lines and transformers is shown in Table 4 and Table 5. The availability factor is low for some transmission lines and transformers because of the regional demand, according to the executing agency[3].

Nha Be Substation

[3] The transmission loss rate for PTC No.4 was 2.96% in 2005 and 2.59% in 2006, that for PC-HCMC was 7.28% in 2005 and 7.4% for 2006, and that for No.2 was 8.23% in 2005 and 8.1% in 2006.

Table 4: Availability Factor of Major Transmission Lines[4]

(%)

Transmission Line	2005	2006	2007 (Jan.–Oct.)
Phu My – Nha Be- Phu Lam S/S 220 kV transmission line	106.02	92.28	99.93
Nha Be S/S – Phu Dinh S/S 110 kV transmission line	60	60	70
Phu My P/S – Cai Lay S/S 220 kV transmission line	86.36	87.84	99.32
Phu My P/S – Long Binh S/S 220 kV transmission line	98.86	101.14	97.73
An Nghia S/S – Can Gio S/S 110 kV transmission line	2	2	2
Nha Be S/S – Can Duoc S/S – Go Cong S/S 110 kV transmission line	57	61	65

(Source) PTC No.4, PC-HCMC, PC-No.2

Table 5: Availability Factor of Transformers

(%)

Substation	2005	2006	2007 (Jan.–Oct.)
Nha Be Substation	83.2	83.8	73.95
	83.2	83.8	73.95
	40.3	51.6	39.8
	36.4	40.8	61
Cay Lay Substation	100.3	103.1	104.7
Viet Thanh Substation	42	58	71
Chanh Hung Substation	62	58	80
	100	115	78
	100	110	52
Anh Nghia Substation	17	23	18
Can Gio Substation	16	17	15
Can Duoc Substation	59	64	67
Go Cong Substation	81	85	90

(Source) PTC No.4, PC-HCMC, PC-No.2

2.3.2 Effect in meeting the power demand

Table 6 shows the electric power production in the whole country, the southern region, and the power plant constructed under this project.

The power plant generates about 21% of the total electricity production in the southern region and about 11% of the total electricity production in the entire country in 2006. In terms of electricity supply capacity, as shown in Table 7, without this project, the power generation capacity would be less by about 20% for the southern region and less by about

[4] Excluding the transmission line connected to the existing line because of the difficulties regarding land acquisition, the branch line to the substation and the section that was upgraded accordingly.

10% for the whole country. Therefore, this project contributed to meeting the power demand both for the southern region and the entire country.

Table 6: Electric Power Production

(unit: GWh)

	2004	2005	2006
National electric power production	46,201	52,078	59,013
Electric power production in the southern region	24,163	27,025	30,827
Electric power production by the project power plant	6,521	7,170	6,416

(Source) EVN, PMTP

Table 7: Power Supply Capacity

(unit: MW)

	2004	2005	2006
National	8,283	9,255	10,187
South	4,073	4,539	5,007
Project power plant	1,091	1,071	1,071

(Source) EVN, PMTP

2.4 Impact

2.4.1 Contribution to economic vitalization

The GDP growth rate in Vietnam has been reaching over 7% since 2002, as shown in Table 8, and marked a growth rate of 8.44% in 2005. The GDP growth rate in Ho Chi Minh City, the largest city in Vietnam located in the southern region, has been 10–12%, exceeding the national growth rate. Both Ho Chi Minh City and the whole country have been sustaining high economic growth.

Table 8: GDP Growth Rate of Vietnam and Ho Chi Minh City

(%)

	2001	2002	2003	2004	2005	2006 (Prel.)
Vietnam	6.89	7.08	7.34	7.79	8.44	8.17
Ho Chi Minh City	9.5	10.2	11.4	11.7	12.2	12.2

(Source) Statistical Yearbook of Vietnam 2006, Statistical Yearbook of Ho Chi Minh City 2003 and 2006

The trends in power consumption of customer category (Table 9) shows that electric

power consumption has increased 1.7–1.8 times both in the southern region and the whole country between 2001 and 2005. Power consumption in commercial and manufacturing sectors has also increased by the same degree or has almost doubled.

