

ASIAN DEVELOPMENT BANK

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**IMPACT EVALUATION STUDY
OF
ASIAN DEVELOPMENT BANK ASSISTANCE
TO THE
POWER SECTOR
IN
INDONESIA**

July 2003

CURRENCY EQUIVALENTS

Currency Unit – rupiah (Rp)
(as of 1 October 2002)

Rp1.00	=	\$0.000111
\$1.00	=	Rp9000.00

ABBREVIATIONS

ADB	–	Asian Development Bank
ADTA	–	advisory technical assistance
DGEEU	–	Directorate General for Electricity and Energy Utilization
DMC	–	developing member country
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
GDP	–	gross domestic product
IMF	–	International Monetary Fund
IPP	–	independent power producer
JEXIM	–	Export-Import Bank of Japan
JIBC	–	Japan Bank for International Cooperation
OECF	–	Overseas Economic Cooperation Fund
PCR	–	project completion report
PLN	–	P.T. Perusahaan Listrik Negara (Persero)
PPA	–	power purchase agreement
PPAR	–	project performance audit report
PPTA	–	project preparatory technical assistance
TA	–	technical assistance
T&D	–	transmission and distribution
WACC	–	weighted average cost of capital

WEIGHTS AND MEASURES

c-km	–	circuit kilometer
GWh	–	gigawatt-hour (1 million kWh)
kWh	–	kilowatt-hour
MVA	–	megavolt-ampere
MW	–	megawatt
MWh	–	megawatt hour

NOTES

- (i) The fiscal year (FY) of the Government and PLN ends on 31 December. Prior to 1995, FY of the Government and PLN ended on 31 March.
- (ii) In this report, "\$" refers to US dollars.

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EXECUTIVE SUMMARY

Between 1970 and 2001, the Asian Development Bank (ADB) provided the Government of Indonesia with 27 loans for 26 power sector projects, amounting to \$2.912 billion or 16% of total ADB lending to Indonesia. Additionally, 13 advisory and 11 project preparatory technical assistance (TA) grants totaling \$7.9 million were provided to the power sector. Indonesia ranks first in terms of total ADB assistance to the power sector in all its developing member countries. The Government's power sector policy in the past has focused on (i) diversification of generation mix away from oil, (ii) promotion of rural electrification and private sector participation, and (iii) supply and end-use efficiency improvements. ADB's lending strategy in Indonesia's power sector has focused on the development of indigenous energy resources, environmental protection, and institutional strengthening of P.T. Perusahaan Listrik Negara (Persero) (PLN), with increasing attention given to the social impacts of power projects, private sector participation, and sector restructuring.

This impact evaluation study mainly—but not exclusively—reviews the past performance, effectiveness, and impact of ADB's assistance to the Indonesian power sector since 1980. The objective of the study was to assess the broad development impacts of ADB's assistance to the power sector in Indonesia in terms of economic growth, social improvement, environmental protection, and policy and institutional changes, and to provide guidance for future operations. The study examines the outcomes and development impacts of the 10 projects commenced and completed after 1980 and the effectiveness of the seven advisory TAs approved and completed after 1992. PLN was the executing agency for all the loan projects and most of the TAs. In view of the importance of current power sector restructuring, the study also reviews the implementation and potential impacts of the ongoing program and TA loans approved in March 1999.

PLN has experienced continuing rapid growth in the last two decades and its operational performance has improved. The installed generating capacity of PLN grew from 2,680 megawatts (MW) in FY1980 to 9,120 MW in FY1990, and to 20,760 MW by 2000. PLN's energy sales increased from 6,200 gigawatt hours (GWh) in 1980 to 27,740 GWh in 1990, and 79,160 GWh by 2000. The percentage of rural villages electrified increased from about 17% in 1985 to 84% in 2000. Part of these achievements can be attributed to ADB's assistance.

Among the 26 projects financed by ADB loans, 22 have been completed, three are ongoing, and one was cancelled. One project was financed by a blend of Asian Development Fund and ordinary capital resources. Of the 12 projects commenced and completed after 1980, four have been postevaluated and all rated as generally successful. The study reconfirmed the findings of project completion reports and project performance audit reports that the principal objectives of the power sector projects at the time of appraisal were substantially met. These objectives included (i) expanding or upgrading power supply to meet growing demand for electricity, (ii) developing energy infrastructure based on indigenous resources, (iii) improving overall power system reliability and efficiency, and (iv) improving the access of rural people to electricity. Despite the generally positive evaluation of the completed projects, significant delays were experienced by almost all completed projects. The general conclusion drawn was that project implementation schedules need to be scrutinized more closely, especially with regard to the time required for releasing counterpart funds by the Government, procurement procedures, and securing rights-of-way for transmission lines.

ADB's assistance to the Indonesian power sector succeeded in meeting its output targets at the project level. ADB-financed investment projects have directly resulted in additions to the power system of about 2,480 MW of generating capacity, 1,790 circuit-kilometers (c-km) of 275 kilovolt (kV) and 500 kV transmission lines, 3,010 c-km of 70 kV and 150 kV transmission lines, and 20,120 c-km of low and medium-voltage distribution lines.

Funding for 500 kV transmission system development and expansion on Java was a feature of ADB's assistance to the Indonesian power sector from the early 1980s. These investments in 500 kV transmission systems increased bulk power transmission capacity in Java and improved power system efficiency, most importantly by bringing about the interconnection of major generation sources and load centers, thus establishing the foundation of the cost-effective main power grid in Java.

Apart from assessing the performance of ADB's assistance at the project level, this study takes a broader view, giving more importance to the long-term development impacts of ADB's assistance. The macroeconomic impact of ADB's assistance was examined by using a general equilibrium model calibrated with a database representing the Indonesian economy in 2000. The result shows that the linkage between economic growth and ADB's power sector assistance is clear but relatively weak due mainly to the fact that the share of electricity in the model is very small.

A sample of projects financed under four loans was selected to assess the socioeconomic and environmental impact of ADB's power sector projects. Field surveys were carried out at selected locations. The findings from the socioeconomic survey confirmed that in all selected locations ADB-financed power projects had a positive poverty reduction impact through employment generation during project construction, creation of employment in power service delivery, and new economic opportunities in connection with the use of electricity after project completion. The increases in either the quantity or quality of electricity supply have had distinct impacts on the quality of life for many people, including the poor. The use of electricity adds convenience to people's everyday life. Improved lighting extends the hours for work, education, and recreation. Outdoor illumination enlivens communities and contributes to improved security. ADB's assistance to the power sector in Indonesia has made significant contributions in these regards. The study has not found significant social and environmental issues that had not been addressed in ADB power sector operations in Indonesia.

ADB's policy dialogue with the Government brought about successful implementation of PLN's action plan for efficiency improvements in the late 1980s. As a result, PLN's operational efficiency improved significantly between 1985 and 1996. System losses were reduced from 25% in 1985 to 12.1% in 1996. Sales per employee increased from 222 megawatt hours (MWh) in 1985 to 1,161 MWh in 1996. The share of oil-based generation fell from 75% in 1985 to 26% in 1996. Accounts receivable dropped from 2.1 months in 1985 to 1.4 months in 1996. PLN became, overall, a well-run power utility with acceptably low energy losses, good revenue collection, and a steadily improving network suited to the demand for electricity.

Compared to the volume of lending operations, the size of the grant-financed TA program was small. While the TA program responded to the sector's requirements and was appropriate in nature, recommendations generated by the TAs with respect to energy conservation, tariff rationalization, and sector restructuring appear to have been used less than expected.

ADB's effort to help PLN become a technically competent, efficient, and modern public utility was successful. Its assistance through loans, TA, and policy dialogue with the Government made important contributions to the improved technical capability of PLN and operational performance of the sector. Nevertheless, the financial position of PLN remains problematic. Improvements in operations of, and ability to make rational tariff proposals by, PLN did not make PLN financially viable, since the Government often had not been able to approve the proposals fully or in time. While the covenanted financial targets were often not met, PLN did turn profitable in 1990 and remained profitable till 1997 with reasonable rates of return on revalued assets, debt service coverage, and self-financing ratios. Since then the economic and political problems associated with the Asian financial crisis have seriously eroded the financial soundness of PLN. Recent attempts by the Government to raise tariffs every quarter to enable PLN achieve an 8% rate of return by 2005 may yet return PLN to financial soundness. ADB has played a major role in the power sector restructuring since 1998 through policy-based program lending. However, significant delays in implementing the policy and structural changes outlined in the program loan suggest an overoptimistic implementation time frame.

This study concludes that ADB's conventional lending operations to the Indonesian power sector have had significant impacts in terms of power system development, macro-economic linkages, socioeconomic development, and institutional development, but its sector reform assistance—the complexity of which is recognized in this study—has not met with the same level of success to date. Overall, ADB's assistance to the Indonesian power sector has been assessed as successful.

The study identified the following key issues relevant to ADB's future operations in Indonesia's power sector:

- (i) The success of ADB's operations is attributable in large part to the appropriateness of government policies most of the time and ADB efforts to reconcile them, as needed, with ADB's sector strategy through policy dialogue undertaken during country programming and project processing missions. Thus, a thorough understanding is required of wider development priorities at the time of appraisal, accompanied by the flexibility to adjust policy to suit changing circumstances. In this context, the importance of policy dialogue during country programming and loan processing cannot be underestimated.
- (ii) Even when the targets specified in the financial covenants are not met fully, continued support by way of further lending may still be appropriate, as long as the utility is allowed to remain profitable and reach reasonable financial soundness. When the Government's willingness to move in the right direction and improve the finances of the utility becomes suspect, such support should be discontinued.
- (iii) Policy-based lending has been only moderately efficacious and financial assistance alone has had a limited impact on the speed and scope of sector reform. Program loans need to be disbursed fast, while the implementation of structural reform needs a much longer time frame. This calls for new and imaginative lending modalities, such as hybrid loans with both project and policy implementation components (sector development programs) or a cluster of program loans each tied to implementation of key specific milestones of the sector reform.
- (iv) The significant cost underruns in projects evident in this study should not recur to the same extent. They suggest a systemic weakness in project planning, design,

and implementation, and particularly in cost estimation. There is room for improvement in PLN, the Government, and ADB in this regard.

- (v) Although the private sector is expected to play an increasing role in the future, PLN will still have to make significant investments in generation outside Java-Bali, as well as the transmission and distribution facilities throughout the country. Notwithstanding its ability to self-finance a proportion of the requirements, PLN is expected to require further assistance from some or all of its traditional external sources including ADB.
- (vi) In light of the changed political and economic realities of Indonesia and newly adopted geographical focus for ADB operations in Indonesia, ADB's assistance in the power sector will favor provinces outside Java in the future. Different tactics and approaches from those adopted for Java-Bali are required to address the special features of the outer islands where technical, financial, and managerial capabilities of the local governments and special business units are relatively weak.

