



Extended Annual Review Report

Project Number: 35914
Loan/Investment Number: 1906/7176
November 2008

Loan and Political Risk Guarantee under the Coguarantee Program VIE: Phu My 2.2 Power Project

In accordance with ADB's public communication policy (PCP, 2005), this extended annual review report excludes information referred to in paragraph 126 of the PCP.

Asian Development Bank

CURRENCY EQUIVALENTS

Currency Unit – dong (D)

		At Appraisal	At Project Completion
		24 May 2002	4 February 2005
D1.00	–	\$0.0001	\$0.0001
\$1.00	–	D15,248	D15,791

ABBREVIATIONS

ADB	–	Asian Development Bank
BOT	–	build-operate-transfer
COD	–	commercial operations date
EIA	–	environmental impact assessment
EPC	–	engineering, procurement, and construction
EVN	–	Electricity of Vietnam
FIRR	–	financial internal rate of return
FY	–	fiscal year
IPP	–	independent power producer
ISO	–	International Organization for Standardization
MECO	–	Mekong Energy Company Limited
MOI	–	Ministry of Industry
PDMP	–	Power Development Master Plan
PM2.2	–	Phu My 2.2. Power Project
PRG	–	political risk guarantee
RRP	–	report and recommendation of the President

WEIGHTS AND MEASURES

Btu (British thermal unit)	–	252 calories
kV (kilovolt)	–	1,000 volts
kWh (kilowatt-hour)	–	1,000 watts per hour
MW (megawatt)	–	1,000,000 watts
GWh (gigawatt-hour)	–	1,000,000 kilowatt-hours

NOTES

- (i) The fiscal year (FY) of the Mekong Energy Company Limited ends on 31 December. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2008 ends on 31 December 2008.
- (ii) In this report, "\$" refers to US dollars.

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CONTENTS

	Page
BASIC DATA	i
EXECUTIVE SUMMARY	ii
I. THE PROJECT	1
A. Project Background	1
B. Key Project Features	1
C. Progress Highlights	2
II. EVALUATION	3
A. Project Rationale and Objectives	3
B. Development Impact	3
C. ADB Investment Profitability	5
D. ADB Work Quality	6
E. ADB's Additionality	7
F. Overall Evaluation	7
III. ISSUES, LESSONS AND RECOMMENDED FOLLOW-UP ACTIONS	8
A. Project Issues	8
B. Lessons and Recommendations	8
APPENDIXES	
1. Project-Related Data	10
2. Overview of Viet Nam's Power Sector	12
3. Private Sector Development Indicators and Ratings	15
4. Environmental, Health, and Safety Performance	19

BASIC DATA
Phu My 2.2 Power Project (1906/7176 – VIE)

Key Dates	Expected	Actual
Concept Clearance Approval		17 October 2001
Board Approval	3 April 2002	2 July 2002
Loan Agreement		31 October 2002
Loan Effectiveness		31 October 2002
First Disbursement	31 October 2002	6 January 2003
Commercial Operations Date	1 September 2004	4 February 2005
Loan Closing	4 September 2005	4 September 2005
Months (effectiveness to commercial operations date)		27.5

Project Administration and Monitoring	No. of Missions	No. of Person-Days
Fact-Finding	5	85
Loan Appraisal/Negotiations	3	26
Project Administration	2	7
XARR Mission	1	8

XARR = extended annual review report.

EXECUTIVE SUMMARY

On 2 July 2002, the Board of Directors of the Asian Development Bank (ADB) approved (i) a direct loan of up to \$50 million from ADB's ordinary capital resources; and (ii) a political risk guarantee (PRG), without a government counterguarantee, under the Coguarantee Program to mobilize up to \$25 million of extended political risk insurance for the benefit of guaranteed lenders for loans of up to \$25 million to the Mekong Energy Company Limited (MECO) for the Phu My 2.2 Power Project (the Project or PM2.2). The Project involved the construction of a 715 megawatt gas-fired, combined-cycle power station located in the Phu My Power Generation Complex in the Tan Thanh district of Ba Ria-Vung Tau province about 75 kilometers southeast of Ho Chi Minh City, Viet Nam. This extended annual review evaluates ADB's assistance to help develop the Project. It is based on findings of the Extended Annual Review Mission fielded on 16–19 June 2008 and on information gathered from project processing files, ADB Board documents, audited financial statements, and related operation and technical reports.

MECO was established as one of the first independent power producers in Vietnam under a 20-year build-operate-transfer (BOT) contract entered into between the Ministry of Industry and MECO, which is incorporated in Viet Nam as a 100% foreign-owned company.. MECO entered into a 20-year power purchase agreement with Electricity of Viet Nam as offtaker of electricity and a 20-year gas supply agreement with the Viet Nam Oil and Gas Corporation.

The evaluation criteria used are based on Project Administration Instructions 6.07b on Extended Annual Review Reports for Nonsovereign Operations issued on July 2008. Thus the Project was evaluated along the following dimensions: (i) development impacts and outcomes, (ii) ADB investment profitability, (iii) ADB work quality, and (iv) ADB additionality.

The development impact was evaluated using four criteria: (i) private sector development; (ii) business success; (iii) contribution to economic development; and (iv) environment, social, health, and safety performance. The contribution to private sector development is rated excellent. The Government used PM2.2 to establish a viable BOT framework and is among the first large-scale BOT gas-fired power plants in Viet Nam, contributing to a more reliable base load and more diversification of energy sources. The smooth operation of PM2.2 creates demonstration effects and a model that may be replicated for future private sector participation in the power sector. The IPP sector is maturing after PM2.2 and Phu My 3 have had a demonstrational effect, and the Government is considering to invite IPPs in future BOT projects with less comprehensive guarantees by the Government.

In terms of business success, PM2.2 is rated satisfactory. PM2.2 has been operating satisfactorily since its commercial operations date of 4 February 2005. For the last three years, financial performance at the operating and net profit level has exceeded the conservative projections in the Report and Recommendation of the President (RRP).

PM2.2's economic sustainability is rated excellent, while its environment, social, health, and safety performance is rated satisfactory. PM2.2 was in compliance with ADB Environment Policy and certified International Organization for Standardization 14001 for environment management standards and Occupational Health and Safety Assessment Series 18001 for occupational health and safety management systems.

The investment outcome of PM2.2 is rated satisfactory, as interest payments were made on time. The criteria for ADB's work quality, consisting of screening, appraisal, and structuring,

and ADB's role and contribution, are rated excellent. ADB played a crucial role as provider of a direct loan and a PRG under the Coguarantee Program to catalyze commercial financing. ADB's involvement also enhanced the project sponsors' confidence about investing in the first large-scale independent power producer in Viet Nam given the strength of ADB's public and private operations and long-term participation in the development of the power sector in Viet Nam. ADB's monitoring and supervision is rated satisfactory.