Table 9: Trends in Power Consumption by Customer

(unit: GWh)

	National		South	
	2001	2005	2001	2005
Household	12,651	19,476	5,600	8,330
Commercial	1,251	2,079	757	1,463
Manufacturing	10,511	21,095	5,965	11,880
Agriculture, Forestry, Fishery	465	571	32	70
Others	972	1,700	535	1,571
Total	25,851	44,923	12,888	23,314

(Source) EVN

Although it is difficult to identify the direct beneficiaries of this project as the power generated at this power plant is transmitted to the grid, a company survey was conducted in the south to ascertain the general trend in the electric power supply and its impact on the business operation of companies. According to the result, companies' recognition of general power supply (such as the reliability of the power supply and the amount of power supply necessary for their business operation) shows an overall improvement compared to that of before 2002 (Figure 2 and 3). For the further improvement of the power supply, it was mentioned to expand the capacity and amount of electricity supply to address the power shortage during the dry season and at peak hours, indicating that power supply is not at a sufficient level. Still, without expansion of the power supply capacity, the situation would have been recognized as worsening, because the power demand and consumption have been growing remarkably as Vietnam has been experiencing increase in economic activities.

Figure 2: Amount of Power Supply

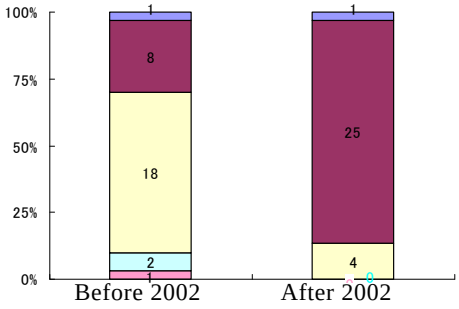
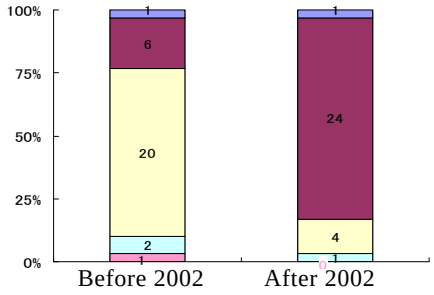
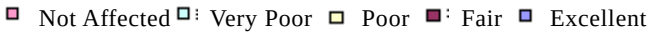


Figure 3: Reliability of Power Supply





(Source) Beneficiary Survey

This project, which accounts for about 21% of the electric power production in the south as well as about 11% of the national electric power production (2006), is considered as supporting the recent high rates of economic growth in the south and that of the whole country by expanding the electric power supply.

The number of presumed beneficiaries of this project is estimated at 10.34 million[5] people (accounting for approximately 12% of the national population).

2.4.2 Impact on environment

According to Phu My Thermal Power Company, monitoring of air and water quality, etc. is conducted quarterly for the Phu My Power Complex. Since the operation has started, the monitoring report has been submitted to the provincial government for approval every year. The Ba Ria Vung-Tau Provincial Government says that, based on the report submitted in 2006, the discharged water and air meet the emission standards of Vietnam and solid wastes are treated properly. According to the monitoring result conducted in March 2007 (on air quality and discharged water), some data exceeded the environmental standards and emission standards in Vietnam, allegedly due to external factors such as construction of the entrance road to the power complex, the road condition, heavy traffic, and quality of water taken from the river, etc.

2.4.3 Impact on local residents

Land acquisition for the construction of the power plant, etc. was conducted for the entire Phu My Power Complex, which affected 142 households. Among them, about 4–5

[5] Estimated by dividing the total electric power production of this plant in 2006 by the electric power consumption per capita of the same year in Vietnam.

households were allegedly resettled related to this project, according to the third project management committee in charge of project implementation and the people's committee concerned. The people's committee says that these households are in stable living conditions after the resettlement.

For the construction of transmission lines and substation facilities, 1,735 households were affected in total and among them 823 households were relocated. Land acquisition for this project was conducted in 5 provinces and 16 people's committees were involved. According to one of these people's committees that we interviewed, some of the relocated households do not maintain previous living standards[6], and the committee is planning to carry out support measures to help improve the living standards of these households through the provision of loans, etc.

2.5 Sustainability (Rating: a)

There is no problem with the capacity of the executing agency and the operation and maintenance system. This project is expected to be highly sustainable.

