

Vietnam

Phu My-Ho Chi Minh City 500kV Transmission Line Project

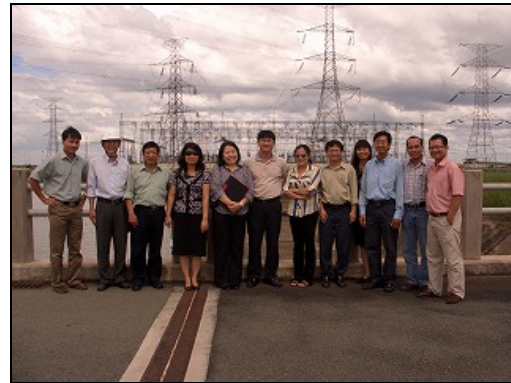
Evaluator: Vietnam-Japan Joint Evaluation Team 2008¹

On-site Survey: November 2008

1. Project Profile and Japanese ODA Loan



Project Site



Phu My Switchyard behind Joint Evaluation Team

1.1 Background

In Vietnam, the demand for electricity has been increasing rapidly along with economic development since the introduction of the *doi moi* policy in 1986. The electricity consumption increase rate between 1995 and 1999 reached 12.7% in the entire country, and was forecasted to continue increasing at a high pace.

The Government of Vietnam (GOV) have developed several large-scale thermal power generation plants (Phu My Thermal Power Plant Complex: PMTPC) in Phu My, 45km southeast of Ho Chi Minh City, as part of its plan to develop the area a power generation base with a final installed capacity of over 3,000 MW. At the time of the appraisal of this project (2001), Phu My 1 gas combined cycle plant with a gross output of 1,090MW had been developed with a Japanese ODA loan and had been operating since early 2001.

¹ The Vietnam-Japan Joint Evaluation Team 2008 consisted of the three Working Groups each of which evaluated different projects. This project was evaluated by the Transmission Line Group joined by the following members: Cao Manh Cuong (Ministry of Planning and Investment: MPI), Cao Thanh Phu (MPI), Vu Van Thai (Ministry of Industry and Trade: MOIT), Nguyen Sy Be (MOIT), Luong Thi An (Electricity of Vietnam: EVN), Nguyen Xuan Thang (EVN), Le Sy Hoi (EVN), Nguyen Quoc Dung (Thermal Power Project Management Unit No.3 of EVN: TPPMU3), Tran Ngoc Anh (TPPMU3), Luong Lan Dung (National Transmission Corporation: NPT), Tran Kim Vu (NPT), Le Hoang Quan (PTC4), Nguyen Truc Van (NPT), Vu Tien Dung (Power Transmission Company No.4 of NPT: PTC4), Lieu Sy Dang Huy (PTC4), Nguyen Phuong Nam (PTC4), Nghiem Ba Hung (national consultant), Takako Haraguchi (Japanese consultant).

Along with this development of PMTPC, it was projected that the existing 220kV transmission facilities (1,450MW in 2001) could not fully extend power from the complex, and thus a stable power supply in the southern Vietnam would be undermined without increasing transmission capacity.

1.2 Objective

The objective of the project was to stabilize the power supply to Ho Chi Minh City and the southern part of Vietnam by the construction of 500kV transmission lines and substations for a high capacity transmission substation system from the Phu My Thermal Power Plant Complex, thereby contributing to the economic development of the region.

Logical Framework Applied for Ex-Post Evaluation

Goal	Economic development of the region
Purpose	Stable power supply to HCMC and southern area
Outcome	1. Increase in power supply from the Phu My Thermal Power Complex (PMTPC) 2. Decrease of transmission loss
Output	1. Construction of transmission lines (T/L) 2. Construction and Expansion/ renovation of substations (S/S) 3. Installation of communication lines 4. Consulting services
Input	Total cost: 15,443 million Yen (JBIC loan: 13,127 million Yen; GOV portion: 9,025 million Yen)

1.3 Borrower/ Executing Agency/ Implementing Agency

Borrower: The Government of Socialist Republic of Vietnam (GOV)

Executing Agency: Electricity of Vietnam (EVN)

Implementing Agency: Management Board Thermal Power Project Management Unit No.3 (TPPMU3), EVN

1.4 Outline of Loan Agreement

Loan Amount / Disbursed Amount	13,127 Million Yen / 8,249 Million Yen
Date of Exchange of Notes / Date of Loan Agreement	March 30, 2001 March 30, 2001
Terms and Conditions	
- Interest Rate	1.8% p.a. 0.75% p.a. for Consulting Services
- Repayment Period (Grace Period)	30 years (10years) 40 years (10 years) for Consulting Services
- Procurement	General Untied

Final Disbursement Date	January 29, 2007
Main Contractor (over 1 billion JPY)	Power Construction Company No. 2 (Vietnam), Power Construction Company No. 1 (Vietnam). VATECH Transmission & Distribution SA (France), Nissho Iwai Corporation (Japan).
Consulting Services (over 100 million JPY)	Power Engineering Consulting Company No. 2 (Vietnam), Newjec Inc (Japan).
Feasibility Study	2000 Government of Vietnam

2. Results of Evaluation

2.1 Relevance (Rating: a)

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

2.1.1 Consistency with Vietnamese Development Policies

A high priority for power sector development has continuously been seen in the Socio-Economic Development Plans (SEDP) of both before and after the project. SEDP 1996-2000 (at the appraisal or ex-ante evaluation stage) included the addition & upgrading of power resources and the network in the Industrial Development Program and Infrastructure Development Program. SEDP 2006-2010 (at the ex-post evaluation stage) puts an even higher priority on power sector development than the 1996-2000 plan: electricity is the sector that is first mentioned in both industrial and infrastructure development plans. Synchronous investment in power resources and grids is also mentioned.