PM2.2's overall rating is considered to be highly successful. PM2.2 succeeded in meeting its primary development objectives, that is, to (i) provide additional base load capacity to ease Viet Nam's power supply shortfall in a least-cost manner, (ii) expand consumer access to a competitively priced and reliable power supply within a relatively short time, (iii) support the commercialization of indigenous natural gas and provide environmentally clean energy, (iv) promote good commercial practices in power plant operation and management, and (v) serve as a model for other project finance transactions in Viet Nam

The main variations from the original RRP are (i) a delay in the commercial operations date by 5 months from September 2004 to February 2005 because of damage to the steam turbine and delays in completion of the 500-kilovolt transmission line, (ii) a lower project cost than projected in the RRP, and (iii) a higher dependable capacity than the conservative RRP estimate. An issue also arose with regard to nonpayment of gas take-or-pay invoices by Electricity of Viet Nam because of a dispute about a definition in the power purchase agreement relating to the pass through of gas take-or-pay payments before the rescheduled commercial operations date. The matter was resolved in June 2005 after the Ministry of Industries stepped in and the company settled its obligations to PM2.2.

ADB can draw a number of lessons and recommendations from PM2.2. First, we recommend that ADB systematically identifies opportunities for catalyzing commercial finance through its private sector operations in those countries where ADB plays an active role in sector reform. In this fashion, complementarities between ADB's private and public sector operations promote confidence among sponsors and financiers, contribute to the successful evolution of the regulatory and institutional framework, and eventually lead to the replication of a successful IPP model. Second, we recommend that ADB makes more frequent use of the guarantor-of-record structure, which ADB used for the first and only time to date in the PM2.2 Project. The guarantor-of-record structure helps ADB to mobilize long-term debt from commercial lenders while also reducing ADB's risk exposure compared with a direct PRG. By acting as guarantor-of-record, ADB will maximize the amount of guarantee coverage and hence increase development impact for ADB's limited financial resources. Thirdly, a major lesson from PM2.2 is that any transfer of advanced technology may require subsequent adjustments and that the manufacturer's commitment to the region is crucial. Therefore, we recommend a wide-ranging long-term service agreement with the manufacturer, which ensures that necessary repairs are carried out promptly and the borrower's financial interests are protected for any project involving transfer of advanced technology.

I. THE PROJECT

A. Project Background

1. On 2 July 2002, the Board of Directors of the Asian Development Bank (ADB) approved (i) a direct loan of up to \$50 million from ADB's ordinary capital resources, and (ii) a political risk guarantee (PRG), without a government counterguarantee, under the Coguarantee Program to mobilize up to \$25 million of extended political risk insurance for the benefit of guaranteed lenders who would make loans of up to \$25 million to the Mekong Energy Company Limited (MECO) for the Phu My 2.2 Power Project (the Project or PM2.2).¹ The Project involved the construction of a 715 megawatt (MW) gas-fired, combined-cycle power station located in the Phu My Power Generation Center in the Tan Thanh district of Ba Ria-Vung Tau province, about 75 kilometers southeast of Ho Chi Minh City, Viet Nam.

2. In the 1990s, Viet Nam embarked on an initiative to develop a legal and regulatory framework for the power sector along with the introduction of private power companies. This initiative included the development of Viet Nam's offshore natural gas reserves and the addition of new gas-fired generating capacity. The Project is an integral part of the master plan for the development of electricity during 1996–2000 approved by the prime minister on 3 September 1997. The master plan identified PM2.2 as a project to be developed on a build-operate-transfer (BOT) basis. Following an international competitive bidding process under the stewardship of the World Bank, on 28 October 1997 the Ministry of Industry (MOI) of Viet Nam issued invitations to submit tenders for the right to develop the Phu My 2 – Phase 2 Power Facility. The Project was the first BOT project in Viet Nam bid on an internationally competitive basis.

3. In January 1999, the Project was awarded to a consortium comprising Electricité de France International, the overseas investment arm of Electricité de France, with a 56.25% ownership stake; Summit Global Management II B.V, a subsidiary of Sumitomo Corporation, which is involved with independent power producer (IPP) projects worldwide, with a 28.125% ownership stake; and the Tokyo Electric Power Company International B.V., a subsidiary of the Tokyo Electric Power Company, which supports IPP businesses in Asia, with a 15.625% ownership stake (collectively referred to as the sponsors). Following award of the contract, the sponsors approached ADB for financing in August 1999 and again in April 2001 after developing the project structure sufficiently to proceed.

B. Key Project Features

4. MECO was established as one of the first IPPs in Vietnam, closely followed by the Phu My 3 Power Project. The Ministry of Planning and Investment granted the sponsors an investment license on 18 September 2001, amended on 14 November 2002 and 17 June 2005, giving them permission to establish a BOT company. The 20-year BOT contract, entered into between the MOI and MECO, defines the rights and obligations of the Vietnamese counterparties (Electricity of Viet Nam [EVN], the Vietnam Oil and Gas Corporation, and the MOI) and MECO in implementing the Project. Under a Government guarantee between MECO and the Ministry of Planning and Investment, the Government guarantees the performance

¹ ADB. 2002. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan and Political Risk Guarantee under the Coguarantee Program to Mekong Energy Company Limited for the Phu My 2.2. Power Project in the Socialist Republic of Viet Nam*. Manila.

obligations of each of the Vietnamese counterparties under the project agreements,² including payment obligations.

5. The Project sells power exclusively to EVN, a state-owned utility company, under a 20-year power purchase agreement. EVN purchases the available capacity and the plant's energy output on a take-or-pay basis.³ Domestic gas is supplied by the state-owned Vietnam Oil and Gas Corporation under a 20-year gas supply agreement. Gas is sourced from the Nam Con Son basin and transported through a 370-kilometer offshore gas pipeline.

6. The Project is located in the Phu My Power Generation Center together with five other gas-fired power plants.⁴ The site was selected for its proximity to gas supply lines, easy connection to the national power transmission grid, good transportation infrastructure, and access to cooling water. Land is leased from the Urban Development Construction Company of the Tan Thanh district of Ba Ria-Vung Tau province. Potable and process make-up water is supplied by the Tan Thanh district of Ba Ria-Vung Tau Water Supply Company and EVN provides raw water for plant cooling. To connect the power plant to the grid, EVN built a 500-kilovolt (kV) electricity transmission line to the Phu My 500 kV connection switchyard within the Phu My Power Generation Center.

7. The Project involved constructing and operating a 715 MW power plant, along with establishing ownership. The power plant's combined-cycle system consists of two General Electric 9FAe class F technology combustion gas turbines, two heat recovery steam generators, and one steam turbine. Running on gas in combined cycle, each gas turbine's gross output is 224 MW and the steam turbine's gross output is 281 MW.