2.5.1 Executing Agency

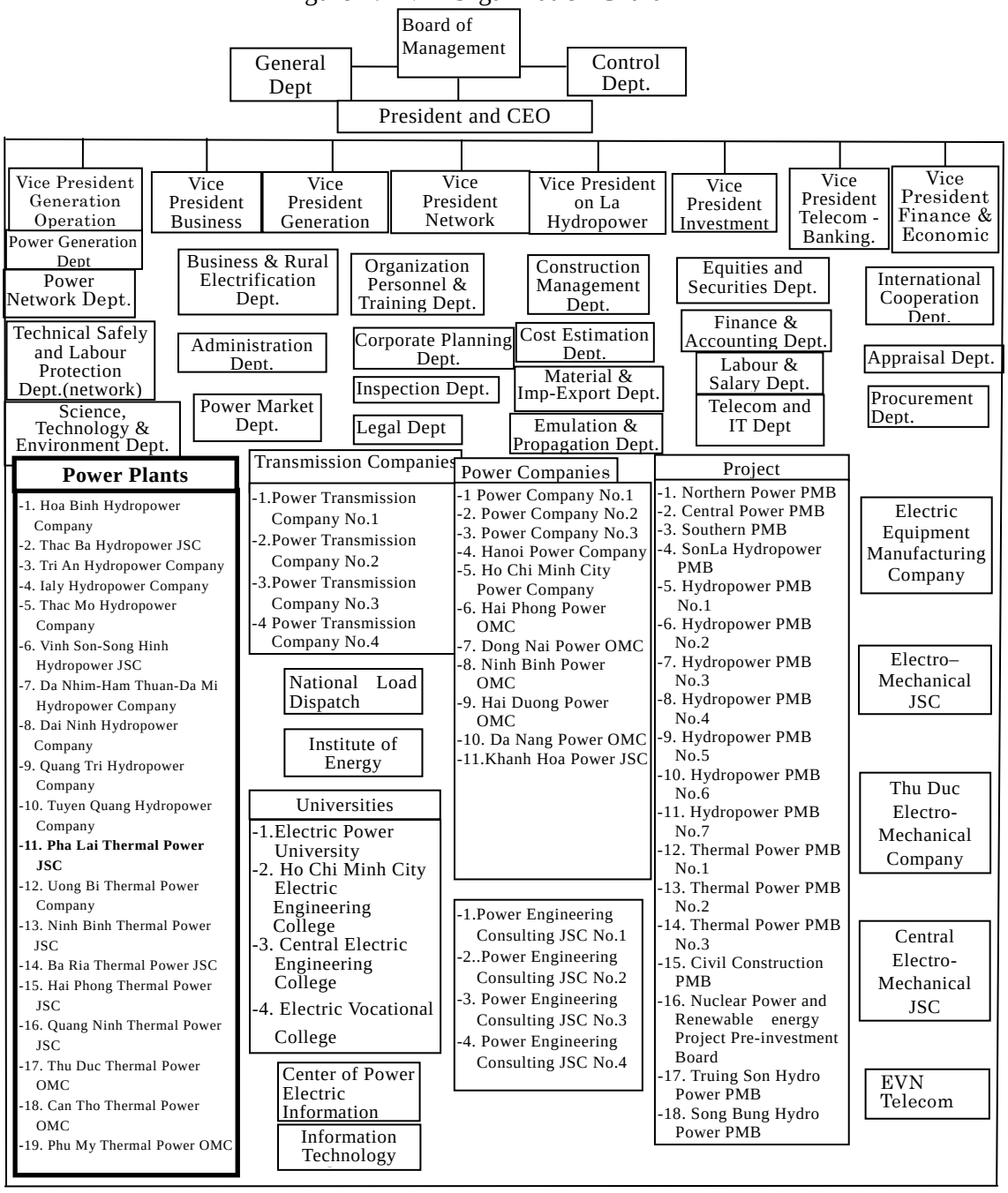
2.5.1.1 Operation and maintenance system

The facilities are operated and maintained by subsidiaries of EVN. Figure 4 is the organization chart of EVN.

Some changes such as conversion to a joint stock company are planned for each subsidiary. However, as EVN will hold at least 51% of the shares, a stable transition is expected and thus sustainability with respect to the operation and maintenance system is considered to be high.