As for power sector development plans, the Power sector Master Plan IV (for 1996-2000 with a perspective up to 2010) planned to increase generation capacity from 4,435MW (1994) to 19,000MW (2010). Development of the PMTPC was one of the key proposals in the Master Plan IV. At the ex-post evaluation stage, the Power sector Master Plan VI 2006-2015 plans to increase: (i) generation capacity from 12,357MW to 42,000MW; (ii) 500kV lines from 3,259km (2007) to 5,209 km; and (iii) 500kV substation capacity from 7,464MVA to 13,764MVA. The Master Plan VI also places importance on the development of transmission and distribution networks synchronously with power generation source development. The transmission lines of this project are the essential sections needed to complete the Nha Be – O Mon – Phu Lam 500kV transmission loop circuit in the south, with a total length of 366km.

2.1.2 Consistency with Needs

Table 1 shows the basic indicators of power demand and supply in Vietnam at the ex-ante and ex-post evaluation stages. A high demand for power both before and after the project can justify the necessity of developing transmission lines to carry generated power. As for PMTPC, a bigger generation capacity than originally planned clearly shows that this project was necessary not only at the ex-ante stage but at the ex-post stage².

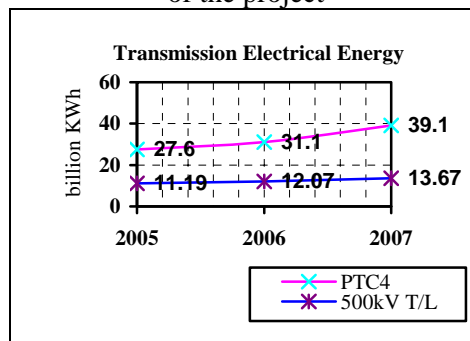
Table 1: Basic power indicators

Indicator	Ex-ante evaluation stage	Ex-post evaluation stage
Power consumption increase	12.7% p.a. (1995-1999)	14.7% p.a. (2000-2007)
Power demand forecast	12.2% p.a. (1990-2010)	17-20% p.a. (2006-2015)
Generation capacity (Vietnam)	5,652MW (2000)	13,512MW (2007)
Generation capacity (PMTPC)	3,600MW (plan)	3,925MW (2008)
Length of 500kV transmission lines	1,529km (1999)	2,469km (2004)

Source: EVN

Figure 1 shows the amount of power transmitted through 500kV transmission lines compared to the total power transmitted in the south, where transmission is operated by Power Transmission Company No.4 (PTC4) of the National Power Transmission Corporation (NPT).

Figure 1: Amount of power transmitted through 500kV transmission lines of the project



Source: EVN

2.2 Efficiency (Rating: b)

While the project cost was lower than planned, the project duration was much longer than planned. Therefore, the evaluation for efficiency is moderate.

2.2.1 Output

The project output was achieved mostly as planned. The output includes the following items:

- Construction of transmission lines
 - Phu My- Nha Be 500kV x 2 circuits: length 42.6 km, design transmission capacity of 2,250 MW, same as planned.
 - Nha Be- Phu Lam 500kV x 1 circuit: length 16.6 km, design transmission capacity of 1,500 MW, same as planned.

² According to the appraisal in 2001, it was estimated that power from the Phu My complex would overflow even with the development of additional 220kV transmission facilities (under the plan to increase 220kV transmission capacity from 1,450MW in 2001 to 2,100MW in 2005).

- Additional output (not subject to the ODA loan): temporary connection (500kV line and 500kV bays³ to carry power from the Phu My 3 and the Phu My 4 thermal power plants in 2004 (see also 2.2.3 *Project Period*). This connection was not in the original plan.
- Expansion/ renovation of substations
 - Nha Be Substation 500kV- 600 MVA x 2 with 8 bays was planned. In fact, only 6 bays were installed (a reduction of 2 bays) due to difficulties in ensuring enough rights of way (ROW).
 - Phu My 1 Switchyard 450MVA x 1 with 15 bays, same as planned.
 - Phu Lam Substation 500kV x 1 bay. Installation of some equipment to complete the 500kV bay and hand-over of the remaining equipment of the bay to PTC4 (as contingency material and equipment) - Equipment procurement was implemented as planned.
- Installation of communication lines (optic fiber, etc)
 - Phu My- Nha Be, Nha Be- Phu Lam, Phu My- Ba Ria, Phu My- Long Thanh. Mostly as planned, except for a change in the type of some optic fiber cables routed from OPWW (wind type) to OPGW (Optical fiber composite overhead ground wire) which is of better quality. This change was possible because OPGW became more easily available than had been estimated at the appraisal.
- Consulting services
 - Evaluation of bids and contract negotiations, construction supervision: foreign 128MM, local 370MM was originally planned. The actual work volume was reduced to foreign 103.1MM, local 289.3MM by the executing agency. The terms of reference were same as planned.

The quality of the completed output is mostly good: there were some broken relays⁴ in operation, but they were repaired.

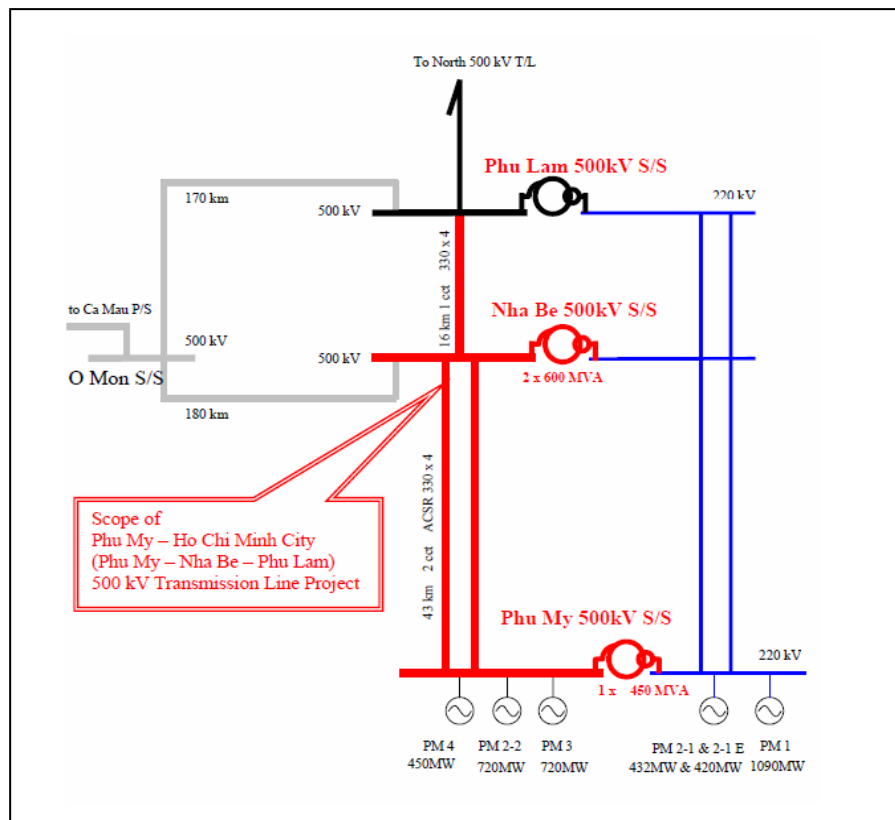
The implementing agency (TPPMU3) had difficulty in connecting the project transmission system to the existing network, because the technical specification of the interfaces was not agreed on by the organizations in charge of the connected systems at project preparation stage.