INDONESIA

ADB ASSISTANCE TO POWER SECTOR IN EACH PROVINCE



I. INTRODUCTION

1. With a population of around 214 million, 58% of whom live in rural areas, Indonesia had achieved strong economic development with gross domestic product (GDP) growth at about 7% annually over the two decades before the Asian financial crisis in 1997–1998. The incidence of poverty in Indonesia, i.e., proportion of the population under the poverty line, steadily decreased from 21.6% in 1984, to 15.1% in 1990, and 14.7% in early 1997. The Asian financial crisis affected Indonesia more than any other country in the region with depreciation of the rupiah against the United States dollar by more than fourfold. GDP growth fell to 4.7% in 1997; GDP contracted by 13.2% in 1998. The poverty incidence soared from late 1997 to a peak of 23.5% in early 1999. From 1999, however, the economy started to show signs of recovery with GDP growth at 0.2% in 1999, 4.8% in 2000, and 3.3% in 2001.

2. Electricity has played an important role in the development of the Indonesian economy and improved access to basic services. For nearly 20 years preceding the Asian financial crisis, the average annual growth rate of electricity sales of P.T. Perusahaan Listrik Negara (Persero) (PLN) was 14.6%, which indicated an elasticity of electricity sales growth to GDP growth of about 2.3. The total number of electricity consumers increased nearly elevenfold from 2.7 million in 1980 to 11.5 million in 1990, and 28.6 million in 2000. The percentage of rural customers in total PLN customers increased from 38% in 1985 to 67% in 2000. The percentage of rural villages electrified (rural electrification ratio) also increased significantly from about 17% in 1985 to 38% in 1990 and 84% in 2000.

3. Indonesia has been the largest recipient of Asian Development Bank (ADB) loans in the power sector of all ADB's developing member countries (DMCs). Geographically, ADB power sector operations have covered all provinces in Indonesia. Functionally, ADB's intervention has focused on developing non-oil-based power generation and associated transmission, distributing electricity to existing and new consumers, integrating isolated systems, improving supply efficiency, and strengthening institutions. The objective of this impact evaluation study¹ is to assess the broad development impact of ADB's assistance to the power sector in terms of economic growth, social improvement, environmental protection, power sector development, and institutional capacity enhancement.

4. Considering data availability, this study mainly—but not exclusively—evaluates ADB's assistance to the Indonesian power sector since 1980. The study examines the outcomes and development impact of 10 loan projects commenced and completed after 1980² and the effectiveness of the seven advisory technical assistance (TA) grants approved and completed after 1992.³ It also examines the implementation and potential impacts of the program and TA

¹ The study was undertaken by an Operation Evaluation Mission comprising H. Wang, Evaluation Specialist/Mission Leader; J. Wilson and J. Toomey (Staff Consultants) assisted by an international consultant (B. Smith) and four domestic consultants (E. Ginting, E. Suleeman, L. Miftahul Jannah, and Suyud Warno Utomo). Peer review of the report was undertaken by an international consultant (V. Krishnaswamy).

² These projects were under Loans 430-INO: *Java EHV Transmission* (the loan was approved in 1979, and became effective in 1980), 459-INO: *Second Java EHV Transmission*, 544-INO: *Surabaya Distribution and Sulawesi Power*, 569-INO: *Second Sulawesi Power*, 600-INO: *Transmission and Distribution System Development*, 674-INO: *Power XVIII*, 835-INO: *Power XIX*, 1032-INO: *Power XX*, 1092-INO: *Power XXI*, and 1172-INO: *Power XXII*.

³ TAs 2171-INO: *Environment and Energy Efficiency*, 2227-INO: *Load Characteristics Survey Outside Java*, 2429-INO: *Strategic Planning for Power Sector Study*, 2430-INO: *Geothermal Power Development Study*, 2633-INO: *Electricity Tariff Rationalization Study*, 3027-INO: *Revaluation of the Operating Assets of PLN*, 3083-INO: *Development of Power Sector Restructuring Policy*. These TAs gave a complete picture of the institutional issues addressed through advisory TAs since 1980.

loans approved in March 1999.⁴ Special attention has been paid to four recently completed sample projects.⁵ The content of these selected projects reflects the broad range of ADB's lending to the power sector and thus provided the opportunity to distill from them a sufficiently comprehensive assessment of broad development impacts. PLN was the executing agency for all the project loans. The Directorate General for Electricity and Energy Utilization (DGEEU) was the executing agency for the program and TA loans.

5. This study started with a desk review of relevant ADB documents and PLN's annual reports. The ADB country assistance plan and country operational strategy for Indonesia, ADB energy policy papers, reports and recommendations of the President, project completion reports (PCRs), and project performance audit reports (PPARs) served as major references for the study. The study also undertook interviews with officials from key governmental and nongovernmental agencies active in the sector, as well as from other aid agencies. Field visits were made to selected project sites in North Sumatra, West Sumatra, South Sulawesi, North Sulawesi, and West Java. A general equilibrium model calibrated with a database representing the Indonesian economy in 2000 was used to estimate the macroeconomic impacts of ADB assistance to the power sector. A household survey was also carried out in selected project areas to assess the socioeconomic and environmental impacts of ADB-financed projects.

6. The financial internal rates of return (FIRRs) and economic internal rates of return (EIRRs) of the four sample projects were recalculated to check their financial and economic impacts. The FIRRs and EIRRs of other projects reported in PCRs and PPARs were also reviewed.

II. THE POWER SECTOR IN INDONESIA

A. Sector Structure at Present

7. Responsibility for the formulation and promulgation of power sector policy in Indonesia lies with the Ministry of Energy and Mineral Resources, which discharges its responsibilities through the DGEEU. The primary license (authority) for power generation, transmission, and distribution in Indonesia is held by PLN under the Electricity Law of 1985.⁶ PLN's top level of management is composed of executive directors, known as the Board of Directors, who report through the president director to a board of commissioners composed of nominated government officials.

8. PLN has two wholly owned subsidiaries that own and operate the power generation plants in Java; 1 power transmission unit and 4 power distribution units in Java; 17 regional operational units outside Java that, with the exception of Sumatra, handle generation and transmission as well as distribution; 2 operational units in Sumatra responsible for generation and transmission; and various other special units including for construction.

9. In mid-1999, a new law on regional autonomy was enacted, which gave a larger role to the local governments in planning and development activities. In response to the initiative for regional autonomy, the focus of the ongoing reorganization is decentralization and empowerment of operational units to become strategic business units. The corporate office,

⁴ Loan 1673-INO: *Power Sector Restructuring Program* and Loan 1674-INO: *Capacity Building for Establishment of a Competitive Electricity Market*.

⁵ These are distribution expansion in 40 towns outside Java in Loan 835-INO; Singkarak hydropower scheme in Loan 1032-INO; 500 kilovolt transmission grid expansion and Darajat geothermal power scheme in Loan 1092-INO; and expansion of the Suralaya coal-fired power station in Loan 1172-INO.

⁶ PLN's responsibilities may change as a result of the passage of the new Electricity Law in September 2002.

which earlier took all decisions in operational and investment-related matters, is now transforming itself as a “holding company” with strategic business units as “virtual” subsidiaries.

B. Historical Perspective and Development

10. PLN is a long-established organization with roots that go back to the 1800s, so it is appropriate to view ADB’s assistance since the 1980s within the context of PLN’s origins and progress to date.

11. PLN was formed in 1950 after the Government acquired various power companies that had been independently operating in the country.⁷ Its subsequent development is characterized by four distinct phases. The first phase, from 1950 to the early 1960s, was a period of establishment and organizational growth and is not examined in this study. The second phase, from then to the late-1980s, reflected rapid growth as the country underwent industrial development and the coverage of electrification was extended, combined with measures to improve efficiency of operation. In 1972, PLN’s status was changed from a department of the Ministry of Public Works and Electric Power to a state-run corporation, which was wholly owned by the Government and functioned with a fair degree of autonomy in its day-to-day operations. The third phase comprised recognition by the Government of the need for private investment in the sector, leading to the introduction of independent power producers (IPPs). In 1994, PLN was converted from a state-run corporation without authority to issue shares (a *Perum*) into a state-owned limited liability company whose shares can eventually be owned by private investors (a *Persero*). The Asian financial crisis in 1997 and PLN’s subsequent recovery since then constitutes the fourth phase.

12. During the 1970s and 1980s there was a rapid expansion in the availability of electricity. The installed capacity of PLN grew from 500 megawatts (MW) in FY1970 to 2,680 MW in FY1980, and to 9,120 MW by FY1990. PLN’s energy sales increased from 2,444 gigawatt hours (GWh) in FY1974 to 27,740 GWh in FY1990, at an average growth rate of 16.4%. This rate of increase can be attributed almost entirely to growth in customer numbers. Residential customers increased from 913,940 to 10,742,000, industrial customers from 7,145 to 36,000, and business customers from 78,080 to 404,000 between FY1974 and FY1990. The expansion in capacity played a key role in accommodating the large increase in power demand from the fast-growing manufacturing sector and rural development.

13. PLN’s efforts in the second half of the 1980s were directed at increasing electrification, particularly in rural areas, and at improving the adequacy and reliability of public power supply. During the 1980s, it was one of the fastest-growing power utilities in the region with an electricity demand doubling every 4-5 years and with more than a million new customers connected every year. Some features of power sector development in Indonesia compared with that in some of its neighbors between 1984 and 1994 are given in Table 1.

14. Recognition by the Government in the late 1980s of a widening gap between the demand for power and PLN’s capacity to supply it led to the acceptance that the private sector would need to play an important complementary role in the power sector. The Government issued Presidential Decree No. 37 in 1992 to allow private capital, including foreign capital, to supply bulk power to PLN. As a result, 27 power purchase agreements (PPAs) were signed for

⁷ Electricity was first introduced in Indonesia towards the end of the 19th century when Dutch companies, such as tea and sugar plantations and factories, installed electric power plants for their own use. The first public electricity supply began when a Dutch-owned gas company expanded its activities to power after 1980. A state electricity company was also formed in 1927 to manage hydroelectric plants.

a total prospective installed generating capacity of around 11,000 MW. Expansion of transmission and distribution facilities remained the exclusive responsibility of PLN.

Table 1: Regional Electricity Profile, 1984–1994

Country	Average Annual Growth of Generation (%)	Growth in Electricity Consumption per Capita (kWh)	Elasticity of Electricity Sales to GDP Growth
Indonesia	12	12.6	2.0
Malaysia	9	8.7	1.7
Thailand	8	11.7	1.5
Philippines	5	2.4	2.3

GDP = gross domestic product, kWh = kilowatt-hour.

Source: Asian Development Bank. 1997. Electric Utilities Data Book.

15. Around the same time, the Government also promoted a small-scale power generation program, inviting private sector investors to fund renewable energy generation plants. However, the Asian financial crisis brought the program to a halt and PLN chose to cancel the contracts.⁸

16. Table 2 summarizes PLN's development during 1980–2000, highlighting its continuing rapid growth. The significant increase in residential customer numbers over this period reflects the widespread extension of electrification into rural areas. By 2000, electricity had been extended to 49,155 of the 58,545 villages and about 52% of the estimated 52 million households in the country were PLN customers. The percentage of rural customers in total PLN customers increased from 38% in 1985 to 67% in 2000. Plant generation mix also improved between 1980 and 2000. While the percentage of hydropower remained almost unchanged, the share of diesel generation decreased from 22% in 1980 to 12% in 2000. The composition of PLN's generating capacity in 2000 is 15% hydropower, 32% coal-fired plant, 12% diesel, 33% natural gas fixed combined-cycle plant, 6% gas turbines, and about 2% geothermal. Seventy-five percent of the generating capacity is on Java.⁹

17. PLN's growth continued in 2001, with energy sales increasing by 6.8% and the number of customers increasing by 4.3%. In a country consisting of five large islands and hundreds of small islands with a total area of 1.9 million square kilometers and stretching from India to Australia, such extensive coverage of urban and rural population by electricity supply is clearly a noteworthy achievement.