[6] These are the households that received monetary compensation for relocation and preferred not to relocate to the resettlement site.

Figure 4: EVN Organization Chart



(Source) EVN Annual Report (2007)

(1) Power plant

The power plant is operated and maintained by Phu My Thermal Power Company (PMTP). PMTP was established in 1997 as a subsidiary of EVN and became a One-Member Limited Company in 2005. It has 482 employees. Phu My Thermal Power Plant No.1 is operated by Operation Workshop No.1 (103 employees) and maintained by the Mechanics and Heat repair Workshop and the Electric and Automatic Repair

Workshop (157 employees). With the planned conversion of PMTP to a joint stock company in 2008, these operation and maintenance departments are planned to be separated as joint stock companies. It is expected that disclosure of information and clarification of management responsibility will be undertaken after the conversion to joint stock companies with more than 51% of the shares held by EVN.

(2) Transmission lines and substation facilities

Among transmission lines and substation facilities, those of 220 kV and over are operated and maintained by Power Transmission Company No.4 (PTC No.4) with a total of 2,270 employees. Eastern Power Transmission No.1/No.2 is in charge of operation and maintenance, where 17-22 employees and 6–12 employees engage in operation and maintenance of transmission lines and substations, respectively. It is decided that PTC No.4 will be merged with other transmission companies[7] into National Transmission Company under the umbrella of EVN in 2008.

Operation and maintenance of 110 kV and 66 kV transmission lines and substation facilities is performed by the Ho Chi Minh City Power Company (PC-HCMC) or Power Company No.2 (PC-No.2)[8] depending on the location of each facility. At PC-HCMC, the High Voltage Network Division is in charge. A team of 61 employees is in charge of transmission lines and 9–15 employees are respectively in charge of each substation. At PC-No.2, the Long An High Voltage Team and the Tien Giang High Voltage Team are in charge. Six employees are in charge of transmission lines and 8–10 employees are respectively in charge of each substation. According to PC-No.2, one substation is understaffed at the time of evaluation. They explain that training is now underway and 2 additional staff members will be assigned to this substation in the second quarter of 2008.

Conversion of power companies to joint stock companies scheduled for 2007–2008 is suspended and the new schedule is unknown at the time of evaluation. After the conversion to joint stock companies, EVN will hold 51% of the shares.

2.5.1.2 Technical capacity

(1) Power plant

Training was provided by the contractor under this project and also by EVN. According to PMTP, in most cases, their employees are able to handle operation and maintenance by themselves.

[7] In Vietnam, there are currently four power transmission companies from No.1 to No.4, which respectively serve different areas.

[8] PC-No.2 took over operation and maintenance of facilities constructed under the project from PTC No.4 in April 2007.

(2) Transmission lines and substation facilities

According to PTC No.4, a training course was held during the project and in most cases their employees are able to handle operation and maintenance by themselves.

PC-HCMC and PC-No.2 have to rely on suppliers, etc. sometimes for trouble shooting and maintenance purposes (especially regarding equipment with new technology).

2.5.1.3 Financial status

At the time of evaluation, PMTP is a One-Member Limited Company, and PTC No.4, PC-HCMC, and PC-No.2 are state-owned enterprises, 100% owned by EVN. PTC No.4 virtually functions as the cost center of EVN and is financially dependent on EVN. As for PMTP, PC-HCMC and PC-No.2, the selling prices between them and EVN as a business partner are set based on the cost.

Major financial indicators of EVN (consolidated basis) are as shown in the table below. As far as can be judged from these figures, the current financial status of EVN can be considered good. The future financial situation of EVN might be affected by the progress of electricity tariff revision. Electricity tariffs are scheduled to be raised on July 1, 2008, followed by transition to tariffs based on the market price in 2010 (with conditions such as upper and lower limitations of 25%). It is considered that financial sustainability could be sustained if the tariff revision is conducted as planned.