8. The Project was implemented under a fixed price, turnkey engineering, procurement and construction (EPC) contract consisting of an equipment supply contract and a construction service contract. The Centre d'Ingenierie Thermique was responsible for the design, engineering, and supply under the equipment supply contract. The Compagnie Financiere de Valorisation pour L'Ingenierie was responsible for construction, erection, testing, and commissioning under the construction service contract. Both companies are 100% owned subsidiaries of Electricité de France. The EPC contract included performance guarantees for capacity and heat rate targets backed by liquidated damages provisions. The Tokyo Electric Power Company performed the role of owner's engineer. A technical services agreement, renewable yearly, is provided by Electricité de France and the Tokyo Electric Power Company. A long-term service agreement, which covers service, technical support, and spares, is being maintained with General Electric. This agreement was originally for 6 years, but was amended and expanded in 2006 to cover 20 years or the entire duration of the BOT contract and includes replacement of capital parts and an obligation for General Electric to fix defects at its own expense.

C. Progress Highlights

9. The Project was constructed over 26 months starting on 1 December 2002. The Project's originally targeted commercial operations date (COD) of 1 September 2004 was

² These include the BOT contract, the power purchase agreement, the gas sales agreement, the land lease agreement, the water supply agreement, the investment license, the Ministry of Justice's legal opinion, and other agreements relating to the Project made between MECO and a government body and approved by the MOI.

³ A take-or-pay provision provides for the payment of the Project's fixed capacity charge based on the plant capacity made available to the utility and is not based on the actual delivery of electricity.

⁴ The total installed capacity of these power plants is about 3,800 megawatts.

delayed by 5 months because of (i) damage to the steam turbine discovered during commissioning in August 2004 that took 3 months to repair, (ii) delays in completion of the 500 kV transmission line linking the Project to EVN's substation, and (iii) delays in the completion of the gas pipeline.

10. Under the power purchase agreement, the required COD was 1 December 2004, with gas take-or-pay obligations under the gas supply agreement also to take effect on that date. In consideration of the multiple causes of the delays, the MOI approved a modified required COD of 22 January 2005 without allocating responsibility for the delays. However, a further delay of 13 days ensued because of a gas turbine combustor defect. The COD was declared on 4 February 2005.

11. No site construction-related deaths occurred and there were only four occurrences of major injury, none with significant permanent consequences. No major accidents have occurred since the start of operations. During construction the Project was fully compliant with all Vietnamese, ADB environment policy and World Bank environmental standards (as required under ADB environment policy).

12. The Project was completed below the budgeted cost of \$480.1 million, because of savings generated from unutilized contingencies and savings in project implementation and management costs. The Project was financed by 75% debt and 25% equity. The debt financing comprises a direct loan from ADB, a direct loan from the Japan Bank for International Cooperation, and a direct loan from PROPARCO. In addition to the direct loan, ADB provided a PRG under the Coguarantee Program of \$22.7 million in favor of the commercial lenders. The World Bank's International Development Association provided a partial risk guarantee in favor of the commercial lenders.

II. EVALUATION

A. Project Rationale and Objectives

13. 1.PM2.2 achieved the development impact objectives articulated in the RRP by (i) providing additional base load capacity to mitigate the forecast power shortage, especially during the dry season; (ii) transferring the best available technology and best practices in power plant operations; (iii) expanding consumer access to power and helping the Government attain its goal of electrifying 85% of households by 2005;⁵ (iv) supporting the commercialization of indigenous natural gas to replace imported fuel oil and provide environmentally clean energy; (v) bringing private sector investment into the power sector and freeing up limited Government funds for use in areas that require public expenditure; and (vi) serving as a model for other project finance transactions in Viet Nam. The description of Viet Nam's power sector is in Appendix 2.

B. Development Impact

1. Private Sector Development

14. Private sector development impacts are classified as beyond company impacts and direct company impacts. Appendix 3 provides a detailed assessment of individual indicators.

⁵ Vietnam achieved an electrification rate of 90% by 2007.

15. With demand for power increasing at an average annual rate of 14% during the 1990s, the Government faced the challenge of financing and implementing an investment program to address this unprecedented growth in energy demand. One of its strategies was to encourage and introduce private sector capital and direct participation in the power sector. To this end it issued Decree No. 87/CP on BOT contracts to facilitate private investment in infrastructure, including power.

16. The Government used PM2.2 to establish a viable BOT framework for future infrastructure development projects by the private sector. PM2.2 was awarded based on a transparent, international competitive bidding process to ensure the least-cost tariff. PM2.2 was the first such project to be bid out, closely followed by the Phu My 3 Power Project, both of which were financed by ADB. PM2.2 and the Phu My 3 Power Project, Viet Nam's first large-scale, foreign-owned BOT projects, have contributed significantly to increasing the share of IPPs and of gas-fired power plants in total energy production in Viet Nam. Following the successful implementation of both projects, Viet Nam is developing other power plant complexes with private sector participation replicating the Phu My model. The new investment laws covering BOTs (Decree 62) were drafted based on experience gained with the two projects. The IPP sector is maturing after PM2.2 and Phu My 3 have had a demonstrational effect, and the Government is considering to invite IPPs in future BOT projects with less comprehensive guarantees by the Government.

17. The sponsors have transferred advanced technology and know-how to local staff, especially in the areas of plant operation and health and safety procedures, by means of on-the-job and classroom training, technical training at General Electric's headquarters in Atlanta, and financial training at Electricité de France's headquarters in Paris. PM2.2 has successfully trained local staff to take over all but four management positions that are still held by expatriates.

18. The PM2.2's contribution to private sector development is rated excellent overall and on individual indicators (Appendix 3).

2. Business Success

19. MECO's operating and financial performance is considered satisfactory. With the exception of the first year of operations in 2005, MECO's actual financial performance has exceeded the RRP's more conservative projections at both the revenue and net income level.

20. MECO has complied with its financial covenants, maintaining both its historic and projected debt-service coverage ratio above the covenanted level. Since the start of commercial operations, operating cash flows have been strong, allowing the company to service its debts and distribute dividends. The business success is, therefore, rated satisfactory.

3. Economic Sustainability

21. PM2.2 helped EVN to provide electricity to households and to exceed the target of 85% of households with access to electricity (88% of households had access to electricity in 2005 and 90% in 2007). The Project supported the commercialization of indigenous natural gas, which replaces imported fuel oil, thereby saving foreign exchange. As a committed offtaker, PM2.2 was one of the major downstream gas utilization projects crucial for the success of the Nam Con Son Gas Development Project, a project considered to be the single most important macro project under development in Viet Nam in the 1990s.

22. The economic internal rate of return was recalculated and is higher than the original estimate in the RRP because of differences in economic benefits and the costs of associated facilities. The revised economic benefits are based on a study that explicitly calculated willingness to pay,⁶ while the RRP figures were based on average Government-set retail tariffs. The estimated project costs of associated facilities were also revised based on actual data and on estimates of natural gas prices in the international market. The revised economic internal rate of return is above the social discount rate of 12%. The Project's economic sustainability is rated excellent.