18. The presence of a significant privately owned captive power generation capacity is a noteworthy feature of the Indonesian power sector. In 2000, the total installed captive generation capacity was 13,900 megavolt amperes (MVA) compared with PLN's installed capacity of 26,000 MVA.¹⁰ Approximately 60% of captive generation capacity is estimated to

⁸ By mid-1997, PLN had signed PPAs with about 26 companies that planned to add 280 MW of power from 44 such power plants, each with a capacity less than 30 MW. Unlike the PPAs for the large conventional power plants, the Government did not offer any assurances and the tariff was fixed in rupiah. The companies were given a year for financial closure and another two for implementation.

⁹ The Java-Bali area accounts for around 77% of Indonesian GDP, highlighting the importance of the Java-Bali power system.

¹⁰ The word "captive" in this context means "for-own-use". PLN describes 5,600 MVA of the total of 13,900 MVA as being "pure" captive plant—that is plant for own use as the main resource in the production process—and the balance of 8,300 MVA as being "reserve". Irrespective of categorization, it constitutes a significant additional generation resource. The installed capacity for captive generators is expressed in MVA rather than MW because only their installed MVA capacities are known but the operating power factor is unknown. MW and MVA are not interchangeable here.

come from diesel generators, and about 25% from cogeneration plants using different fuels. Of these capacities, approximately 70% and 31%, respectively, were outside Java. The high proportion of captive plants outside Java reflects, to some extent, the less developed nature of PLN's systems in the other islands. The high proportion of reserve plants in Java reflects a greater degree of commercial and industrial development requiring a higher level of security of power supply. The Government's policy of allowing the continued growth of captive generation capacity provides a built-in compulsion to PLN to improve its efficiency, and permits industry and commerce to grow unhampered by the shortage of PLN resources even faster than it has done in the past.

Table 2: Rapid Growth of P.T. Perusahaan Listrik Negara, 1980-2000

Indicator	Measure	1980	1985	1990	1995	2000
Installed Generating Capacity	MW	2,680	5,810	9,120	14,990	20,760
Transmission Lines of 70 kV and Above	circuit- km	6,370	9,785	13,780	18,640	24,780
Distribution Lines of Low and Medium Voltage	circuit-km	47,000	102,185	200,150	330,750	501,000
Customers						
Residential	'000	1,956	5,514	10,742	18,325	26,797
Industrial	'000	12	20	36	45	44
Business	'000	190	277	404	621	1,063
Others	'000	587	142	251	480	691
Total	'000	2,745	5,953	11,463	19,471	28,595
Energy Sales	GWh	6,560	12,645	27,740	49,750	79,160
Transmission and Distribution Losses	%	23.0	19.8	15.6	12.3	11.7
Average energy sold						
Residential	kWh/ customer/yr	1,156	911	838	931	1,140
Industrial	kWh/ customer/yr	164,295	241,520	392,270	549,465	767,150
Business	kWh/ customer/yr	3,854	4,156	5,758	8,192	9,950
Household Electrification Ratio	%	6.5	15.3	26.9	42.2	52.0
Rural Electrification						
Percentage of Villages Electrified	%		17.6	38.6	61.8	84.0
Number of Rural Customers	Million		2.3	6.4	11.9	19.3

GWh = gigawatt-hour, km = kilometer, kWh – kilowatt-hour, MW = megawatt .

Source: P.T. Perusahaan Listrik Negara (Persero) data.

III. EXTERNAL ASSISTANCE TO THE SECTOR

A. Asian Development Bank Assistance

19. ADB's operations in the power sector in Indonesia commenced in 1970 with a project preparatory technical assistance (PPTA), followed by two project loans and another PPTA in 1971. Between 1970 and 2001, ADB approved 27 loans (six from the Asian Development Fund

and 21 from ordinary capital resources) for 26 power sector projects, amounting to \$2.912 billion or 16% of total ADB lending to Indonesia. One project was financed by a blend of Asian Development Fund (Loan 166-INO[SF]) and ordinary capital resources (Loan 167-INO) loans. PLN was the executing agency for all projects except the program and TA loans approved in 1999.¹¹ Additionally, 13 advisory and 11 PPTAs totalling \$7.9 million were approved. The loans covered a wide range of power projects, including hydro, diesel, geothermal, and coal-fired thermal power plants, as well as transmission and distribution systems. Earlier TAs were all for the preparation of projects. After 1986, project preparation activities were financed with loan funds and TAs mostly used for addressing specific technical and institutional issues.¹² A list of the loans and TAs is given in Appendix 1.

20. Until 1997, the Government and PLN regularly prepared policy papers and power sector development plans to set objectives, identify investment programs, and allocate resources. ADB's lending operations for power system development were formulated in line with the national development plan, Government sector policy, and ADB's sector policy prevailing at the time. Excluding the program and TA loans, the proceeds of ADB's loans were broadly allocated as follows: 48% to generation, 36% to transmission, and the remaining 16% to distribution. Of the 48% allocated to generation, hydropower accounted for 29 percentage points, coal-fired power plant for 17, and geothermal power plant for 2.

21. The 13 advisory TAs supported, among other things, creation of the PLN design unit; strategic planning of power sector development; power demand analysis; training for environmental planning and management of coal-fired power plants; and studies covering tariff rationalization including the development of an automatic adjustment mechanism, energy efficiency and environmental improvements, geothermal power development and steam pricing, the revaluation of PLN's network assets, and power sector restructuring assistance.

22. Table 3 provides an overview of the 10 loan projects and Table 4 lists the seven TAs covered by the study.

23. The projects under loans 430 and 459-INO were formulated on the basis of PLN's 8-year power development plan (1979-1987) to connect three independent power supply systems in Java and increase the generation capacity using non-oil resources to the maximum extent possible. These projects introduced 500 kV extra high-voltage transmission technology into Indonesia and connected three previously isolated power systems.

24. Between 1982 and 1995, under the guidance of the first Energy Policy Paper,¹³ ADB's lending strategy for the Indonesian power sector (apart from supply augmentation in line with PLN's power development plan) was intended to help create energy infrastructure based on indigenous energy resources, address environmental and social impacts of new projects, and strengthen the institutional capacity of PLN. From Loan 544-INO onward, the project objectives shifted in emphasis from capacity expansion alone to include establishing new customer connections, improvement of the quality and reliability of power supply, development of renewable energy resources, and institutional capacity building of PLN.¹⁴

¹¹ DGEEU was the executing agency for the program loan of \$380 million (Loan 1673-INO) and the accompanying TA loan of \$20 million (Loan 1674-INO).

¹² After 1986, two PPTAs were approved, namely TA 3481-INO: *Outer Island Electrification in 2000* and TA 3807-INO: *Regional Power Transmission and Competitive Market Development* in 2001.

¹³ In March 1981, ADB issued a Policy Working Paper No. 2-81: *Role of the Bank in the Energy Sector in the Region*.

¹⁴ Institutional support components under Loans 600-INO and 674-INO were later cancelled at the requests of the Borrower. PCRs and PPARs do not provide any reason for the cancellation. A number of ADB's DMCs do not wish to utilize loan funds, and look instead for grant funds for institution building components.

Table 3: Projects Covered by the Study

Loan No.	Project Content
430-INO approved in 1979	The project's objective was to transmit power from the coal-fired thermal power plant in Suralaya to Jakarta and other load centers in West and Central Java. It provided for construction of 119 kilometers (km) (238 circuit-km [c-km]) of 500 kilovolt (kV) transmission lines in West Java between Suralaya and Jakarta (Gandul) together with 500 kV substations at Suralaya and Gandul (1,000 MVA). The project introduced extra high-voltage transmission technology into Indonesia and connected three previously isolated power systems.
459-INO approved in 1980	The project objective was the same as for Loan 430-INO. The project provided for construction of 139 km (152 c-km) of 500 kV transmission lines from Jakarta (Gandul) to Bandung via Cibinong in West Java and 500 kV substations at South Bandung (500 MVA) and Ungaran (500 MVA) in Central Java.
544-INO approved in 1981	The project objectives were to reinforce the power distribution system near Surabaya, increase generating capacity in the Minahasa area, expand transmission system near Ujung Pandang (Makassar), provide consulting services for the preparation of a hydropower project in Sengguruh, and strengthen PLN's operations. Project scope included expansion of transmission and distribution (T&D) systems in Surabaya consisting of 90 km of transmission lines, 400 MVA of substation transformers, 1,000 km of distribution lines, 200 MVA of distribution transformers and 114,000 new customer connections; construction of the 17 MW Tanggari I hydropower project in North Sulawesi including 12 km of transmission lines; the construction of 18 km of transmission lines for the expansion of the transmission system in Ujung Pandang; engineering design of the 29 MW Sengguruh hydropower project in East Java; and set-up of Engineering Design Centre in PLN.
569-INO approved in 1982	The primary project objectives were to rehabilitate and strengthen power transmission and distribution systems in North and Central Sulawesi, to connect about 72,000 new consumers in Minahasa and Ujung Pandang, and to fund feasibility studies for hydropower generation at the Tanggari I Power Station in Manado. The project scope included rehabilitation and extension of T&D systems in the Minahasa area in North Sulawesi consisting of 20 km of transmission lines, 30 MVA of substation transformers, 1,050 km of distribution lines, 55 MVA of distribution transformers and 30,000 new customer connections; rehabilitation and extension of the T&D systems in the Ujung Pandang area consisting of 12 km of transmission lines, 20 MVA of substation transformers, 100 km of distribution lines, 46 MVA of distribution transformers; and consulting services for preparation of feasibility study for 19 MW Tanggari II hydropower project.
600-INO approved in 1982	The project's objectives were to improve the quality of power supply for about 320,000 existing consumers and to provide electricity to about 270,000 new consumers in five cities, to discourage industrial and commercial users from setting up uneconomic captive plants, to better utilize hydropower resources to achieve overall economy in operations of PLN, and to strengthen the institutional capability of PLN. The project provided 92 km of transmission lines, 265 MVA of substation transformers, 1,570 km of distribution lines, 540 MVA of distribution transformers and 846,000 new customer connections as compared to 270,000 envisaged at appraisal; and included a study for the development of mini hydropower for supply to rural and isolated areas. Consulting services for strengthening the institutional capability of PLN in fields of project evaluation and load management was cancelled at the request of PLN.
674-INO approved in 1983	The main project objectives were to develop hydropower and geothermal resources to supply power to new consumers, improve the quality and reliability of power supply for about 80,000 existing consumers and provide electricity to about 189,000 new consumers