³ 500kV bay of temporary Phu My 500kV substation; 500kV transmission lines Phu My – Nha Be – Phu Lam.

⁴ EVN Function Code 87B/50BF.



Figure 2: Layout of the project facilities



2.2.2 Project Period

The project duration was planned to be 32 months, from March 2001 to October 2003. This broke down as follows: (i) consulting services from June 2001 to October 2005 (53 months⁵), (ii) civil works from April 2002 to October 2003 (19 months), (iii) land acquisition and resettlement from April 2000 to July 2001 (16 months).

However, the actual project duration was 56 months, from March 2001 to October 2005, with

⁵ The period of the consulting services is longer than the project duration, because the calculation of the project duration is based on the definition made at the appraisal: the completion date of the civil works.

a 24 months delay against the original plan (=175%). The breakdown of this was: (i) consulting services from August 2001 to August 2007 (73 months), (ii) civil works from July 2002 to October 2005 (40 months) including the 500kV Transmission Lines (July 2002 –January 2004 (18 months)) and the 500kV Substations at Phu My, Nha Be, Phu Lam Bay (January 2004 - August 2005 (19 months)), (iii) land acquisition and resettlement from May 2001 to January 2004 (33 months).

The delays were mostly because of the delay in approving tender results⁶. As mentioned in 2.2.1 *Output* above, this gave rise to the need to construct a temporary Phu My 500kV substation and temporary 500kV transmission lines (short section) to carry power from the Phu My 2-2, Phu My 3 and Phu My 4 thermal power plants from Jan 2004, when the 500kV transmission lines construction had been completed but the synchronous 500kV substations had not yet been completed. This ad-hoc solution was implemented under EVN instruction, and installed using the standby strategic materials of EVN. It was dismantled when the comprehensive 500kV substations started operation.

2.2.3 Project Cost

The originally planned total cost was 15,443 million yen, of which foreign currency accounted for 11,544 million yen and local currency 3,899 million yen. Up to 13,127 million yen was to be funded by Japanese ODA loans.

The actual total cost was 10,091 million yen, including 8,249 million yen of foreign currency funded from Japanese ODA loans. The reason for the cost under-run was competition in tender.

2.3 Effectiveness (Rating: a)

The implementation of the project realized the expected outcome mostly as planned. Therefore, effectiveness of the project is high.

2.3.1 Stable Power Supply

After the project, the power supply has taken a greater leap forward than in the 1990's. The volume and reliability of the power supply has improved remarkably: unexpected power-cuts owing to network faults have decreased; the power supply for production- business is increasing. While the improvement of the overall power supply situation in the south and in

⁶ As some bid evaluations were not fully in accordance with the relevant procurement guidelines, re-evaluation had to be conducted. The land acquisition process was also delayed, but this did not affect the whole construction schedule due to delays in tender approval.

other regions of Vietnam is discussed in 2.3.4 *Impact*, this section illustrates the direct outcome of this project, namely, the transmission of electricity generated by the PMTPC through the 500kV transmission system developed by the project.

(1) Transmission of Power from PMTPC

The target for the electricity supply at the Phu My Switchyard via the project’s 500kV transmission lines was set at 6,812 GWh in 2005 (from the Phu My 2-2 or the Phu My 3, and Phu My 4 power plants) and 11,647GWh in 2020 (from the Phu My 2-2, 3 and 4 power plants)⁷.

Phu My 4 power plant



The actual amount was larger than planned and further increased in the following years: 12,874 GWh in 2006, and 13,099 GWh in 2007. The reason for the higher level of power transmission than planned is that the Phu My 3 plant (BOT) was completed earlier than the original plan in response to the rapid increase in electricity demand.

Table 2: Flow of electricity generated at PMTPC (PMTPC)

Year	Plan		Actual		
	2005	2020	2005	2006	2007
Capacity of PMTPC (MW)*	3,160	3,880	3,704	3,865	3,925
Capacity of PM2-2, 3 & 4 (MW)	1,170	1,890	1,890	1,890	1,890
Total generation from PMTPC (GWh)	--	--	13,830	15,740	17,220
Generation from PM2-2, 3 & 4 (GWh)	--	--	11,190	12,069	13,673
Transmitted via 500kV system (GWh)	6,812	11,647	8,305	12,874	13,099

Source: EVN Note: capacity of PMTPC includes those under both EVN and BOT.

(2) Availability Factor

Availability factors (defined as the ratio of maximum load to designed capacity) exceeded the targets for the transmission lines and one substation where data was available.

Transmission lines. The Installed transmission capacity of the 500kV transmission lines was 2,250 MW between Phu My and Nha Be, and 1,500 MW between Nha Be and Phu Lam. The planned maximum load of the 500kV transmission lines in 2005 was 1,200MW between Phu My and Nha Be, and 1,094MW between Nha Be and Phu Lam.