4. Environmental, Social, Health, and Safety Performance

23. ADB classified the Project as environment category A with potential environmental impacts if the appropriate mitigation measures were not properly incorporated in the design and in operation and maintenance activities.⁷ With the exception of industrial noise, the Project has met applicable government standards, ADB *Environment Policy* (2002), and World Bank emission standards. The Project complied with its commitment to implement the mitigation measures in the environmental impact assessment. The Project's monitoring system consists of (i) continuous and automatic monitoring systems within the power plant for nitrogen oxides, sulfur dioxide, carbon dioxide, oxygen, dust, stack temperature, water temperature before and after going through the condenser, and neutralization pit pH; (ii) monthly monitoring on site of noise, wastewater pH, biological oxygen demand, total coliform, *E. coli*, and heavy metals; and (iii) quarterly monitoring of ambient air quality, noise, and ambient water quality for the Phu My Power Generation Complex's shared facilities and for PM2.2. Air emission, water temperature, and waste management levels have not been exceeded; however, industrial noise standards have been exceeded in several areas. To mitigate this, protective equipment is issued to workers and exposure to extremely noisy areas is limited to two hours.

24. PM2.2 has obtained International Organization for Standardization 14001 certification for environmental management standards and Occupational Health and Safety Assessment Series 18001 certification for its occupational health and safety management system. The Quality, Health, Safety, and Environment Unit manages environmental performance and ensures compliance with applicable standards and regulations. In addition, PM2.2 contributed to establishing the Environment Management Group within the Phu My Power Generation Center and to the sharing of knowledge about environmental management within the group. The Project's environmental performance is rated as satisfactory.

C. ADB Investment Profitability

25. ADB's investment profitability is considered satisfactory. The interest rate margin is comparable to that charged by the Project's other lenders and is in line with the pricing of other private sector projects at the time of project processing.

⁶ Robert Vernstrom. 2006. *EVN Bulk Tariff, Distribution Margin, Retail Consumer Tariff Design and Development of an Independent Creditors Model*. Report for Electricity of Vietnam.

⁷ Two environmental impact assessment reports prepared for the Project. The first was finalized in April 2001. The second revised and upgraded report was issued in January 2002 and was prepared by a team of experts of the Consortium Colenco Power Engineering Ltd. in Baden, Switzerland, and Fichtner GmbH & Co. in Stuttgart, Germany. This revised report complied with the environmental standards, environmental impact assessment procedures, and requirements of the Vietnamese Government, ADB, and other financiers of the Project. The summary environmental impact assessment was circulated to ADB's Board of Directors on 22 February 2002.

26. Since the start of commercial operations, MECO has been making principal and interest payments on time. Loan repayment began on 15 October 2005 and final repayment is scheduled on 15 July 2017. For the PRG Coguarantee Program, MECO pays ADB an annual arrangement fee, which is a percentage value of the loan amount, and an annual administration fee.

D. ADB Work Quality

1. Screening, Appraisal, and Structuring

27. Prior to the inception of the Project, ADB had provided loans for transmission projects and helped create an enabling environment for private sector participation in the power sector. ADB became involved in the Project in 1999 and helped the sponsors structure the Project and develop a viable financing plan. Because of its reputation in the market, the sponsors asked ADB to take the lead role in conducting due diligence, which involved technical, legal, environmental, sectoral, and commercial aspects. ADB thus played a key leadership role in the due diligence process that covered key project issues, including the competitiveness of the project tariff, the financial sustainability of the offtaker, the gas supply arrangements, the EPC and management arrangements, and the environment mitigation measures.

28. ADB also took the lead in structuring and negotiating the terms and conditions and preparing the legal documentation. ADB led loan negotiations with the sponsors to ensure that all risks and lenders' concerns were addressed. Commercial lenders indicated that they would not provide assistance to the Project without ADB participation. For the first time ADB acted as a guarantor of record, catalyzing commercial political risk insurance. Cooperation between ADB and the World Bank also sent a strong signal to the market of its confidence and commitment to the Project, which was the first of its kind in Viet Nam.

29. ADB's performance in relation to screening, appraisal, and structuring is rated excellent.

2. Monitoring and Supervision

30. ADB closely monitors project implementation through MECO's submission of various reports, including semi-annual operating reports; quarterly and annual financial accounts; health, safety, and environment reports; and annual reviews that comprise both field and desk reviews. MECO has complied with all reporting requirements in a timely manner. ADB has been prompt in giving its consent to waivers and requests for any amendments to existing agreements subject to a thorough review of the requests.

31. ADB's performance in relation to monitoring and supervision is rated satisfactory.

3. ADB Role and Contribution

32. Being a direct lender and provider of PRG for PM2.2, ADB played a critical role in mobilizing commercial financing, as commercial banks had hesitated to lend on an uncovered basis given the market conditions, perceived political risks, and the lack of a track record for IPP projects in Viet Nam at that time. PM2.2 also represented the first PRG transaction under the Coguarantee Program. Under the Coguarantee Program, ADB would act as guarantor of record

for private sector risk insurers.⁸ By acting as guarantor of record, ADB was able to increase the amount and improve the terms and conditions of the political risk insurance coverage. This enabled the mobilization of long-term debt from commercial lenders at more attractive terms than would otherwise have been available, while at the same time reducing ADB's risk exposure compared with a direct PRG. Moreover, private sector risk insurers did not want to participate in the Project without ADB's participation as guarantor of record. ADB was able to substantially reduce the cost of political risk coverage quoted by private insurers. The sponsors are considering other opportunities in Viet Nam and have indicated that they would pursue a similar financial structure and collaboration with ADB. ADB's role and contribution is rated excellent.

33. ADB's overall work quality is rated excellent.

E. ADB's Additionality

34. PM2.2 was the first BOT IPP in Viet Nam. The Government did not have experience in implementing a similar large-scale BOT project. As a result, ADB added significant value during the PM2.2 execution phase by building confidence among commercial lenders and sponsors. ADB's role as a guarantor of record enhanced protection to commercial lenders in addition to the guarantee undertakings from the Government.

35. ADB has been a long-term partner with the Government in developing the power sector. ADB's public sector operations provided technical assistance to overcome legal and regulatory obstacles for private sector power producers including (i) finalization of the new Electricity Law which included unbundling of power sector operations, (ii) establishment of an independent and transparent sector regulation, (iii) depoliticizing tariff setting, and (iv) encouraging more private sector investment.⁹ The complementarities between ADB's public and private sector operations promoted confidence among sponsors and financiers and contributed to the successful evolution of the regulatory and institutional framework. Without ADB assistance, the financial closure of PM2.2 would not have occurred on a timely basis or with appropriate financing terms given the perceived high country risks and the lack of precedent cases for large-scale BOT IPPs in the country. The successful operation of PM2.2 creates a demonstration effect for the development of future foreign-owned IPPs in Viet Nam.