Loan No.	Project Content
	<p>in North Sumatra and Bali, discourage industrial and commercial users from setting up uneconomic captive plants, and strengthen PLN's capability in financial management. The project consisted of the following parts: construction of the 29 MW Sengguruh hydropower project in East Java; construction of the 16 MW hydropower project in South Sumatra; T&D extension in North Sumatra consisting of 327 km of transmission lines, 60 MVA of substation transformers, 1,155 km of distribution lines, 27 MVA of distribution transformers and 112,000 new customer connections; distribution system extension in Denpasar (Bali) consisting of 3,186 km of distribution lines, 65 MVA of distribution transformers and 147,000 new customer connections; engineering design of the 175 MW Singkarak hydropower project in West Sumatra; feasibility study and engineering design of the 55 MW Dieng geothermal project in Central Java. Institutional support to PLN in financial management was cancelled at the request of PLN.</p>
835-INO approved in 1987	<p>The project objectives were to reduce energy losses in distribution systems, improve the quality and reliability of power supply, expand distribution systems to provide electricity to new consumers, and enable PLN to better utilize its available generation, transmission, and distribution facilities. The project covered a 3-year time slice of PLN's distribution system development outside Java (sector loan). The project was expected to cover 40 major towns but this was expanded to 80 accounting for more than 50% of PLN's energy sales outside Java. The project provided 7,344 km of distribution lines, 630 MVA of distribution transformers and 420,000 new customer connections.</p>
1032-INO approved in 1990	<p>The project objectives were to develop a hydropower generation facility that would replace the small, uneconomical oil-fired generating units and meet the long-suppressed incremental power demand of the central Sumatra region by the least-cost generating option. The project provided for construction of the 175 MW Singkarak hydropower project in West Sumatra and engineering design for the 19 MW Tanggari II hydropower project in North Sulawesi.</p>
1092-INO approved in 1991	<p>The project objectives were to expand bulk power transmission capacity in Java and meet the rapidly growing demand, to develop a renewable energy resource in West Java, and to prepare for the development of renewable energy resources in Sumatra. The project provided for reinforcement and expansion of 500 kV transmission on Java by the addition of 301 km (351 c-km) of 500 kV transmission lines and extensions to 500 kV substations at South Bandung and Ungaran; construction of the 55 MW Darajat geothermal power plant in West Java; engineering design for the 210 MW Musi hydropower project in southern Sumatra; engineering design for the 57 MW Peusangan hydropower project in Aceh in northern Sumatra.</p>
1172-INO approved in 1992	<p>The project was an integral part of the least-cost power development plan for Java-Bali system. By using indigenous coal as fuel, the project contributed to the Government's policy of releasing oil for export. The project provided for expansion of Suralaya coal-fired power station in West Java by addition of 3 x 600 MW units (5, 6, and 7); reinforcement of the associated 500 kV transmission grid by the addition of the 125 km Cilegon to Cibinong 500 kV transmission line in West Java. An advisory technical assistance to assist PLN in strengthening its capability to handle environmental matters accompanied the project.</p>

25. Introduction of ADB's Energy Policy in October 1995 emphasized enabling private investment in the energy sector, demand-side management, integrated resource planning, energy efficiency, and local and national environmental considerations. Since 1996, ADB lending mainly supported the Government for its Power Sector Restructuring Program, and the program and the TA loan (1673-INO and 1674-INO) were approved in March 1999.

26. In line with ADB's Energy Policy, most recent advisory TAs mentioned in Table 4 focused on the three key areas in power sector development: environmentally sustainable development and energy conservation, tariff rationalization, and sector restructuring.

Table 4: Advisory Technical Assistance Covered by the Study

TA No	Scope of Technical Assistance
2171 approved in 1994	The technical assistance (TA) was to support the Government's energy policy of environmentally sustainable development and utilization of the country's energy resources. The TA covered three main topics: (i) total energy management of urban buildings, (ii) energy efficiency labeling program, and (iii) environmental impact assessment of transmission lines.
2227 approved in 1994	The objective of the TA was to provide technical inputs to determine consumer load characteristics for designing a simplified and rational tariff based on long-run marginal cost. The TA made a survey of the load characteristics of eight interconnected systems outside Java. The results of the TA were used in TA 2633-INO: Electricity Tariff Rationalization Study.
2429 approved in 1995	The main objective of the TA was to prepare a strategic plan for the development of power sector for optimal utilization of indigenous energy resources. The TA proposed a strategic plan for the development of the Indonesian power sector on the basis of the optimal use of the indigenous energy resource potential and available financial resources. The study recommended the unbundling of PLN and the restructuring of the power sector in progressive stages to a multiple buyer/multiple seller model.
2430 approved in 1995	The main objective of the TA was to identify the barriers to development of Indonesia's geothermal power potential and recommend remedial measures for its optimal utilization. The TA examined the geothermal development potential and made recommendations regarding the pricing and commercial aspects for the delivery of geothermal power, the required legal and regulatory arrangements, and the associated institutional framework.
2633 approved in 1996	The objective of the TA was to analyze the extent of cross-subsidies in electricity tariff and the social impact of eliminating them, and to develop a medium-term strategy for phasing out the cross-subsidy. The TA proposed a phased, time-bound program for increasing electricity tariff that was later integrated into the Power Sector Restructuring Program Loan approved in 1999.
3027 approved in 1998	The main objective of the TA was to clarify the asset base used for the rate of return loan covenant, and determine electricity tariffs that would be required to enable PLN to comply with that covenant.
3083 approved in 1998	This was a small-scale TA to finance a workshop for formulation of a power sector restructuring policy in conjunction with the processing of the Power Sector Restructuring Program Loan.

27. ADB-financed projects have directly resulted in additions to the power system of about 2,480 MW in generating capacity; 1,790 c-km of 275 kV and 500 kV transmission lines; 3,010 c-km of 70 kV and 150 kV transmission lines; and 20,120 c-km of low and medium-voltage distribution lines; an estimated 2,500 MVA of transformer capacity at various levels in the system; and direct connection of around 1.6 million customers. These capacity additions accounted for about 14% of the total increase in PLN's generation capacity, 26% of the increase in its transmission capacity, and 4% of the increase in PLN's distribution capacity between 1980 and 2000.

28. Funding for 500 kV transmission system development and expansion on Java was a feature of the ADB's assistance from the early 1980s to the mid-1990s, commencing with Loan 430 and continuing with loans 459, 1092, and 1172. These projects increased bulk power transmission capacity in Java and, most importantly brought about the interconnection of major generation sources and load centers, establishing the foundation of the main power grid in Java.

29. Investments in regional transmission and distribution made a significant contribution to the electrification of regions outside Java by supporting urban development, rural electrification initiatives, loss reduction, and improvement in the reliability of power systems.

B. Performance of Asian Development Bank Operations

30. Of the total 27 ADB loans for 26 projects approved before 2001, 20 projects¹⁵ have been completed and PCRs were prepared for all. However, only 6 out of 21 PCRs provided specific project ratings. Three of them were rated as generally successful and three as partly successful.¹⁶ The conclusions of the PCRs were generally favorable. PPARs were prepared for all loans¹⁷ approved before April 1982, except loans 125-INO (footnote 16) and 343-INO, but none for projects after that time. Of the 13 projects that have been postevaluated since commencement of ADB lending to the Indonesian power sector in 1971, 10 were rated as generally successful and 3 as partly successful. Considering the project ratings given in the PCRs and PPARs combined, 12 of the 20 completed projects were rated as generally successful, 4 partly successful, and 4 not rated. Judging from a generally successful rate of 60% and nil for unsuccessful rating, it was concluded that the principal objectives of the power sector projects at the time of appraisal have been substantially met.¹⁸

31. Implementation delays, cost overruns, and cost underruns were the problems most cited in the PCRs and PPARs of the projects studied. All completed projects experienced significant delays with the exception of the expansion of Suralaya power plant (Loan 1172-INO). In some cases, the delays were caused by construction difficulties or the poor performance of contractors, but the general conclusion drawn is that project implementation schedules at appraisal were far too optimistic, especially with regard to the time required for releasing counterpart funds by the Government, procurement procedures, and securing rights-of-way for transmission lines.

32. With the exception of the Singkarak Hydropower Project (Loan 1032-INO) there were no project cost overruns after 1980, although there had been a pattern of cost overruns in earlier loans. From 1980, cost underruns became significant, leading to a continuing pattern of partial loan cancellations. In some cases the underruns were more than 40% of the cost estimated at

¹⁵ Loan 125-INO: Irian Jaya Power approved in 1973 was cancelled in June 1978 at the request of the Government. Two additional loans, namely loans 1320-INO and 1673-INO, were closed during the preparation of this report in December 2002 and the PCRs are yet to be prepared.

¹⁶ Prior to 1995, PCRs did not contain a project rating. Further, before September 2000, a three-category rating system was used, namely generally successful, partly successful, and unsuccessful.

¹⁷ An analysis of PPAR findings was presented in ADB's Sector Synthesis of Post Evaluation Findings in the Power Subsector (December 1997).

¹⁸ These immediate project objectives included (i) expanding, or upgrading power supply to meet growing demand for electricity; (ii) developing energy infrastructure based on indigenous resource; (iii) improving overall power system reliability and efficiency; and (iv) improving access of the rural people to electricity.

appraisal.¹⁹ The cost underruns were mainly attributed to (i) deletion of some project components, (ii) lower bid prices arising from intense competition, (iii) depreciation of the rupiah against the dollar in 1997, and (iv) the projects not actually needing the level of contingencies provided for in the cost estimates.²⁰

33. The main performance data given in the PCRs and PPARs for all completed projects are given in Appendix 2. About two thirds of the nine projects with EIRR calculations both at appraisal and after completion incurred lower postevaluation EIRRs. The EIRRs of these nine projects ranged from 9.6% to 24.4% during postevaluation compared to appraisal estimates of 10.9%–34%. The divergence with appraisal estimates was mainly attributable to implementation delays and differences between prices assumed at appraisal and the actual. Nine out of the 11 projects with FIRR calculations both at appraisal and after completion incurred lower ex-post FIRRs. The FIRRs of these 11 projects ranged from 1.3% to 13% during postevaluation compared to appraisal estimates of 2.1%–24.3%. The lower FIRRs were due mainly to the lower-than-expected average tariff in dollar equivalent as a result of rupiah devaluation in 1986 and depreciation in 1997.

34. Main lessons identified in the PCRs and PPARs are (i) the need for more realistic time schedules for land acquisition, which should take into account past experiences rather than government assurances alone; (ii) the need for electricity to support economic and industrial growth at regional level requires detailed analysis to prioritize system expansion; (iii) the need to introduce “supply and erect” type contract packages to reduce project completion delays associated with faulty equipment replacement; (iv) cost estimates were too conservative in many instances and more reliable estimates could be obtained by taking into account the results of recent bidding for similar type of work or equipment; (v) the sector lending approach is more suitable for distribution and transmission projects; (vi) comprehensive information on geological and hydrological conditions is essential to reduce technical risks associated with hydropower projects; and (vii) the need to familiarize power plant operation staff with environmental mitigation measures. This study considered whether ADB had learned from the lessons identified in its PCRs and PPARs and found no significant matters of concern. Nevertheless, though, the continuing pattern of time overruns and cost underruns since 1980 was not corrected, implying that the opportunity to apply these lessons was not sufficiently taken up.