The actual installed transmission capacity was same as planned. The actual maximum load of

⁷ Phu My Thermal Power Complex consists of six thermal power plants of both EVN and BOT projects: EVN projects include Phu My 1 (1,090MW, 2002-), Phu My 2-1 (450MW, 1997-), Phu My 2-1 Extension (440MW, 1999-), Phu My 4 (450MW, 2004-) and Power Increase System (55MW, 2007-); and BOT projects include Phu My 2-2 (720MW, 2005-) and Phu My 3 (720MW, 2004-).

the 500kV transmission lines in 2005 between Phu My and Nha Be was 1892MW, reaching an 84% design capacity. The figures in 2006 and 2007 were 2,130MW (95%) and 1,906MW (85%), respectively.

Substations. Only a figure for the Nha Be Substation was available: the target load at the Nha Be Substation in 2005 was 42% of installed transmission capacity. In 2005, actual load reached 63%.

(3) Electricity Consumption within Substations

Total consumption within the Phu My and Nha Be substations was 0.66GWh (2005), 1.43GWh (2006), and 1.54GWh (2007)⁸.

(4) Transmission Loss

The target transmission loss of the project was 0.33% in 2005. In fact, because the data recorded in the operation did not reflect the loss of transmission lines and of transformers, the loss cannot be estimated.

However, the data recorded in the operation of the southern grid shows that the project contributed to a reduction in transmission loss. The rates of network loss in the southern grid (220kV and 500kV transmission system under PTC4) are 2.96% (2005), 2.59% (2006) and 2.10% (2007).

2.3.2 Internal Rate of Return (IRR)

In appraisal, the financial internal rate of return (FIRR) of the project was estimated at 13.9%, including investment, re-investment and operation and maintenance costs as the costs, and revenue from power sales as the benefits.

In ex-post evaluation of the project, FIRR was re-calculated at 17.6% - 18.9%, depending on the estimation of sales price. One possible reason for a higher FIRR than appraisal is that the Phu My 3 power plant was put into commercial operation early.

2.4 Impact

Although it is difficult to identify what exactly was the contribution of this particular project, it can be said that the volume and reliability of the power supply have been improved through a number of electricity development projects under the Power Master Plan IV, including this

⁸ The planned value set at appraisal was 22GWh. However, the evaluation team considers this value too high for the concerned facilities. A concrete basis for this value was not found in existing project documents.

project, thus supporting the economic development of Vietnam.

2.4.1 Impact on Economic Development of the Region (Achievement of Goal)

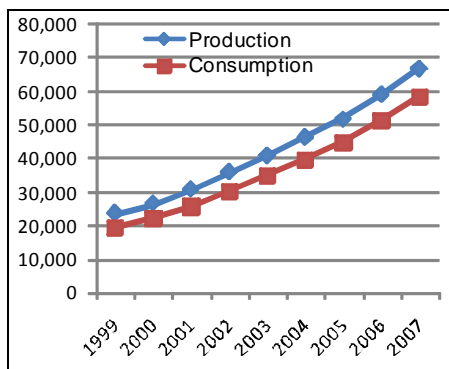
(1) Economic Growth

The annual average GDP growth rate 1997-2007⁹ of Vietnam was 7.2%. Sectoral growth rates during the same period were 11.4% in the manufacturing sector, 3.5% in the agricultural sector and 12.0% in the energy and water supply sector. Development in the industrial sector has driven Vietnam's economic growth.

(2) Power Supply for Economic Development

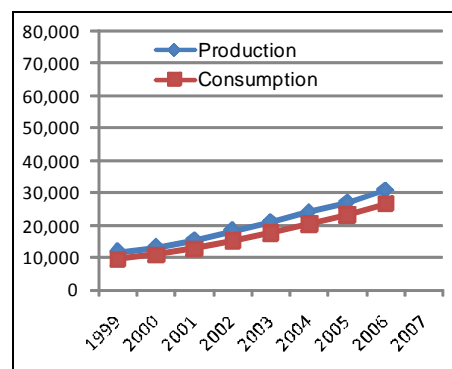
It is natural to assume that increased power supply has supported economic development. As Figures 3 and 4 show, both power production and consumption have been constantly increasing.

Figure 3: Power production and consumption in Vietnam as a whole
(Unit: million kWh)



Source: EVN

Figure 4: Power production and consumption in the south
(Unit: million kWh)



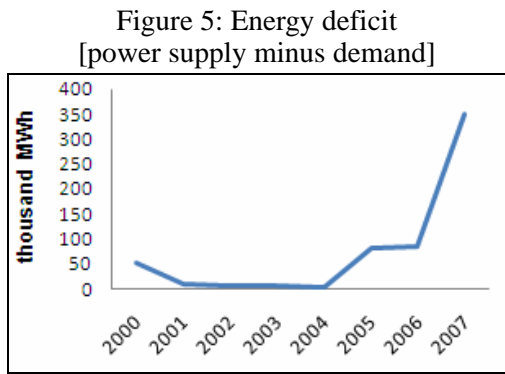
Source: EVN

Thanks to progress in power sector development, including this project, the gap between power demand (as projected by EVN) and supply was reduced to nearly zero during the period from 2001 and 2004. However, due to a rapid increase in demand, the gap has become wider again (Figure 5).

The number of electricity consumers (in terms of the number of meters) increased from 3,063 thousand in 1999 to 10,390 thousand in 2006. Also, the rate of households with access to the national grid increased from 60% to 92% during the same period. The share of power

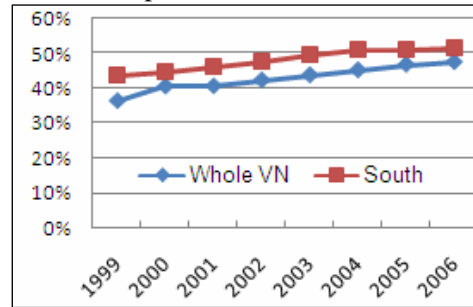
⁹ At 1994 constant price.

consumption in the production sector¹⁰ is increasing as well: in 1999, it accounted for 36% of power consumption in Vietnam as a whole and 44% in the south; in 2006, the share increased to 48% and 52%, respectively (Figure 6). Among provinces in the south, where industrial development is prominent, the share reaches 78% in Dong Nai Province, 30km north of Ho Chi Minh City, where a number of industrial parks are located.