36. ADB's involvement in and supervision of PM2.2 has helped ensure that the Project meets standards and complies with environmental and social safeguard requirements. Furthermore, the successful implementation of PM2.2 provides lessons and know-how for future development of other IPPs, including projects under consideration for potential ADB assistance. ADB's additionality is assessed as excellent.

F. Overall Evaluation

37. Overall, PM2.2 is rated highly successful. The ratings are summarized in the following table. PM2.2 is the first BOT project in the power sector in Viet Nam. Other power plants are

⁸ Under the Coguarantee Program, ADB issues a political risk guarantee in favor of commercial lenders that is fully underwritten by political risk insurance providers. By acting as guarantor of record, ADB shares its preferred credit status and other ADB Charter benefits with the political risk insurance provider covering the syndicated commercial loan in a manner similar to what ADB would do as a lender of record under its complementary financing scheme for lenders.

⁹ ADB. 2001. *Technical Assistance to the Socialist Republic of Viet Nam on Roadmap for Power Sector Reform*. Manila. and TA No. 3763-VIE: Roadmap for Power Sector Reform. Technical Assistance Completion Report: Successful.

now being developed with private sector participation using the IPP framework of the Phu My model, and new investment legislation was enacted based on experience with PM2.2 and PM 3. PM2.2 has been operating satisfactorily since the start of operations. ADB played a crucial role in due diligence and in structuring the Project. The Project's innovative financing structure has served as a model for other BOT projects in Viet Nam and was awarded Project Finance Deal of the Year for 2002 by several international publications, including *Finance Asia* and *AsiaMoney*.

Evaluation of the Phu My 2.2 Project

Indicator/Rating	Unsatisfactory	Partly Satisfactory	Satisfactory	Excellent
Development Impact				
Private Sector Development				X
Business Success			X	
Economic Sustainability				X
Environment, Social, Health, and Safety Performance			X	
ADB Investment Profitability			X	
ADB Work Quality				X
ADB Additionality				X
	Unsuccessful	Partly successful	Successful	Highly successful
Overall Rating				X

ADB = Asian Development Bank.

III. ISSUES, LESSONS AND RECOMMENDED FOLLOW-UP ACTIONS

A. Project Issues

38. The key variations of actual performance from the assumptions in the RRP are as follows:

- (i) The COD was delayed by 5 months because of (i) damage to the steam turbine discovered during commissioning in August 2004 that took more than 3 months to report, (ii) delays in completion of the 500 kV transmission line linking the Project to EVN's substation, and (iii) delays in the availability of gas.
- (ii) The project cost was lower than the RRP estimate because of savings generated from unutilized contingencies and savings in project implementation and management costs.
- (iii) The dependable capacity was higher than the conservative RRP estimate, resulting in higher capacity charge revenue than in the original projections.
- (iv) A problem was encountered with nonpayment of invoices by EVN during January and February 2005 because of a dispute about a definition in the power purchase agreement relating to the pass through of gas take-or-pay payments before the rescheduled commercial operations date. This dispute resulted in nonpayment to the gas supplier, the Vietnam Oil and Gas Corporation. The matter was resolved in June 2005 after the MOI stepped in, and EVN settled its obligations to PM2.2.

B. Lessons and Recommendations

39. **Promote complementarities between private sector and regional operations.** An important lesson from PM2.2 is that ADB can contribute to a successful development outcome and maximize its additionality by using its public and private sector operations concurrently.

PM2.2. has shown that private sector operations' involvement and expertise in structuring IPPs can successfully catalyze commercial finance in the context of a lack of precedent cases while ADB's public sector operations strengthen the institutional framework. Therefore, we recommend that ADB systematically identifies opportunities for catalyzing commercial finance through its private sector operations in those countries where ADB plays an active role in sector reform. In this fashion, complementarities between ADB's private and public sector operations promote confidence among sponsors and financiers, contribute to the successful evolution of the regulatory and institutional framework, and eventually lead to a demonstration effect and replication of a successful IPP model.

40. **Increase usage of guarantor-of-record structure.** We recommend that ADB makes more frequent use of the guarantor-of-record structure, which ADB used for the first and only time to date in the PM2.2 Project. The guarantor-of-record structure helps ADB to mobilize long-term debt from commercial lenders while also reducing ADB's risk exposure compared with a direct PRG. By acting as guarantor-of-record, ADB will maximize the amount of guarantee coverage and hence increase development impact for ADB's limited financial resources. In order to fully align ADB's interests with those of the private sector guarantor, ADB should consider in future transactions to provide a PRG alongside the commercial PRG provider, in the same way as ADB funds an A Loan alongside B Loans from commercial banks.

41. **Ensure long-term commitment of the manufacturer if the project involves technology transfer.** PM2.2 involved the transfer of the most advanced gas-fired generation technology available at the time, resulting in one of the most efficient plants in the region. A major lesson from PM2.2 is that any transfer of advanced technology may require subsequent adjustments and that the manufacturer's commitment to the region is crucial. Therefore, we recommend a wide-ranging long-term service agreement with the manufacturer, which ensures that necessary repairs are carried out promptly and the borrower's financial interests are protected, for any project involving transfer of advanced technology.

PROJECT-RELATED DATA

A. Investment Identification		
1.	Country	Viet Nam
2.	Loan Number	7176/1906
	Political Risk Guarantee Number	GU 1906
3.	Type of Business	Conventional Energy Generation
4.	Project Title	Phu My 2.2 Power Project
5.	Investee Company and/or Borrower	Mekong Energy Company Limited
6.	Amount of Approved ADB Assistance	
	Direct Loan	\$50.0 million
	PRG under the Coguarantee Program	\$25.0 million
7.	Project Completion Report Number	PCR: VIE 1063

ADB = Asian Development Bank, PRG = political risk guarantee.

B. Investment Data		
1.	Concept Clearance Approval	17 October 2001
2.	Date of Board Approval	2 July 2002
3.	Signing Date of Legal Documents	
	Loan Agreement	31 October 2002
	Political Risk Guarantee Agreement	31 October 2002
4.	Date of Loan Effectiveness	
	In Loan Agreement	31 October 2002
	Actual	31 October 2002
	Number of Extensions	None
5.	Loan Closing Date (end of availability period)	
	Tranche A:	
	In Loan Agreement	4 February 2005
	Actual	4 April 2005
	Number of Extensions	1
	Tranche B:	
	In Loan Agreement	4 September 2005
	Actual	4 September 2005
	Number of Extensions	None

7.	Disbursements			
a.	Direct Loan			
		Initial Disbursement	Final Disbursement	Time Interval
		6 January 2003	31 August 2005	968 days
		Effective Date	Original Closing Date of Availability Period	Time Interval

		31 October 2002	4 September 2005	1,039 days
		Amount Disbursed: US\$45,897,059.00		
b.	ADB Political Risk Guarantee Covered Loan			
		Initial Disbursement	Final Disbursement	Time Interval
		6 January 2003	31 August 2005	968 days
		Effective Date	Original Closing Date of Availability Period	Time Interval
		31 October 2002	18 October 2005	1,083 days
		Amount Disbursed: US\$22,687,500.50		
8.	Loan Repayment			
a.	Direct Loan			
		Initial Repayment Date	15 October 2005	
		Final Repayment Date	15 July 2017	
b.	ADB Political Risk Guarantee Covered Loan			
		Initial Repayment Date	15 October 2005	
		Final Repayment Date	15 July 2013	

LIBOR = London interbank offered rate.