35. TA completion reports were prepared for only two of the seven advisory TAs covered in this study, and none of them were postevaluated.²¹ Main findings regarding tariff rationalization (TA 2227-INO and TA 2633-INO) and sector restructuring (TA 2429-INO) were incorporated in the design and implementation of the Power Sector Restructuring Program (footnote 4). Considerable implementation delays were experienced in most cases. The recommendations of the advisory TAs with respect to energy conservation, tariff rationalization, and sector restructuring appear to have been used less than expected. On the whole, the TA program was found appropriate and effective.

¹⁹ In respect of the 20 completed projects the total loan amount utilized (\$1,263.40 million) was about 78% of the total loan amount approved (\$1,625.45 million). Such cost underruns, in varying degrees, appeared to be common in respect of many DMCs in the 1980s which may be due to (i) an overreaction to the cost overruns in the earlier decade caused by oil price shocks; (ii) overestimated project base costs, and (iii) ADB’s methodology for price contingencies and the inflation rate projections underlying them.

²⁰ It is noted that \$35.8 million from the unused portion of Loan1271-INO was reallocated to Loan1032-INO to cover the cost overrun on Singkarak hydropower project and the allocation of savings of \$7 million under Loan 835-INO to extend the scope of the Distribution Expansion Outside Java Project from 40 towns to 80 in the same regions.

²¹ TA 2171-INO, TA 2429-INO, and TA 2430-INO were attached to recently closed Loan 1320-INO and Loan 1397-INO for which the PCRs are yet to be prepared. TA 3083-INO was a small-scale TA for which no completion report would be required.

C. Other External Assistance

36. External assistance has played a key role in expanding PLN's power supply system and diversifying its generation mix. Between FY1984 and FY2000, the three major external sources have been the Japanese Government through the Export-Import Bank of Japan (JEXIM) and the Overseas Economic Cooperation Fund (OECF), the World Bank, and ADB. The World Bank financed a wide range of activities concentrated mostly in Java, including thermal, geothermal, and hydropower projects; transmission and distribution projects; and rural electrification projects. The World Bank has been active in providing TA to address sector and institutional issues. OECF and JEXIM made substantial contributions to the Indonesian power sector covering large-scale hydropower and thermal power projects, transmission and distribution projects, and rural electrification projects. A statement of external assistance (Appendix 3) received by the power sector between the first and sixth 5-year plan periods (FY1970 to FY1999), compiled by Bank Indonesia, shows that out of the total assistance of \$16.17 billion, multilateral development banks provided \$5.25 billion (33%) and bilateral sources provided \$4.21 billion (26%). The rest of the financing (41%) came principally from export credits. Nonetheless, the share of multilateral development banks such as ADB and the World Bank is understandably small, reflecting their status as lenders of last resort. Also a great deal of bilateral official and commercial financing takes place in the context of the sector development plans and institutional goals and targets agreed to between the multilateral development banks and the Government.

37. Since the early 1980s, ADB has been closely coordinating its operations in the Indonesian power sector with the major sources of assistance, particularly the World Bank and Japan Bank for International Cooperation (JBIC),²² through policy dialogue covering development issues relating to efficiency improvement, cost recovery, promotion of private sector participation, and sector restructuring. Reflecting also the level of coordination, ADB has cofinanced two power projects²³ with the World Bank and assisted the Government in arranging major cofinancing from JEXIM and OECF for four projects.²⁴ This study found no evidence of significant difficulty arising as a result of there being more than one agency involved in project financing, institutional support, and policy dialogue.

IV. DEVELOPMENT IMPACT OF ASSISTANCE

A. Macroeconomic Impact

38. The importance of electricity as an input into economic growth and the correlation between GDP and energy (electricity) use is well established in the literature and is cited in a recent ADB publication.²⁵ Recent research²⁶ on electricity use and economic development has indicated the essential role that electricity, rather than energy in general, plays in the development of modern society with its substantial associated market and nonmarket benefits. The research examined the correlation coefficients between electricity consumption per capita and GDP per capita for almost all countries for the period 1971–1995. Indonesia has a correlation coefficient of 0.986, demonstrating a very close relationship. From 1985 to 2000, electricity consumption by industrial and business customers—which were the main drivers of

²² As a result of a merger between JEXIM and OECF in October 1999, JBIC was established.

²³ Loan 459-INO: *Second Java EHV Transmission Project* and Loan 1172-INO: *Power XXII Project*.

²⁴ Loan 835-INO: *Power XIX (Sector) Project*, Loan 1032-INO: *Power XX Project*, Loan 1397-INO: *Power Development and Efficiency Enhancement*, and Loan 1673-INO: *Power Sector Restructuring Program*.

²⁵ Asian Development Bank. OED's ADI Series No. 5. *Powering Economic Development and Reducing Poverty with Energy*.

²⁶ R. Ferguson, W. Wilkinson, R. Hill: "Electricity use and economic development", *Energy Policy* 28 2000 (923-934).

rapid economic growth—increased from 245,676 per kWh per customer per year to 777,100 kWh, while the average energy sold to each residential customer remained almost unchanged. During the same period, the Indonesian economy underwent significant structural changes: the agriculture sector accounted for 23.2% of GDP in 1985 and about 16.9% in 2000; manufacturing sector expanded from 15.9% of GDP in 1985 to 26% in 2000; service sectors including communications, finance, and construction also grew rapidly. The share of manufactured goods in total export increased from 12.5% in 1985 to 53.2% in 2000, while the share of mineral fuels decreased from 68.6% to 25.2%. Further, the manufacturing sector provided 9.2% of the employment in 1985 and 12.9% in 2000. ADB's assistance to the capacity additions in power generation, transmission, and distribution resulted in a significant increase in electricity consumption by industrial and business customers and therefore certainly contributed to these ends.

39. Significant expansion of electrification in Indonesia has taken place since 1980. Although much of it was achieved with financing from other sources, ADB-financed projects made a significant contribution to electrification of the country, supporting both urban and rural electrification initiatives. PLN's consumer electrification ratio reached 52% in 2000 compared to 15% in 1985, rural village electrification ratio increased from about 17% in 1985 to 84% in 2000, and number of rural customers almost quadrupled from 2.3 million in 1985 to 19.3 million in 2000. Thus, ADB operations in the power sector provided essential support to rural development and the provision of basic services in rural areas.

40. Attempts were made to estimate quantitatively the macroeconomic impacts of ADB's assistance to the Indonesian power sector, using a general equilibrium model²⁷ calibrated with a database representing the Indonesian economy in 2000. Details on how the model was used are given in Appendix 4. The macroeconomic impact of an increase of 10% in supply capacity and improved operation efficiency by 2% in 2000, are presented in Table 5.

Table 5: Macroeconomic Impacts of Asian Development Bank Assistance

Variable	10% Increase in PLN's Power Supply Capacity	2% Increase in PLN's Operating Efficiency
Change in Real GDP (%)	0.126	0.030
Change in Export Volume (%)	0.194	0.048
Change in Import Volume (%)	(0.188)	(0.048)
Change in Balance of Trade (%)	0.108	0.026
Change in Employment (%)	0.066	0.016
Change in Consumer Price Index (%)	(0.054)	(0.014)

GDP = gross domestic product, PLN = P.T. Perusahaan Listrik Negara (Persero).

Source: General equilibrium model simulation results.

41. As seen in Table 5, 10% increase in PLN's power supply capacity and 2% increase in operating efficiency is expected to increase GDP by 0.126% and 0.03%, respectively. The macroeconomic impacts of power supply increases and efficiency improvements calculated by the general equilibrium model are not large. This is mainly because (i) the underlying model is primarily designed to describe how industries and consumers respond to various policy options; (ii) the share of electricity in the input-output data used in the model are very small (only around 1% of costs); (iii) the model incorporates only operating cost inputs between sectors but not the impact of investment expenditures; and (iv) the impacts presented do not represent accumulative effect of ADB's assistance, but annual macroeconomic effects. Furthermore, the model reflects a static situation and does not incorporate the transient economic costs that arise

²⁷ The model was also used to analyze the macroeconomic impact of electricity tariff increases under the TA Loan 1674-INO: *Capacity Building for Establishment of a Competitive Electricity Market*.

due to power supply interruptions stemming from, for example, poor reliability or nonavailability.²⁸

42. The EIRRs of the four sample projects were recalculated: expansion of the Suralaya coal-fired power plant; construction of the Singkarak hydropower plant; construction of the Darajat geothermal power plant; and implementation of the Distribution Expansion Outside Java Project. Table 6 shows that the recalculated EIRRs are in the range 12%–28% with the exception of Singkarak: it has a recalculated EIRR of 4.6% reflecting its lower energy output to date and its construction cost and time overruns. Details of the calculations are given in Appendix 5. The ex-post EIRRs available for 11 of the 21 completed projects range from 9.4% to 22.9% indicating positive economic impacts.

Table 6: Recalculated Economic Internal Rates of Return

Project	PCR Estimates of EIRR (%)	Recalculated EIRR (%)
Suralaya Coal-Fired Plant Expansion	14.8	12.0 ^a
Singkarak Hydropower	9.6	4.6 ^a
Darajat Geothermal	16.8	11.2 ^a
Distribution Expansion Outside Java	24.4	28.4

EIRR = economic internal rate of return, PCR = project completion report.

^a Costs and benefits associated with distribution were removed from the generation projects and consumer surplus omitted. EIRR calculated is therefore a lower bound.

B. Socioeconomic Impact

43. ADB-financed power sector projects have resulted in a range of downstream socioeconomic benefits at the local level. The improved power supply has increased employment opportunities, stimulated development of new businesses, and brought easier access to information. The use of electricity has also added convenience to people's everyday life including the lives of the poor. Improved lighting extends the hours for work, education, and recreation. Outdoor illumination enlivens communities and contributes to improved security. The improved quality of electricity supply to existing consumers in project areas benefited all user groups. The secured power supply also facilitated the development of new industrial estates and tourism industries in some regions.

44. Lack of baseline data does not allow a quantitative assessment of the socioeconomic impacts on the local economy in the project areas. Information on most socioeconomic indicators are available only after 1993, while all completed projects under the study were approved before 1992.²⁹ Hence, benchmark or performance targets were not set during appraisal for comparison against actual socioeconomic benefits. In order to gain some insight into the socioeconomic impacts of ADB-financed power sector projects, four sample projects (footnote 5) were investigated. These projects, for which PCRs were prepared most recently, covered all major components of ADB's power sector intervention in Indonesia. A total of 142 individual interviews and 18 group discussions were undertaken. A synthesis of the broad

²⁸ It is estimated that the economic cost of demand not served is of the order of Rp13,000 per kWh used. The figure is indicative only for a variety of reasons including the unknown contribution of captive power to total electricity generation and use.