Source: EVN

Figure 6: Share of power consumption in the production sector



Source: EVN

As power generated at PMTPC is sent to the national grid, the benefits of this project reach the entire country and have contributed to the increase in the power supply mentioned above. Using the data on power production, it can be calculated that 20% of power generated in the whole country in 2007 or 42% of power generated in the south in 2006 was transmitted through the 500kV transmission system developed by the project. Also, the number of people benefitting from this project can be calculated at 21,132 thousands by dividing the power transmitted through the project system by per capita power consumption (609kWh in 2006).

As stated in 2.1 *Relevance*, the project 500kV transmission lines are part of the Nha Be – O Mon – Phu Lam 500kV transmission loop circuit. However, the Phu My-O Mon- Phu Lam sections have not yet been completed, mainly due to difficulties in land acquisition. To avoid instability of the whole network due to an incomplete loop circuit, EVN had to install an additional system for automatic source-shedding.

(3) Opinions of Beneficiaries

Power companies. The direct beneficiaries of the project are the power distribution companies who receive electricity from the project transmission lines. All three distribution companies operating in the south, namely the Ho Chi Minh City Power Company (HCMC PC), the Dong

¹⁰ EVN classifies electricity consumer into: (i) residential and management; (ii) business and services; (iii) production; (iv) agriculture, forestry and fishery; and (v) others.

Nai Power Company (Dong Nai PC) and Power Company No. 2 (PC2)¹¹, together with several local distribution companies under these power companies, were interviewed for the ex-post evaluation. All mentioned that power from PMTPC had become one of their main power sources, and had contributed to the improved power supply¹² and industrial development.

Local governments. People's committees in Ho Chi Minh City, Dong Nai Province, Binh Thuan Province, Lam Dong Province, Nhon Trach District of Dong Nai Province and Tan Thanh District of Ba Ria-Vung Tau Province were interviewed for the ex-post evaluation. They said that power development in the south had in general impacted industrial development, especially through the development of industrial parks. They also stressed that power sector development promoted agricultural development (e.g. by powering irrigation pumps and in animal husbandry) as well as rural electrification.

Consumers. 30 companies (mainly manufacturers and shops/ hotels), who are customers of PC2 and HCMC PC, were surveyed, using the same questionnaire as the one used in 2007 for the ex-post evaluation of the Phu My Thermal Power Plant Project (1)-(4) (Loan Agreements were concluded in 1994, 1995, 1997 and 1999 and the project completed in 2005).

These results are consistent with the 2007 survey, showing the common perception of the respondent companies that power supply volume and reliability have improved since the early 2000's. At the same time, many respondents mentioned recent power shortages and the need for more improvement. Although the number of the samples of this survey was very small, such a consistent trend might show some extent of credibility of the results. Box 1 shows more details of the customer survey.

Interview with a power company



Interview with a provincial government



¹¹ HCMC PC is responsible for power distribution in Ho Chi Minh City, Dong Nai PC is responsible for Dong Nai Province, and PC2 is for all other provinces in the south. Under each of these companies, there are a number of local (i.e. lower level) distribution companies.

¹² For example, electricity sales of the Dong Nai PC in 2002, 2004 and 2006 increased by 20.7%, 18.7% and 18.89%, respectively.

Box 1. Overview of the EVN Customer Survey in the South

1. Objective of the survey: to collect information on effects of power sector development in the south in the 2000's.

2. Survey period: November 2008

3. Survey methods:

- 1) Written questionnaire same as the one used in 2007 for the ex-post evaluation of Phu My Thermal Power Plant Project (1)-(4) (“the 2007 survey”).
- 2) Semi-structured interviews with three of the questionnaire respondents.

4. Profile of respondents: total 22 responses from PC2 and HCMC PC customers

- 1) PC2 customers: total 10 responses (3 stores and 7 manufacturers)
- 2) HCMC PC customers: total 12 responses (1 store, 6 manufacturers, 2 hotels, 3 other services)

	No. of employees	Annual power consumption	Annual electricity charge paid
Maximum	2,000 persons	19,000 MWh	181,000 million VND
Minimum	15 persons	650 MWh	220 million VND
Average	482 persons	5,838 MWh	7,610 million VND

* The 2007 survey collected a total of 30 responses.

5. Major survey results in comparison to the 2007 survey

1) Amount of power supply (unit: number of answers)

The most frequent answer category (highlighted) shifted from “Low” to “Fair” after 2002.

2007 survey (n=30)						2008 survey (n=22)					
	High	Fair	Low	Very low	N.A.		High	Fair	Low	Very low	N.A.
Before 2002	1 (3%)	8 (27%)	18 (60%)	2 (7%)	1 (3%)	Before 2002	1 (5%)	3 (14%)	10 (46%)	1 (5%)	7 (32%)
After 2002	1 (3%)	25 (83%)	4 (13%)	0	0	After 2002	0	14 (64%)	7 (32%)	0	1 (5%)

2) Reliability of power supply (unit: number of answers)

The most frequent answer category (highlighted) shifted from “Poor” to “Fair” after 2002.

2007 survey (n=30)						2008 survey (n=22)					
	Excellent	Fair	Poor	Very poor	N.A.		Excellent	Fair	Poor	Very poor	N.A.
Before 2002	1 (3%)	6 (20%)	20 (67%)	2 (7%)	1 (3%)	Before 2002	2 (9%)	4 (18%)	8 (36%)	0	8 (36%)
After 2002	1 (3%)	24 (80%)	4 (13%)	1 (3%)	0	After 2002	6 (27%)	14 (64%)	1 (5%)	0	1 (5%)

3) Positive effects of power supply on business operation (2008 survey)

- Power supply better meets requirements for manufacturing and business
- Power supply enabled bigger amount of production and improved quality
- Interruption of production due to unstable power supply and outages was reduced
- Outages still occur, but it is informed in advance (before it was not), so we can prepare for them.
- Good cooperation of power companies during past period is appreciated.