OVERVIEW OF VIET NAM' S POWER SECTOR

1. Viet Nam is one of the fastest growing economies in Asia with average annual gross domestic product growth of about 7.3% over the past decade. Corresponding to this rapid economic development, average growth in electricity demand was 13.5% per year from 2002 to 2007. Total power generation reached 68,000 gigawatt-hours in 2007. As of the end of 2007, total installed generation capacity was 12,600 megawatts (MW), of which 4,800 MW was new capacity additions from 2002 through 2007. Installed capacity is expected to reach 25,000 MW by 2010 and 50,000 MW by 2017. Electricity demand is expected to maintain its present growth rate of more than 16% per year until 2010 and to slow to about 11% per year during 2011 to 2015. However, at 800 kilowatt-hours annual per capita consumption remains low compared with Viet Nam's neighbors, with per capita consumption being 1,854 kilowatt-hours/person in Thailand and 3,125 kilowatt-hours/person in Malaysia.

2. The high growth rate of electricity demand, coupled with the country's disproportionate dependency on hydropower, has left Viet Nam with few or no reserves during each year's dry season, when limited river flows reduce hydropower output to about 40% of installed capacity. Without significant increases in thermal plant generation capacity, the continuing demand for electricity would reduce system reserve capacity to zero by 2010. The shortfall is currently about 1,100 MW and Viet Nam Electricity (EVN) has resorted to load shedding to residential and commercial areas to ensure supply to the industrial sector.

Table A2.1: Electricity Demand Projection, Selected Years 2005–2025

Item	2005	2010	2015	2020	2025
Annual Demand (terrawatt-hours)	45.6	97.1	164.9	257.3	381.2
Growth in Demand for the Next 5 Years (%)	16.1	11.1	9.3	8.1	na
Transmission and Distribution Losses and Self-Generation (%)	14.7	13.8	13.2	12.5	11.7
Annual Generation (terrawatt-hours)	53.6	112.7	190.0	294.0	431.6
Maximum Demand (megawatts)	9,500.0	19,550.0	32,200.0	48,650.0	71,400.0
Per Capita Consumption (kilowatt-hours)	549.0	1,106.0	1,774.0	2,629.0	3,703.0

Source: Ministry of Industry

3. Until recently, Viet Nam relied significantly on hydropower, which accounted for about 55% of total capacity. Subsequent to the discovery of gas reserves in the Nam Con Son basin, large-scale, gas-fired power plants in the Phu My Generation Center have played a significant role in providing additional base load capacity to meet the growing electricity demand and have enhanced the diversification of energy sources during the past 5 years. The evolution of Viet Nam's generating structure is consistent with the recommendation under the Fifth Power Development Master Plan (PDMP) that the least-cost power generation alternatives should use natural gas.

Table A2.2: Capacity Mix of Viet Nam's Power Sector, 31 December 2007

Source	IPP				Total (MW)	Percentage of Total
	EVN (MW)	SOE (MW)	Non- EVN (MW)	Under BOT decree (MW)		
Hydropower	4,543	237			4,780	37.9
Coal	1,210	225	165		1,600	12.7
Natural Gas	2,910	500		1,466	4,876	38.7
Furnace Oil and Diesel	476	0	620		1,096	8.7
Imports	220	0			220	1.7
Biomass	0	0	24		24	0.2
Total	9,359	962	809	1,466	12,596	100.0

EVN = Electricity of Vietnam, IPP = independent power producer, MW = megawatts, SOE = state-owned enterprise, BOT = build-operate-transfer.

Source: Institute of Energy, Viet Nam.

4. The Sixth PDMP, approved in 2007, called for addressing the system imbalances and seasonal generation shortages from hydropower by building more thermal power plants based on coal and natural gas. The Sixth PDMP also identified the need to build hydropower plants to optimize the balance between costs and supply security. Most of the large hydropower plants have been identified and some of them are already under construction and will be commissioned after 2013, while others are planned for construction in 2009. By 2015, most of the hydropower plants will have been developed, leaving only small plants of less than 2 MW for development in remote mountainous areas. However, given the demand growth, larger base load generation plants will need to be built.

5. The challenge is to mobilize the financial resources to finance capacity expansion to meet the rapid growth in demand. The power generation capacity additions during 2006–2015 are projected to be more than 24,000 MW, of which 10,000 MW are under construction and will be commissioned by 2010. According to the Sixth PDMP, the total investment requirements for 2006–2015 are estimated at \$46 billion, \$32 billion for generation, \$5 billion for transmission, and \$9 billion for distribution. With EVN's limited internal cash generation and capacity to increase its debt burden, private sector investment will play an increasingly important role in bridging the funding gap. The share of EVN and non-EVN projects for new capacity additions will be 50:50 during 2006–2010 compared with around 70:30 during 2000–2005.

6. Viet Nam's power sector is dominated by EVN, a state-owned corporation involved in power generation, transmission, and distribution. The Government is restructuring the electricity industry, and in June 2006 converted the vertically integrated EVN into a holding company structure. EVN's operating units, consisting of power plants, regional distribution companies, and a power transmission system operator, have been converted into independent subsidiaries of EVN. According to the Electricity Law, which came into effect in July 2005, the Government aims to develop a power market based on principles of transparency and competition to achieve economic efficiency and to attract investment from both the public and the private sectors. The law also states that the state monopoly in the sector will be limited to power transmission, national load dispatch, and strategically important large power plants, leaving power distribution and nonstrategic power generation to potential private power sector investors. Since the enactment of the law, the Government has demonstrated its commitment to transition to a competitive power market by taking several key steps, including establishing the Electricity

Regulatory Authority of Viet Nam, approving a plan for power sector reform, restructuring EVN as a holding company, and initiating the partial privatization of EVN subsidiaries.