Table 10: Profit and Loss Statement of EVN

(million VND)

	2004	2005	2006
Revenue	34,530,167	37,273,867	43,766,287
Gross Profit	8,078,171	5,253,547	6,901,246
Profit for the Year	3,331,325	2,839,455	1,692,427

(Source) EVN

Table 11: Financial Ratios of EVN

	2004	2,005	2006
Equity Ratio	41%	42%	39%
Current Ratio	1.90	1.50	1.68
Quick Ratio	1.59	1.24	1.41

(Source) Calculated by the evaluators based on financial statements of EVN

As mentioned above, operation and maintenance organizations of the facilities are

planned to become joint stock companies, etc. It is considered that financial sustainability of PMTP could also be secured because conversion to a joint stock company, which is planned in 2008, is expected to enhance the profit orientation as an independent company. Also EVN will maintain more than 51% of the shares, and the increase in power demand is expected to continue for a while.

Although the schedule for the conversion of power companies (PC-HCMC and PC-No.2) to joint stock companies is not known at the time of evaluation, it is considered that their financial sustainability could be secured because management responsibility is expected to be clarified with the progress of conversion to joint stock companies with EVN holding more than 51% of the shares, and because it is under consideration that a scheme to support power companies which will not be financially self-sufficient.

2.5.2 Operation and maintenance status

According to the executing agency, the maintenance program is carried out, though the timing may vary depending on the need to address the power demand, and there is no problem in the acquisition of spare parts. Thus, no major problem was found in particular. Though they do not allegedly affect normal operation, there have been defects and breakdowns in some items of equipment that were left unrepaired since immediately after the project completion due to miscommunication with the contractor.

3. Feedback

3.1 Conclusion

In the light of the above, this project can be said to be highly satisfactory.

3.2 Lessons Learned

・Besides construction of a power plant, this project included construction of common facilities with other power plants located in the power complex, such as the cooling water system. According to EVN, this project is a useful model to promote private sector investment, and EVN will utilize this model in the future. Therefore, this project can be considered as an example case for promoting private sector investment in the power sector undertaken concurrently with the power generation capacity expansion through Japan’s ODA loan.

3.3 Recommendations

・It is important for PC-HCMC and for PC-No.2 to establish a system to respond to the operation and maintenance cases which they can not handle by themselves (especially for

equipment using new technologies) through conducting additional training sessions or strengthening coordination with suppliers and contractors, etc.

・In this project, the project implementation and operation and maintenance activities are conducted by different organizations which are under the same EVN group umbrella. It is advisable to promptly deal with any equipment defects that may arise after the completion of facilities through effective coordination between the related parties.

Comparison of Original and Actual Scope

Item	Plan	Output
1. Output • Civil engineering and equipment procurement	(1) Power plant (gas-combined cycle) Gas turbine generators (213 MW x 3 units) Heat recovery boiler Steam turbine generator (450 MW x 1 unit) Power plant related facilities (cooling water system, fuel supply system, switchyard, etc.) (2) Related transmission lines (220 kV: 175 km, 110 kV: 100 km), related substations (220 kV: 3 substations, 110 kV: 6 substations)	(1) Almost as planned Gas turbine generators (234 MW x 3) Steam turbine generator (390 MW x 1) (2) Transmission lines: one line was connected to the existing transmission line and other portions were implemented almost as planned (shortening of 5 lines and extension of one line, change in a branch line to a substation, etc.) Substation facilities: almost as planned (reduction of 2 transformers at one substation)
• Consulting services	F/S review, preparation of D/D and bidding documents, support for procurement, construction supervision, preparation of environmental monitoring program, etc.	Almost as planned (additional construction supervision services)
2. Project Period Tendering of main	Mar. 1997 – Sep. 1998	Apr. 1997 – Sep. 1998

contract		
Power plant construction	Sept. 1998 – Dec. 2000	Sep. 1998 – Sep. 2002
Transmission lines and substation facilities	Sep. 1996 – Apr. 2000	Oct. 1996 – Dec. 2003
Consulting services	Sep. 1994 – Dec. 2001	Sep. 1994 – Mar. 2004
3. Project Cost		
Foreign Currency	64,987 million yen	62,175 million yen
Local Currency	12,493 million yen (1,249,250 million dong)	7,323 million yen (915,375 million dong)
Total	77,480 million yen	69,498 million yen
ODA Loan Portion	61,932 million yen	59,435 million yen
Exchange Rate	1 dong = 0.01 yen (as of October 1998)	1 dong = 0.008 yen (1994–2005 average)