4) Other comments (2008 survey)

- Outage situations should be improved and power supply should be stabilized more.
- Power sector should invest more to generators
- Underground medium voltage grid should be improved
- After 2002 power supply was much better, but after 2008 it is very limited again

6. Comparison between responses from HCMC PC customers and PC2 customers

The score for each answer category was calculated in the following way:

- For each answer to the questions about power supply volume reliability, outages, voltage fluctuation and voltage level, the following points were given:
 4 points for “High” or “Excellent”;
 3 points for “Fair”;
 2 points for “Low” or “Poor”;
 1 point for “Very Low” or “Very Poor”; and
 0 point for “N.A.”
- The score for each answer category was calculated by multiplying the above-mentioned points by frequency.
- Scores were standardized for comparison between HCMC PC customers and PC2 customers (to give a range from 0 points to 100 points)

Differences between “Before 2002” and “After 2002” are generally higher with PC2 customers than HCMC PC customers: impact is perceived more clearly in other areas than HCMC.

HCMC PC customers (located in HCMC)						PC2 customers (located in other areas)					
	Amount	Reliability	Outages	Voltage fluctuation	Voltage level		Amount	Reliability	Outages	Voltage fluctuation	Voltage level
Before 2002	1	8	18	2	1	Before 2002	1	3	10	1	0
After 2002	1	25	4	0	0	After 2002	0	14	7	0	0
Difference	11	16	25	11	(7)	Difference	43	63	55	60	55

2.4.2 Environmental Impact

An environmental impact study was conducted in the feasibility study. Mitigation measures planned in the study were carried out during the construction period (e.g., setting the minimum clearance under transmission lines at 16m, which was higher than VN standard of 14m).

In interviews with local governments, no environmental problems were mentioned related to this project, because the transmission lines do not run above residential areas, unlike other projects. EVN conducted an electric and magnetic field measurement in 2004, and the measured level was within the government standard.

2.4.3 Impact of Land Acquisition and Resettlement

Land acquisition was processed by PCM3 and Ho Chi Minh City according to government regulations. For the construction of substations, towers and rights of way (ROW) for transmission lines, a total 223ha of land was acquired, compared to 220ha in the original plan. The number of affected households was 953 compared to 130 households in the original plan¹³. Reasons for the increase in the number of affected households include: (i) changes in engineering design; (ii) rapid urbanization of the areas; and (iii) the new compensation policy of Ho Chi Minh City¹⁴. A total 206,530 million VND was paid for compensation.

No remaining issues over land acquisition and compensation were reported by PMU3 or by districts where the project substations and transmission lines are located, except in one district where there are ongoing cases of cash payment for agricultural land.

2.5 Sustainability (Rating: a)

No major problem has been observed in the capacity of the executing agency nor in the operation or maintenance systems. Therefore, the sustainability of this project is high.

2.5.1 Executing Agency and O&M Agencies

2.5.1.1 O&M System

The substations and transmission lines developed by the project are operated and maintained by the Eastern Power Transmission Company No.1 and No.2 of the Power Transmission Company No.4 (PTC4). The National Power Transmission Corporation (NPT) was established in July 2008 as one step in the reform of the power sector after 2005, and the responsibility for development, operation and maintenance of transmission systems of 220kV or higher were transferred from EVN to NPT. PTC4, which is in charge of the operation and maintenance of 220kV or higher transmission systems in southern Vietnam, was also transferred to NPT¹⁵. All power feeding is controlled by the National Load Dispatch Center of EVN.

NPT is 100% owned by State. Although equitization of the power sector is underway as part of power sector reform, the State keeps exclusive right to electricity transmission management to

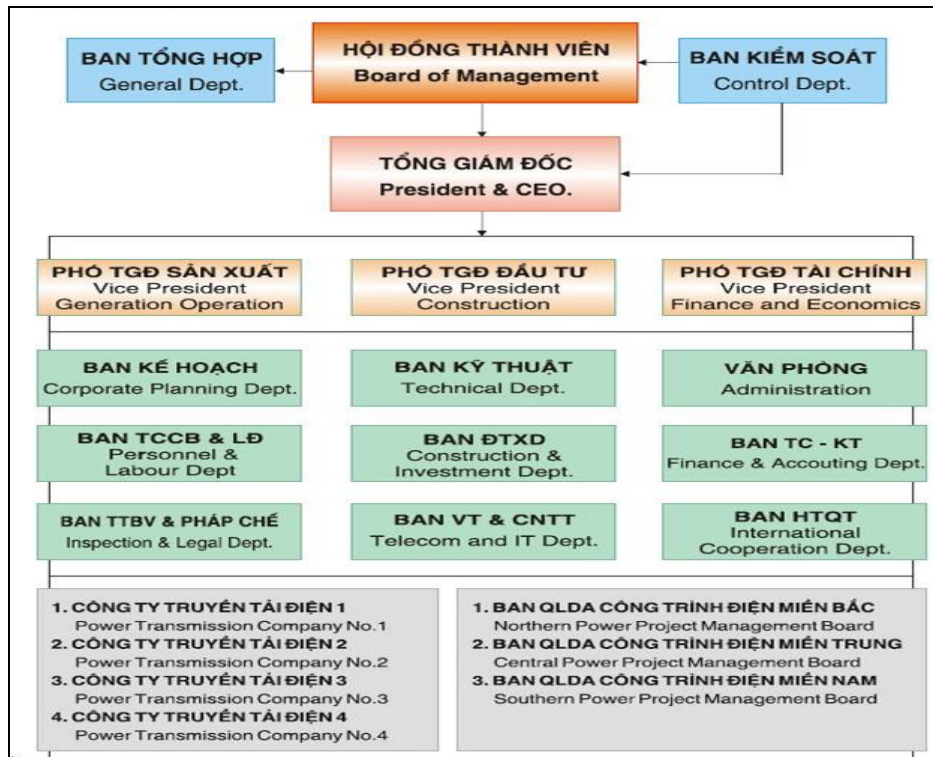
¹³ Out of 953 households, 265 households were subject to resettlement (of which, 222 households found new houses themselves and 43 households moved to houses built by the project), and 688 households received compensation for their land taken for ROW. The project supported the 265 resettled households in the stabilization of their living conditions, including the provision of vocational training.