²⁹ It is important to note that the relevant projects were approved before the formal incorporation of social dimensions in ADB operations in 1993 and before the introduction of mandatory obligations on resettlement in 1995.

socioeconomic impacts of the sample projects is given in Appendix 6. The main findings are as follows:

- (i) Electric lighting is mostly reported as the immediate benefit by the relatively poor households. It gives them more time for social as well as economic activity. With electricity, even relatively poor households shift consumption priorities to include the purchase of electrical appliances that make housework easier and allow for more leisure time. Television and video cassette recorders add a diversion to people's lives.
- (ii) The projects provided employment for many local people both during construction and ongoing operation. People living in the project vicinity also benefited in the longer term from new and improved roads. The increased incomes available to local residents during the construction phase have enabled some to establish small enterprises that provide a stable source of income.
- (iii) As a result of diversion of the natural outflow of Lake Singkarak, people living along the Anai River have benefited from increased agricultural outputs in the area resulting from new and expanded irrigation schemes facilitated by increased water flow in the river as well as improved fishing yields from newly constructed fish ponds.
- (iv) The Singkarak Hydropower Project,³⁰ located in West Sumatra, diverted a major part of the natural outflow of Lake Singkarak from the Ombilin River flowing eastward to the Straits of Malacca to the Anai River flowing westward to the Indian Ocean near the city of Padang. This resulted in significant benefits to those living along the Anai River where the average flow has been increased by 44 cumecs, but severely reduced economic opportunity for those living along the Ombilin River where the average flow in the upper reaches has been reduced from 51 cumecs, to a compensation flow of less than 4 cumecs. Although negative impacts from the reduced flow in the Ombilin River were anticipated prior to project implementation, it would appear that, based on the perceptions of some affected parties, the extent and magnitude of those impacts were underestimated. Reduction in fish yields along the river have significantly reduced incomes from this source and some irrigation schemes have been rendered ineffective, especially during the dry season, resulting in a severe drop in rice production. The mitigation measures carried out by PLN to date do not appear to have addressed all of these issues.
- (v) In the case of 500 kV transmission grid expansion in Java, a number of social issues associated with the right-of-way were found. These issues mainly relate to loss of agricultural production during (and sometimes after) construction, reduction in land values in areas adjacent to the facilities, and perceived health risks from the associated electric and magnetic fields. PLN has taken action to mitigate these problems through implementation of its established guidelines and procedures.

C. Environmental Impact

45. The Government of Indonesia issued its first regulation concerning environmental impact assessment in 1986. Since 1987, the review process for new projects has required detailed environmental assessment as well as management and monitoring plans for environmental

³⁰ The social and environmental impacts of the Singkarak Hydropower Project have been previously assessed in an ADB report "Special Evaluation Study on the Social and Environmental Impacts of Selected Hydropower Projects" published in 1999.

impacts. Approval of the final assessment report is the responsibility of the Environment Assessment Commission (Indonesian acronym AMDAL). Of the projects covered in this study,³¹ an environmental impact assessment was carried out at the time of appraisal only for the projects under loans 1032, 1092, and 1172-INO. For these projects, the PCRs and PPARs did not report any adverse environmental impacts.

46. A similar approach to the socioeconomic impact assessment was followed for assessment of environmental impacts. Projects under loans 1032, 1092, and 1172-INO (namely Singkarak Hydropower Project, 500 kV Transmission Lines, and Darajat Geothermal Power Plant, and expansion of Suralaya Coal-Fired Power Plant) were examined. Field investigation was carried out at the Darajat geothermal power plant, interviews were conducted with PLN staff, and available reports and documents were examined.

47. Overall, mitigation measures taken to address environmental concerns have proved satisfactory and no unanticipated concerns have arisen. At appraisal, the Singkarak Hydropower Project was expected to have significant adverse environmental impacts due to the changes in the flow of the Ombilin and Amai rivers, which would lead to a significant reduction in aquatic life. The decreased flow was also expected to have a negative impact on the quality of the water, leading to an increase in the incidence of skin and intestinal diseases among the local population. To mitigate these negative environmental effects, appropriate mitigation measures were identified and incorporated into the environmental monitoring and management plans approved by AMDAL when the project was developed. The cost of mitigation measures was embedded under the preparatory works in the cost estimate and covenanted in the Loan Agreement. Most of these measures were implemented and the results have proven, on the whole, satisfactory, though the perceptions of the affected parties on the extent and magnitude of the environmental impacts were somewhat different.

48. Without mitigation measures, construction and operation of Darajat geothermal power plant was expected to result in noncondensable gases being released to the atmosphere and in polluted wastewater from cooling towers. Mitigation measures implemented as approved by AMDAL during appraisal fully addressed all environmental concerns. Appropriate design and engineering practices in accordance with ADB's *Environmental Guidelines for Selected Industrial and Power Development Projects* were followed for construction of the overhead 500 kV transmission lines to minimize disturbance to the environment. To address the concerns of people living near the lines regarding possible health hazards from exposure to electric and magnetic fields, PLN has been carrying out regular monitoring in accordance with its environmental management and monitoring plan. Results of the monitoring program show that the measured values of both electric and magnetic field strengths are well within the limits recommended by the World Health Organization.

49. Expansion of the Suralaya coal-fired power plant required the Government to incorporate environmental mitigation measures into the long-term environmental management and monitoring plan. An advisory TA³² was provided to strengthen PLN's institutional capability to deal with environmental issues pertaining to coal-fired power plants. Computer simulation models for air pollution analysis of coal-fired power plants were provided under this TA to train PLN staff in preparing sound environmental management plans. Final design of the expansion of the plant fully addressed the environmental concerns in conformity with international standards. PLN, in accepting ADB's loan, employed an independent consultant to carry out a

³¹ All projects were approved prior to ADB's renewal of its focus on environmental concerns in 1993.

³² TA 1739-INO: *Environmental Planning and Management of Coal-Fired Power Plants*, for \$200,000, approved on 4 August 1992.

quarterly program of monitoring of environmental impacts. Measurements of air quality are within allowable limits and the disposal of solid wastes such as ash are also within established guidelines.³³ On the whole ADB involvement in these projects had the effect of improving government procedures for social and environment aspects, making them more transparent and accountable. This can be regarded as a notable contribution.

D. Institutional Impact

1. Institutional Support to PLN

50. By far the most important impact of ADB power sector operations in Indonesia is on the institutional capacity of PLN. PLN, which was a small and inefficient utility operating like a department of the government with no commercial orientation in the early 1980s, was transformed into a large, modern, and efficient public utility with a commercial orientation appropriately balanced by its social and environmental obligations in the course of about 15 years, mainly as a result of the clear focus of the operations of ADB and the World Bank. All ADB-financed projects focused on the institutional capacity of PLN. ADB's assistance to PLN for institutional strengthening comprised (i) direct institutional support provided by advisory TAs, (ii) indirect support through the involvement of project consultants funded from ADB loans, and (iii) guidance given by successive ADB staff members working with PLN during the processing of successive project loans and their administration.

51. Through the TA program, PLN strengthened its in-house managerial capability in various areas such as planning, project preparation, engineering and project management, efficiency improvements, human resources development, environmental planning and management, and financial management. Through a regional TA, the transmission planning capability of PLN was enhanced. Through training programs carried out with help from ADB and other agencies, PLN was able to develop and retain a cadre of well educated and well trained managerial and technical staff with growing and relevant skills.

52. Assistance by ADB staff also played a crucial role in the operational improvements of PLN. An action plan for efficiency improvement was developed with the help of ADB and implemented during 1986–1991. The plan consisted of an analysis of PLN's operations and identification of corrective measures to reduce energy losses and fuel consumption, substitute oil use, improve maintenance, rehabilitate old power stations, reinforce distribution networks, and upgrade metering and billing procedures. Quantitative performance targets and indicators such as sales, losses, consumer connections, billing collections, and fuel consumption by region were introduced as a part of the institutional strengthening.

2. PLN's Operational Performance

53. PLN's operational performance in the early 1980s was generally unsatisfactory, characterized by low system load factors, excessive energy losses, and low sales per consumer and per employee. Key factors characterizing PLN's performance³⁴ included:

³³ The Operations Evaluation Mission observed that the temperature of the cooling water discharged from the plant is up to 3°C above the recommended maximum. The effects of this on the marine life in the area have not been fully investigated to date.

³⁴ A comparative analysis of PLN's technical operations was done by ADB staff in 1985.

- (i) infancy of power supply in terms of low per capita power generation and a low electrification ratio;
- (ii) geographic dispersion in terms of a preponderance of isolated power systems, many of which had average sizes of only 1 or 2 MW, so that PLN's installed capacity exceeded its peak demand by 75%, a far higher reserve margin than needed in an integrated system;
- (iii) a nonoptimal plant mix of gas turbine and diesel power, characterized by low thermal efficiency and high operating costs; and
- (iv) an unfavorable consumption structure and load demand profile, which limited the leverage available to PLN to draw more profitable revenues from industrial consumers (Over 70% of PLN's total consumers were small residential and commercial consumers using electricity primarily for lighting only.).

54. In the course of two decades, PLN's installed generation capacity increased eightfold, its electricity sales (in GWh) increased twelvefold, and the number of its customers increased elevenfold. It acquired a clear focus on cost reduction and aggressively pursued integration of the isolated grids; least-cost planning for generation, transmission, and distribution; fuel diversification away from oil; and operational and dispatch improvements. It achieved a dramatic reduction of system losses and improved its metering and billing collection efficiencies remarkably. Its sales per employee and customers per employee ratios also improved notably. Table 7 summarizes the indicators that clearly demonstrate the extent of transformation of PLN.

Table 7: Operating Efficiency Indicators for Selected Years

Indicator	Measure	1985	1990	1996	2000
Sales Increase	% per annum	14.5	18.4	15.5	11.0
Number of New Connections	'000 per annum	820	1,147	2,535	1,070
Sales per Employee	megawatt hrs	222	581	1,242	2,474
Customers per Employee	number	103	240	486	894
Transmission and Distribution Losses	%	19.8	15.6	12.3	11.7
Share of Oil-Based Generation	%	75	37	21	21
System Load Factor	%	60.9	67.5	66.8	69.5
Accounts Receivable	months	2.1	1.7	1.2	1.4

Source: PT. Perusahaan Listrik Negara (Persero) data.

3. PLN's Financial Performance

55. A particular area in which ADB played an institutional development role was promotion of the sound financial management of PLN. This it did through dialogue during its project loan processing and administration and through its loan covenants. ADB always encouraged the Government and PLN to take the steps needed for PLN to achieve financial viability and recover the full cost of its operations and a share of capital investment costs. By 1990, after successful implementation of the ADB-promoted action plan for efficiency improvement, PLN was, overall, a well-run utility with acceptably low operating costs, low levels of system losses, good revenue collection patterns, and a steadily improving network suited to the demand for power. Debt service coverage and self-financing capability also improved between 1991 and 1996. It is noteworthy that these improvements accompanied a continued rapid growth in energy demand: during 1991–1996 sales grew at an average rate of 12.3% per annum, continuing to be driven largely by new connections that increased at an average rate of 12.2% per annum.