PRIVATE SECTOR DEVELOPMENT INDICATORS AND RATINGS: INFRASTRUCTURE
Phu My 2.2 BOT Power Company Limited

Impact of the Project	Ratings				
	Impact to Date	Potential Impact (Sustainability) and Risk to Its Realization	Combined Rating ^a	Justification/Annotations	
1. Beyond Company Impact	Rating ^b	Rating ^c	Risk ^d		
1.1. Private sector expansion. Contributes as a pioneering or high-profile project to facilitating or preparing for more private participation in the sector and economy at large	Excellent	Excellent	Low	Excellent	PM2.2 was one of the first large-scale IPP projects and the first IPP for a power plant in Viet Nam. PM2.2 was the first to be bid out, closely followed by PM3, both of which were financed by ADB during the same period. PM2.2 and PM3, the only large-scale foreign-owned BOT projects in the country, have contributed significantly to increasing the share of IPPs and of gas-fired power plants in total energy production. Following the successful implementation of PM2.2 and PM3, Viet Nam is developing other power plant complexes with private sector participation replicating the Phu My model (e.g., Nghi Son, O Mon, Mong Duong, and Nhon Trach power complexes).
1.2. Competition. Contributes new competition pressure on public and/or other sector players to increase efficiency and improve access and service in the industry	Satisfactory	Satisfactory	Low	Satisfactory	Because of acute shortages of power generation capacity, EVN plants are currently not competing with PM2.2, but PM2.2 has introduced best practices in power plant operation. In this regard, PM2.2 has put pressure on other power plants and other relevant parties, such as local contractors, to improve operating standards. EVN has improved the technology of its new power plant following the establishment of PM2.2 and PM3.
1.3. Innovation. Demonstrates efficient new products and services, including areas such as marketing, distribution, tariffs,	Satisfactory	Satisfactory	Low	Satisfactory	PM2.2 applies modern technology to power plant operations. At the time of construction, the plant's turbine was the most advanced

Impact of the Project	Ratings				
	Impact to Date	Potential Impact (Sustainability) and Risk to Its Realization		Combined Rating ^a	Justification/Annotations
production, and technology; and ways to cover or contain cost, manage demand, etc.					technology in the world. PM2.2's efficiency had a demonstration effect on other power generation companies in Viet Nam, including EVN. Project operating practices and health and safety procedures are up to the international standards of the project sponsors.
1.4. Linkages. Relative to investments, contributes notable upstream or downstream linkage effects to business clients, consumers, suppliers, key industries, etc. in support of growth.	Excellent	Excellent	Low	Excellent	PM2.2 serves as a key component of the gas for power production chain by being a downstream user of indigenous gas discovered in the Nam Con Son basin.
1.5. Catalytic element. Contributes by including pioneering and/or catalytic finance, mobilizing or inducing more local or foreign market financing and/or foreign direct investment in the sector.	Excellent	Excellent	Low	Excellent	ADB's lead role in due diligence and involvement in the transaction provided comfort to and attracted private sector interest. Using the guarantor of record structure for the first time, ADB catalyzed commercial political insurance. The success of PM2.2 creates a demonstration and catalytic effect for more private sector participation in the sector.
1.6. Affected laws, frameworks, regulation. Contributes to improved laws and sector regulation for PPPs, concessions, joint ventures, and BOT projects; and to liberalizing markets as applicable for improved sector efficiency.	Satisfactory	Excellent	Low	Excellent	The Government recently passed the Electricity Law and issued a plan for power sector development that envisages the phased establishment of a competitive power market. The Government strongly encourages investment in the power sector by both domestic and foreign sources. The recently promulgated Investment Law provides for more equal treatment of domestic and foreign investors. The new laws covering BOT projects (Decree 62) were drafted based on experience gained with PM2.2 and PM3, the first BOT projects in the country.
2. Company Impact with Wider Potential					

Impact of the Project	Ratings				
	Impact to Date	Potential Impact (Sustainability) and Risk to Its Realization		Combined Rating ^a	Justification/Annotations
2.1. Skills contribution. Contributes to new strategic, managerial, and operational skills with actual or potential wider replication in the sector and industry.	Excellent	Excellent	Low	Excellent	<p>PM2.2 is currently managed by a team of experienced professionals seconded from its three sponsor companies. PM2.2's staff of 70 consists of 5 foreign and 65 local staff.</p> <p>Transfer of technology and know-how from the sponsors to local staff has been considerable, especially in the areas of plant operations and health and safety procedures, by means of on-the-job and classroom training, technical training at General Electric's headquarters in Atlanta, and financial training at Electricité de France's headquarters in Paris. PM2.2 has successfully trained local staff to take over all management positions except five remaining expatriate positions.</p>
2.2. Demonstration of new standards. Demonstrates new ways to operate the business and compete, and investee performance against relevant best industry benchmarks and standards.	Satisfactory	Satisfactory	Low	Satisfactory	<p>PM2.2 uses modern technology for power plant operations (e.g., F class of gas turbine, which is the latest available technology). PM2.2. is one of the more efficient electricity generation plants in the world.</p> <p>PM2.2 follows a manual for a power plant management system that comprehensively covers all areas of operation, including internal control procedures. In addition, PM2.2 was certified International Organization for Standardization 14001 for environmental management and Occupational Health and Safety Assessment Series 18001 for occupational health and safety and will maintain its operating procedures to comply with these standards.</p>

Impact of the Project	Ratings				
	Impact to Date	Potential Impact (Sustainability) and Risk to Its Realization		Combined Rating ^a	Justification/Annotations
2.3. Improved governance. As evident in set standards in corporate governance; stakeholder relations; environmental, social, health, and safety fields; and/or in good energy conservation standards.	Excellent	Excellent	Low	Excellent	PM2.2 contributed to establishing the EMG within the Phu My Power Generation Center. The EMG also consists of representatives from PM3 and EVN as the operator of other Phu My plants. PM2.2 shares knowledge about environmental management with the EMG. Regarding safety, PM2.2 has coordinated with other industries in the compound. It also regularly conducts fire fighting training in coordination with provincial fire fighters.
3. Overall PSD Rating. Unsatisfactory, partly satisfactory, satisfactory, and excellent. The rating is not an arithmetic mean of the individual indicator ratings and does not have fixed weights. Actual positive or negative impacts, future impacts, and risks to its realization need to be considered.	Excellent	Excellent	Low	Excellent	PM2.2 is the first large-scale ,BOT, gas-fired power plant in Viet Nam and contributes to a more reliable base load and to more diversification of energy sources. The contractual structure and legal documentation were used as the basis for future IPP projects. The smooth operations created demonstration and catalytic effects for future private sector participation in the power sector. PM2.2 regards environment, health, and safety as priorities; adopts best practices in these areas; and shares the knowledge with other counterparts in the sector.

ADB = Asian Development Bank, BOT = build-operate-transfer, EMG = Environmental Management Group, EVN = Electricity of Vietnam, IPP = independent power producer, , PM2.2 = Phu My 2.2 Power Project, PM3 = Phu My 3 Power Project, PPP = Public Private Partnership

^a The combined rating should weigh future impact and risk to its sustainable realization.

^b Excellent, satisfactory, partly satisfactory, and unsatisfactory.

^c Rating scale as above.

^d Rating scale: Risk: High, medium, modest, and low.

Source: ADB.