¹⁴ In the course of project implementation, the HCMC People's Committee introduced a new land acquisition policy saying that it would compensate for lands even where legal documents about land use rights were lost. This became a factor in increasing the number of affected people.

¹⁵ O&M of transmission systems of 110kV or lower is carried out by power distribution companies.

ensure power security for the country¹⁶.

Figure 7: Organization chart of NPT



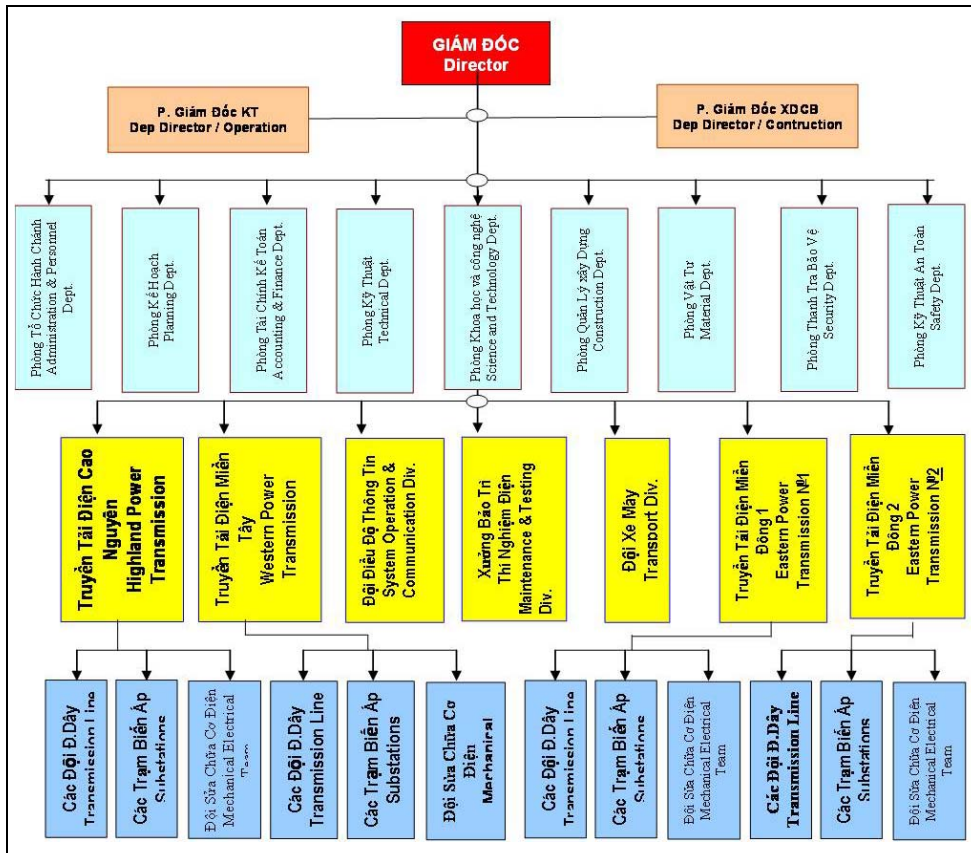
2.5.1.2 O&M Technical Capacity

No serious problem is seen in the technical capacity of PTC4 in the operation and maintenance (O&M) of the project facilities. The operation of each substation is carried out by 50 staff in three shifts. Maintenance of the Nha Be substation, the Phu My switchyard and the 500kV transmission lines is carried out by a maintenance team consisting of 65 persons, including 17 engineers. Some of these staff had experienced O&M of 220kV transmission lines from PMTPC (constructed with another Japanese ODA loan, the “Phu My Thermal Power Plant Project”) and the Phu Lam-Pleiku 500kV double circuit transmission line prior to this project. Various training in O&M was or is provided by project suppliers and NPT¹⁷.

¹⁶ Based on the new Electricity Law in 2005, power generation and distribution is planned to be equitized in three phases: (i) Phase I (2005-) to equitize generation except large-scale power plants of socio-economic and national security importance; (ii) Phase II (2014-) to allow wholesalers other than EVN; and (iii) Phase III (2022-) to equitize distributor (retailers).

¹⁷ Types of training include: training programs to carry out projects provided by suppliers; training for chiefs of operation shifts; regular on-the-job training during implementation, knowledge dissemination, monthly updating of lessons learned from operation practice; cultivating competence of the cadres and staff who are working on O&M to raise their technical level to a higher scale; training courses on integrated control, protection system, programming for control system PLC.

Figure 8: Organization chart of PTC4



2.5.1.3 Financial Status for O&M

The budget of PTC4, including for operation and maintenance of the project transmission system, is fully funded by EVN (since June 2008, through NPT). As Table 3 shows, around 80-110% of the planned budget for O&M is allocated every year depending on requirements that arise in the course of operation¹⁸. Judging from Tables 4 and 5, it can be seen that the recent financial performance of the EVN group is quite good.

Table 3: Budget of PTC4

	2005		2006		2007		2008	
	Plan	Actual (% to plan)	Plan	Actual (% to plan)	Plan	Actual (% to plan)	Plan	Actual (% to plan)
Total budget	630,192	944,564 (150%)	1,040,791	1,040,417 (100%)	1,160,704	1,046,906 (90%)	1,247,428	1,152,711 (92%)
O&M budget	77,670	74,172 (96%)	88,263	82,256 (93%)	88,681	69,733 (79%)	101,000	110,506 (109%)

Source: PTC4

¹⁸ As PTC4 manages O&M cost of its transmission system as a whole, separate budget information on O&M of the project facilities was not available.