56. PLN developed good accounting, financial, and internal control and audit procedures and systems. It also developed the capability to measure its cost of supply and make well argued and meaningful tariff proposals aimed at compliance with the various financial ratios stipulated under the loans of ADB and the World Bank. PLN's financial performance, which was unsatisfactory throughout the 1980s mainly due to low operating efficiency, inadequate tariffs, and high share of socially oriented activities, turned profitable in 1990. PLN's overall profitability as measured by its rate of return on net revalued fixed assets in operation³⁵ had been negative or only marginally positive prior to 1989, but improved over the period 1991-1996 to between 3% and 6% with slightly higher returns in years in which there was a significant tariff increase and lower returns in other years. Improvement in PLN's financial performance in the first half of the 1990s was helped by reduced system losses, improved collections, and a change in its fuel mix away from diesel to coal and gas, especially on Java. Consolidated operational and financial performance details of PLN from FY1991 to FY2001 are given in Appendix 7.

57. The financial targets specified in the covenants agreed upon with ADB and the World Bank have not often been reached.³⁶ Debt-service coverage ratio of not less than 1.5 times was complied with in most years except 1987 and 1988; the stipulated self-financing ratio of not less than 30% of capital expenditure was complied with only in 1995 and 2001, and the covenanted 8% of return on net fixed assets was never achieved. On the whole, while the efforts of ADB and the World Bank through the use of covenants and policy dialogue with the Government did not succeed in enabling PLN always to achieve the stipulated financial targets, they clearly succeeded in moving the utility to marginal profitability and to achieve reasonable debt service coverage ratios and self-financing capability. Since 1998, however, the utility reverted to incurring net losses as a result of inadequate tariff increases and steeply rising debt service caused by the sharp currency depreciation. It is noteworthy that ADB did not provide any new project loan to the Indonesian power sector between 1996 and 2001, partly because of the Government's reluctance to approve tariffs adequate to cover costs of supply.

58. Following the onset of the Asian financial crisis, the rupiah depreciated more than fourfold before stabilizing.³⁷ This had an immediate adverse impact on PLN's profitability given that more than 70% of its expenses and all PPAs were dollar-denominated. Tariff levels in real terms began to deteriorate in 1994 and were improved only after 2000 following the introduction of quarterly increases that are intended to enable PLN to achieve its covenanted rate of return by 2005. Graph 1 compares average nominal and real selling prices, the latter in constant 1990 values. Notably, tariff levels in real terms decreased after 1996 but began to improve in 1999.

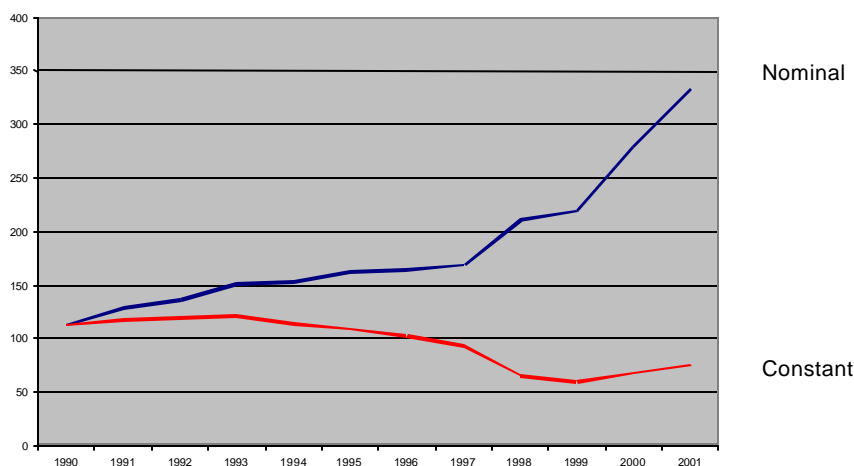
59. Energy purchases from IPPs increased during the late 1990s from 2.7% of PLN's total production in 1994 to 9.8% in 2000, contributing to the deterioration in PLN's profitability. Most PPAs were renegotiated on more favorable terms by 2000.³⁸

³⁵ PLN makes off-balance sheet calculations of return on revalued net fixed assets in service. The results should be treated with caution given that the fixed assets were not revalued comprehensively between 1979 up until 1998: asset values for the purpose of calculating the covenanted ratio in the intervening years were adjusted using movements in indexes. The total asset value so calculated for 1998 differs significantly from the value established on revaluation in 1998 under TA No. 3027-INO.

³⁶ ADB coordinated its operations with the World Bank through the policy dialogue with the Government and, from the mid-1980s, the two organizations adopted common financial covenants in their loan documents with a view to improving their impact.

³⁷ Before the crisis, there were Rp2,500 to the dollar. The rupiah went as low as 17,000 to the dollar before stabilizing in the range 10,000 to 12,000 and then strengthening by 2002 to around 9,000.

³⁸ The levelized cost of purchase at Paiton 1 is understood to have been reduced to around 4.93 cents per kWh and at Paiton 2 to around 4.68 cents.

Graph 1: Average Selling Prices (Rp/kWh)

60. Although PLN's financial performance improved in 2001 as a result of Government subsidy payments, tariff increases, and debt restructuring,³⁹ enabling it to achieve a positive self-financing ratio that year, this improvement was achieved partly at the expense of the curtailment of maintenance and capital expenditure.⁴⁰ Growth in demand continued at high levels, however, with an average annual rate of growth in energy sales of 8.3% and a matching growth in the number of consumer connections of 6.3%. Although these rates of growth were slower than pre-crisis rates, they still placed a heavy burden on PLN for further capital investment at a time when it was not able to respond. This leaves a situation that has yet to be corrected and a legacy from the crisis to be addressed in the short-to-medium term. It is worth noting that the financial recovery plan including quarterly tariff increases (to return PLN to the breakeven point by 2003 and enable it to achieve 8% rate of return on revalued net fixed assets by 2005) is being implemented largely through the intense policy dialogue between ADB and the Government in the context of the program loan and the TA loan approved in 1999 (footnote 4).

61. The FIRRs of the four sample projects were recalculated and compared with the weighted average cost of capital (WACC) to check the financial viability and impact of ADB-financed projects. Table 8 shows that recalculated FIRRs are higher than PCR estimates and compare favorably with WACCs except for the Singkarak Hydropower Project. Thus, ADB-financed power projects have generally supported PLN in terms of its financial growth. The unsatisfactory FIRR of the Singkarak project was attributed mainly to lower than expected plant output—only up to 60% of the design output to date.

62. By and large, this study concludes that institutional impacts of ADB's operations in the Indonesian power sector have been positive. ADB's approach to its policy dialogue appears to have been pragmatic, focusing on the enhancement of technical skills and technical support, tariff adequacy and the financial performance of the utility, the development of indigenous resources, and operational efficiency. Although it is difficult to judge the institutional impact of

³⁹ Overdue interest and penalty charges of Rp28.8 trillion were converted to equity as at 31 December 2001. Rp5.3 trillion of debt was rescheduled as a 20-year term loan with a 2-year grace period and interest at 4% per annum.

⁴⁰ Field investigations and surveys reported ample evidence of a reduction in the quality of PLN's services as its financial health deteriorated after the financial crisis.

ADB's activities, partly because of a lack of sufficiently comprehensive statistics and performance indicators but mainly because ADB was only one of those agencies assisting PLN, the study concludes that the ADB's institutional assistance was successful in its aim and that its impact was significant.

Table 8: Recalculated Financial Internal Rates of Return

Project	PCR Estimates of FIRR (%)	WACC (%)	Recalculated FIRR (%)
Expansion of Suralaya Coal-Fired Plant (Loan 1172-INO)	7.1	4.0	8.7
Darajat Geothermal Plant (Loan 1092-INO)	2.5	3.3	9.4
Singkarak Hydropower Plant (Loan 1032-INO)	5.8	3.4	3.0
Distribution Expansion Outside Java (Loan 835-INO)	6.6	3.9	10.4

FIRR = financial internal rate of return, PCR = project completion report, WACC = weighted average cost of capital.

V. POWER SECTOR REFORM

A. The Government's Reform Agenda

63. The main focus of ADB's assistance to the power sector shifted in 1995 to sector restructuring, following on the Government's recognition since the late 1980s of a widening gap between the demand for power and PLN's ability to supply it. The Government had accepted that the private sector would need to play an important complementary role in public electricity supply. The signing of 27 IPP agreements after 1992 was followed by the reorganization of PLN into a public corporation in 1994 and the separation of its power generation operations in Java-Bali into two subsidiaries in 1995.⁴¹ The objective of that step was to prepare them for public listing in 1997, to decentralize control toward improving service and efficiency, and to allow them to compete with the private electricity-generating companies that were expected to connect to the network. A director of electricity business supervision was established within the DGEEU (then Directorate General for Electricity and Energy Development) in 1997 as a first step toward creating an independent regulatory agency.

64. In 1998, the Government announced its intention to further restructure the power sector to introduce a competitive market in Java-Bali. In its Power Sector Restructuring Policy Paper of 1998, the Government set out its long-term vision for the power sector as "(i) a power sector which is growing rapidly and so able to provide universal coverage for households and to support industrial and commercial growth across the country; (ii) a world-class power sector able to provide high-quality reliable service within increasing levels in efficiency, thereby benefiting consumers in promoting the global competitiveness of the Indonesian economy; (iii) a financially independent and self-reliant power sector." The paper expressed the intention that the power sector be moved significantly closer to realization of this vision over the following 5 years. It acknowledged that, given PLN's then serious financial difficulties, restoration of the sector's financial viability would be given first priority. The clear thrust of the paper was in favor of a fundamental restructuring of the sector.

⁴¹ In 1993, the Minister of Mines and Energy had promulgated a broad policy framework, *Goals and policies for the development of the electric power-sector*, to guide the longer term restructuring of the sector.

65. The paper put forward an argument for the introduction of competition, noting experience around the world that showed that the introduction of competition in the power sector was “feasible and desirable”. The lesson that the Government drew from its experience with IPPs was not that introducing private participation was harmful to the sector but that it must be carried out as part of a deeper restructuring process. Noting that PLN had been at the “cornerstone of the power sector’s success,” the paper expressed the view that “its [PLN’s] monolithic structure had outlived its usefulness and had become a barrier to improving inefficiency.” These and other similar arguments were used to justify a recommendation in the paper in favor of an ultimate restructuring objective for the Java-Bali system of a fully competitive market including multiple buyers and multiple sellers, although the paper did recognize that a single buyer model might be required in a transitional phase. The paper also recognized that, outside Java, system conditions dictated a more gradual move to competition.⁴²

66. Partly reflecting an increased degree of caution on the part of the Government, as well as other practical problems and delays, implementation of the new policy since its introduction in 1998 has been slow. The new Electricity Law was promulgated in September 2002, after more than 2 years’ delay. The Electricity Law includes a timetable for the designation of an area for competition “limited to generation” but it is silent on the form that the competition will take.