ENVIRONMENTAL, HEALTH, AND SAFETY PERFORMANCE

1. The Phu My 2.2 Power Project (PM2.2 or the Project) consists of a two-unit, combined-cycle gas and steam turbine generation plant with gross output of 715 megawatts on a build-operate-transfer basis at the Phu My Power Generation Center in the Tan Thanh district of Ba Ria-Vung Tau province. The gas supply is provided by the Vietnam Oil and Gas Corporation, the state-owned upstream oil company, from the Nam Con Son Gas basin Block 6.1, via the Nam Con Son pipeline. The gas supply is governed by a gas supply agreement on a take-or-pay basis for 20 years. The electricity is purchased by Electricity of Vietnam, also under a 20-year power purchase agreement on a take-or-pay basis. The table presents the main design parameters for PM2.2.

Table A7.1: Main Project Impacts and Mitigation Measures during Operation

Impact	Possible Effects	Mitigation Measures
Climate	Greenhouse effect	Minimizing specific carbon dioxide emissions by assuring high plant efficiency and by using natural gas as fuel (about 420 kilograms/megawatt-hour).
Emissions	Nitrogen oxides and sulfur dioxide pollution	Limiting nitrogen oxide emissions by applying modern combustion. Limiting sulfur dioxide emissions by using of oil for a maximum of 5 days per year.
Ambient air quality	Increase of pollutant concentration	Minimizing impact because all plants at the Phu My Power Generation Center are based on combined-cycle systems and use gas, which has relatively low emission levels, as the main fuel. In addition, stack heights support good dispersion.
Noise	High noise levels near the plant	Applying noise protection measures to meet required standards.
Fresh water demand	Water availability	Fresh water demand of 30 to 50 cubic meters/hour, which is supplied by the Ba Ria Vung Tau Water Company via the existing Phu My Power Generation Center water pipe system.
Cooling water demand	Water availability	Limiting demand because of the use of combined-cycle technology. About 70% of power will be generated by gas turbines, which do not need cooling water. Maximum demand for PM2.2 is about 19 cubic meter per second and about 90 cubic meter per second for the Phu My Power Generation Center as a whole.

Source: Colenco and Fichtner. 2002. *Environmental Assessment Report for Build Operate Transfer (BOT) Project Phu My 2.2 715 MW Combined Cycle Power Plant*. Ho Chi Minh City.

2. The Phu My Power Generation Center covers a total area of approximately 152 hectares, of which PM2.2 has 8 hectares. The Phu My Power Generation Center consists of five power generation plants, Phu My 1, Phu My 2.1, Phu My 2.2, Phu My 3, and Phu My 4, with a combined capacity of 3,812 megawatts. The power plants share a common infrastructure

system, including roads, cooling water supply intake and outlet structures, canals, gas pipelines, gas metering stations, and power transmission, which were developed along with the first power plant.

A. Environmental Impacts and Mitigation Measures

3. The Asian Development Bank classified the Project as environment category A with potential environmental impacts if the appropriate mitigation measures were not properly incorporated in the Project's design, operation, and maintenance. The consortium of Colenco and Fichtner, based in Switzerland and Germany, respectively, prepared the environmental impact assessment (EIA) for the Project in January 2002 in accordance with the World Bank's Operations Policy 4.01: Thermal Power: Guidelines for New Plant.¹ The summary EIA was circulated to the Asian Development Bank's Board of Directors on 22 February 2002.

4. A safeguard mission fielded from 9–15 October 2007 to review the environmental performance of PM2.2 revealed that the Project has complied with its commitment to implement the mitigation measures in the EIA.

B. Environmental Monitoring System

5. PM2.2's environmental monitoring system adequately follows the original monitoring proposed in the EIA. The Project's monitoring system can be subdivided into three basic groups. The first group is continuous and automatic monitoring systems within the power plant for nitrogen oxides, sulfur dioxide, dust, carbon monoxide, Oxygen, stack temperature, water temperature before and after the condenser, and pH of the neutralization pit. Data from these systems are automatically linked to Electricité de France in France. Electricité de France technical staff review incoming data, and if they notice abnormalities, they contact the PM2.2 operator to discuss the issue and possible solutions. The second group is monthly monitoring on site for noise, wastewater for pH, biological oxygen demand, total suspended particles, total coliform, *E. coli*, heavy metals, and the like. The third group is quarterly monitoring of the entire complex's shared facilities and inside PM2.2 for ambient air quality (nitrogen oxides, sulfur dioxide, total suspended particles) noise, and ambient water quality (temperature, total suspended particles, nutrients, and so on). The results are compared with relevant Vietnamese and World Bank standards for automatic and monthly monitoring, and with Vietnamese standards for quarterly monitoring.

C. Institutional Arrangement for Environmental Management

6. The Quality, Health, Safety, and Environment Unit, manned by four staff (one manager, one safety engineer, one health, safety and environment technician, and one fire adviser) manages environmental performance and ensures compliance with applicable standards and regulations. The unit's manager also represents PM2.2 in the Phu My Power Generation Center's Environmental Management Group, which meets quarterly and is mandated to coordinate and oversee ambient environmental conditions and shared facilities, such as the common water intake system and effluent discharges.

7. The Project achieved International Organization for Standardization (ISO) 14001 on 19 October 2006. Its environmental management capacity has clearly been strengthened by the

ISO 14001 process: monitoring plans and reports are readily available; environment policy is clearly posted; activities and signage relating to environment, health, and safety are found throughout the site; and when questioned, the health environment and safety manager demonstrates a clear understanding of the strategic purpose and benefits of ISO 14001. The manager stated that the most prominent benefit is that unlike the Environment Management Plant prepared for the EIA, the ISO Environment Management Plant requires (and receives) buy-in from a broad range of project departments, thereby ensuring that environmental considerations are well integrated into plant operations.

E. Environmental Performance

8. Since the beginning of operations, environmental performance has generally met the standards prescribed in the EIA report. A review of reports found that air emissions (nitrogen oxides, sulfur dioxide, particulates, and carbon monoxide), water temperatures, and waste products have not exceeded standards. Industrial noise standards (85 decibel) are exceeded in many areas. To mitigate this, protective equipment is being issued to workers and exposure to extremely noisy areas is being limited to two hours. The Phu My Power Generation Center's monitoring program revealed noncompliance in relation to dust and wastewater (for total suspended solids, ammonia, and total coliform). These results are most likely due to factors unrelated to the Phu My Power Generation Center, but they do indicate the environmental stresses to which the project area is subject.

9. The Viet Nam Environmental Protection Agency issued a letter in December 2006 confirming that the environmental monitoring and waste management arrangements are consistent with the requirements in the EIA report and that PM2.2 should continue its monitoring activities and periodically report to the agency for approval. The agency also sent a comment letter to the Phu My Power Generation Center's Environmental Management Group stating that environmental monitoring for the complex was also considered consistent with the requirements detailed in the center's EIA report. Det Norske Veritas monitors the environmental performance of ISO 14001 activities.