Table 4: Consolidated balance sheet of EVN group

	2005	2006	2007
Current asset-to-current liabilities ratio	186%	203%	195%
Cash-to-current liabilities ratio	125%	144%	137%
Capital-to-asset ratio	42%	38%	41%
Fixed asset-to-equity capital ratio	175%	188%	177%

Source: EVN

Table 5: Consolidated income statement of EVN group

	(unit: million VND)		
	2005	2006	2007
Total revenue	38,818,688	44,920,047	58,133,397
Gross profit	5,731,131	7,660,987	9,777,833
Profit after tax	2,327,253	2,256,201	3,335,853

Source: EVN

After the transfer of the transmission management from EVN to NPT, NPT is to fund O&M costs for 220kV and 500kV transmission systems¹⁹. While, for the immediate future, the O&M budget is estimated based on EVN's unit costs per km of transmission lines, NPT plans to prepare a more precise cost norm for O&M of specific items of transmission systems.

2.5.2 O&M Status

All the substations and transmission lines are well operated and maintained at the present moment. O&M is carried out based on the following operation principles and procedures:

- Guidance documents on operating equipments provided by manufactory
- Operation and Repair Procedures for Phu My – Nha Be – Phu Lam 500kV T/L
- Procedures for troubleshooting of Phu My 500kV S/S
- Procedures for operation and troubleshooting of Nha Be 500kV S/S
- Procedures for operation and troubleshooting of Phu Lam 500kV S/S
- Operation procedures for 500kV transformers
- Operation procedures for circuit breakers, current transformers, voltage transformers.
- Operation procedures for integrated control, protection system

The evaluation team also visited the Long Binh substation (constructed in 1988 and operated by PTC4), where some equipment of the Soviet-era was still used. For this, too, it can be said that O&M of the PTC4 transmission system is generally in good condition.

¹⁹ NPT was preparing its first financial statement.

Operation of Phu My switchyard



Old substation (Long Binh) still in good condition



3. Conclusion, Lessons Learned and Recommendations

3.1 Conclusion

From the findings described above, this project can be evaluated at highly satisfactory

3.2 Lessons Learned

(1) Project Preparation

- The comprehensive 500kV substation item was delayed due to a prolonged tender appraisal process – to ensure a more efficient project implementation progress, the bid evaluation must be fully in accordance with the relevant guidelines to avoid re-evaluation, and GOV and JICA should accelerate their internal decision-making processes.
- There was a problem with poor design and coordination for the connection of the project system with existing facilities. In the preparation phase of the tender document, technical specifications of facilities and interfaces, as well as forms, procedures and responsibilities for the solution of problems must be agreed between parties in charge of other sections/systems connected to the project in order to ensure synchronization of the whole power network.
- The installation of an additional system to the project transmission system, due to delays in the whole network, imposed additional operational burdens on PTC4²⁰. The technical design of a project must consider that the progress of related projects in the same master plan might affect the operation regime of the project facilities.

(2) Project Implementation

- In this project, compensation was very important in ensuring project progress. In order that compensation can be carried out smoothly, compensation policies should be fair and convincing based on the rules of Vietnam.

²⁰ In the case of 500kV Phu My-Nha Be-Phu Lam Transmission Line, EVN had to install additional system for automatically source – shedding to increase stability for operation of Nha Be – Phu Lam section (1 circuit).

(3) Project Operation

- The quantity of in-depth training on equipment and technology applied should be increased to improve the capacity of the operation staff. For the 500kV Phu My – HCMC Transmission Line, the quantity of training for this project does not quite meet the operation demands of some of the new equipment, in particular integrated control and protection systems. The operation agency had to implement additional training when they took over output of this project and during the operation process.

(4) Project Evaluation

- There should be concrete effectiveness indicators for executing and O&M agencies to measure in order to make data collection for the evaluation of project effectiveness easier in the future.

3.3 Recommendations

- To ensure sustainability in the long term, NPT and PTC4 are recommended to continue good O&M of the project facilities, so that any changes in organizational and budgeting systems will not negatively affect the O&M status.

Comparison of Original and Actual Scope

Item	Plan	Actual
1. Output 1) Construction of transmission lines (T/L)	a) Phu My-Nha Be 500kV x 2 circuits b) Nha Be-Phu Lam 500kV x 1 circuit	a) Same as planned b) Same as planned c) Additional: temporary connection (500kV T/L and 500kV bays to evacuate power from Phu My 2-2 and Phu My 4 power plants in 2004)
2) Expansion/ renovation of substations (S/S)	a) Phu My 1 Switchyard: 450MVA x 1 with 12 bays b) Nha Be S/S: 600MVA x 2 with 8 bays c) Phu Lam S/S: 1 bay	a) Same as planned b) 6 bays (2 bays reduced) c) Some equipment not installed but kept as contingency material
3) Installation of communication lines (optic fiber, etc)	a) Phu My – Nha Be, Nha Be – Phu Lam, b) Phu My – Ba Ria, Phu My – Long Thanh	a) Mostly same as planned, except change in type of some optic fiber cable routes from OPWW (wind type) to OPGW (anti-thunderbolt fiber cables).
4) Consulting services	Foreign: 128MM Local: 370MM	Foreign: 103.1 MM Local: 289.3 MM
2. Project Period	March 2001 – October 2003	March 2001 – October 2005
3. Project Cost		
Foreign Currency	11,544 Million Yen	8,249 Million Yen
Local Currency	3,899 Million Yen (509,008 Million VND)	1,842 Million Yen (258,000 Million VND)
Total	15,443 Million Yen	10,091 Million Yen
ODA Loan Portion	13,127 Million Yen	8,249 Million Yen
Exchange Rate	VND= 0.00766Yen (As of October 2000)	1 VND = 0.00713Yen (Average during period from 2001 to 2007)