B. The Asian Development Bank’s Energy Sector Policy

67. ADB’s involvement in power sector restructuring should be assessed in the context of its own policies for the energy sector of its DMCs generally. Its two energy policy papers are relevant in this regard. The first was issued in March 1981. At that time, effects of the oil price shocks of the 1970s were still being felt and, to help overcome them, the paper put considerable emphasis on supply augmentation based on developing indigenous energy resources. The paper also foresaw a growing role for ADB in the energy sector generally and recommended an increase in ADB professional staff to support this important sector. As a result, lending to the energy sector during the 1980s focused on the accelerated development of indigenous energy resources and supply augmentation, adoption of least-cost considerations in energy planning, efficiency in construction and operation of electricity supply facilities, adoption of energy prices based on full cost recovery, and institution building.

68. ADB’s second energy policy paper, issued in October 1995, focused on enabling private investments in the energy sector consistent with ADB’s *Medium-Term Strategic Framework*,⁴³ which laid down the strategy for its operations as a whole, stressing its role in augmenting external capital flows into DMCs through increased cofinancing and the encouragement of DMCs to adopt policies creating an environment suitable for attracting external capital for development. It put forward the view that utilities should not continue to depend on governments for incremental equity and debt, especially when governments have to cut budget deficits, control inflation, and meet requirements in social sectors. The paper recognized that projected power sector expansion programs were so large that they were beyond the implementation capacity of many of the utilities, leading to the conclusion that there was an urgent need for the introduction of competition, allocation of a greater role to the private sector, separation of the roles of owning and regulating, the introduction of transparent regulation, and broadening of the financial base of the sector. The paper concluded that it should encourage DMCs to undertake restructuring efforts appropriate to the maturity of their capital markets and the extent of autonomy of their public utilities as well as the existing structure of the sector.

⁴² Neither the Government nor PLN seems to have taken full account of the impact of the proposed reforms on the electricity sector outside Java-Bali.

⁴³ ADB.1992. *Medium-Term Strategic Framework (1992–1995)*. Manila.

69. In 2000, ADB reviewed its energy policy again. The review states in its preamble that “*Energy 2000* confirms that the 1995 energy policy continues to be relevant, and within this framework, recommends a realignment towards four operational priorities—poverty reduction, promoting private sector involvement, addressing regional and global impacts, and promoting regional cooperation.”⁴⁴

C. Application of Asian Development Bank Policies in Sector Reform

70. Since the first loan to PLN was approved in the early 1970s, ADB adopted a pragmatic approach to its policy dialogue in the power sector with the Government. Electricity tariffs have always been a major subject of policy dialogue in the power sector. Due to social, political, and macroeconomic considerations, the Government did not approve the required tariff increases after the mid-1980s. Although the electricity tariff was raised by 25% in nominal terms in 1989, by 20% in 1991, and again by 13% in 1993, the inadequate tariff level continued to adversely affect PLN’s financial position. Based on a formula developed by an ADB-financed TA,⁴⁵ PLN prepared a regular tariff adjustment mechanism consisting of structural adjustment to take place once a year; and formula-based quarterly tariff adjustments taking into account changes in the input costs from inflation, changes in fuel prices, power purchase price, and exchange rates intended to keep the tariff level constant in real terms. This automatic tariff adjustment mechanism was approved by the Government with effect from October 1994, but was suspended after the Asian financial crisis in 1997.

71. Presidential Decree No. 37 in 1992 encouraged the participation of private sector investments in electricity generation, transmission, and distribution. However, it opened the door to unsolicited proposals for the private production of electricity. The majority of the 27 agreements signed with IPPs (para. 15) were based on unsolicited bidding processes and resulted in overpriced, dollar denominated, take-or-pay conditions. Many project developers had close connections to the then first family and associates. Although approached by one developer for support, ADB declined to be involved and played little further part in the IPP program other than to give general advice to the Government and PLN on the proper conduct of such programs. The World Bank also counseled the Government to “start small” in its experiment with private power production to reduce risk.

72. Both the World Bank and ADB had helped fund studies during 1996 and 1997 to examine strategic options for the power sector, and the recommendations of those studies—calling for a shift to a competitive market approach—led to the emergence of the multiple buyer-multiple seller market structure proposed for Java-Bali in the Government’s policy paper of 1998. By virtue of an informal division of labor in the Indonesian power sector between ADB and World Bank at the time, ADB took the lead on sector restructuring issues while the World Bank focused on PLN’s corporate and financial restructuring.

73. In March 1999, ADB approved a program loan of \$380 million (Loan 1673-INO) to be released in two tranches and an accompanying TA loan of \$20 million (Loan 1674-INO) to support the Government’s Power Sector Restructuring Program outlined in its 1998 policy paper. The objective of the program and TA loans was to establish a competitive market for electricity in Java-Bali that would increase the economic efficiency of the power sector in that region. Five key areas of activities necessary to achieve its objective were identified:

⁴⁴ By this time, ADB had adopted poverty reduction as its overarching goal and the new paper notes “other strategic objectives, such as economic growth, environmental protection, gender equity, and human resource development are to be pursued in ways that contribute effectively to poverty reduction.”

⁴⁵ TA 1330-INO: *Study on Electric Tariff Adjustment Mechanism*, for \$100,000, approved on June 1990.

(i) restructuring the power sector and creating an enabling environment for a competitive electricity market; (ii) establishing competition in the supply of bulk electricity in Java-Bali; (iii) adjusting tariffs to ensure financial viability of PLN; (iv) increasing private sector participation; and (v) strengthening the regulatory environment, including protecting the interest of the end consumers. In line with ADB policy, the loan funds were not earmarked for the power sector but for use by the Government in support of its broader reform program. The TA funds were to be applied to eight TA components, four of which related to the establishment of a competitive market and the remainder to other support. One of the four market-related components has been cancelled.⁴⁶ Although, as already mentioned, the Government remained committed to the reforms, it continued to be cautious in implementing them.

74. The Government was not able to make the structural changes that would lead to the establishment of a competitive electricity market in Java-Bali within the timeframe previously envisaged and also took a more cautious approach to the power sector reforms than originally intended. However, significant achievements have been made in areas like electricity tariff increases and renegotiation with IPPs. Despite the difficult economic situation, the Government raised the average tariff by 29% in April 2000; 17% in two steps effective from 1 July and 1 October 2001; and by 6% every quarter of 2002. By end of 2002, full agreements had been reached on 10 of the original 27 IPP projects, 10 remain under renegotiation, and 7 have been terminated (Appendix 8).⁴⁷

75. Indonesia has undergone considerable political and institutional change since 1998, and building the acceptance needed for major reforms proved challenging. ADB and the other organizations involved, including the International Monetary Fund (IMF), worked with the Government to help address structural, governance, and other weaknesses in various sectors including the finance sector but policy uncertainty and implementation problems associated with decentralization slowed the process down, slowed economic recovery, and threatened medium to long-term growth. Power sector restructuring was included as one of the conditions in IMF's bailout packages after the 1997 financial crisis but delays in implementing broader economic reforms due to changes in the administration and for other reasons had an adverse impact on the implementation of power sector reform and seriously affected private investment prospects, particularly in energy.

76. The program loan formed a part of the initial assistance package put together by IMF after the Asian financial crisis. A special evaluation study on ADB's crisis support loans in Indonesia was carried out by Operations Evaluation Department in 2001 and highlighted the possible temptation of aid agencies to leverage crisis assistance with the initiation of wide-ranging reforms even if some of them had little direct relationship with the crisis. It further noted that crises are characterized by uncertainties, data constraints, and urgently needed action. Such conditions are unsuitable for negotiating reform programs with longer term perspectives, which need to be preceded by in-depth policy research and dialogue, careful consideration of alternatives, assessment of implementation capabilities, and by stakeholder participation and nurturing of their ownership. According to some government officials interviewed, many components of the program loan and TA loan were not clearly understood at the time of its formulation.

⁴⁶ According to the new law, full competition in power generation will not be achieved before 2009, 6 years later than envisaged at loan appraisal. The development of the market software originally covered under the TA funds was included under a new loan approved in December 2002.

⁴⁷ The PPAs of the renegotiated contracts were extended as part of the settlement, typically from 30 years to 40 for coal-fired plants and from 20 years to 30 for combined-cycle plants. In two cases, Paiton I and Sengkeng, deferred payments were agreed to in respect of energy already taken but not paid for at all or not at the contract rate.

77. Significant delay in implementing the policy and structural changes outlined in the program loan suggests overoptimistic time schedule for reform. Further, the Government's Power Sector Restructuring Policy Paper of 1998 overlooked the absence in Indonesia of several of the enabling ingredients for the operation of sophisticated market mechanisms such as those foreseen in the policy paper. These features included an inadequate legal jurisdiction, weaknesses in the banking sector and in corporate governance practices, a lack of financial strength in the power sector, a lack of interest on the part of private investors to invest in Indonesia at the present time, and, so far, inadequate transparency and predictability in the power sector reform process. Sophisticated market structures introducing competition in the supply of bulk electricity are developed in other countries with very different circumstances from Indonesia and remain largely untested in the developing world. Since Indonesia undertook power sector reform against the backdrop of the Asian financial crisis and the Government was in urgent need of quick-disbursing assistance, it was very likely that many important issues in terms of the technical, institutional, and human resource capabilities in Indonesia could not be adequately addressed during the design of the program loan. These issues and difficulties associated with structural changes have been recognized by ADB as evidenced in its agreement to a longer time period for establishment of the market and various evaluation reports,⁴⁸ but have not yet been fully integrated into its policy approach. Overall, while ADB's time schedule for reform proved optimistic, ADB assistance to the power sector restructuring has been instrumental in initiating important policy changes in the right direction.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. Overall Assessment

78. The overall assessment has been made using five criteria, namely, the relevance of the assistance to national goals and ADB's sector objectives, the efficacy of the assistance in achieving immediate project purposes and its effectiveness in strengthening sector policies and institutions, the efficiency by which the purposes and goals were attained, the sustainability of the benefits of the assistance, and other development impacts of the assistance. The assessments under each criterion are outlined in paragraphs 79–86.

1. Relevance

79. Project objectives and outputs were generally consistent with the Government's development strategy and PLN's long-term development plans as well as ADB's own energy sector policies, which, by and large, were fully realized. ADB's project support met the much needed power system expansion requirements closely linked to economic development. ADB's specialized TAs also helped PLN become a technically sound public utility through support to the creation of PLN design unit, training for strategic planning of power development in general, and for environmental planning and management in particular. Thus, the assistance is considered highly relevant to the country's overall development needs and to PLN's ongoing institutional development. The thrust of the program loan's objectives to unbundle the sector, introduce competition, and enable private sector entry into a competitive milieu was also highly relevant to the needs of the country.

⁴⁸ *Special Evaluation Study on the ADB's Crisis Management Interventions in Indonesia*, August 2001; *Special Evaluation Study on Program Lending*, November 2001; *Special Evaluation Study on the Privatization of Public Sector Enterprises: Lessons for Developing Member Countries*, December 2001.

2. Efficacy

80. With few exceptions, the completed loan projects succeeded in achieving their expected outputs and immediate objectives including the provision of additional capacity to match load growth, the removal of transmission system constraints, improvement in system efficiency and reliability, increase in the use of indigenous energy resources, and resulting socioeconomic development. The TAs provided useful recommendations to the Government and PLN with respect to institutional strengthening, tariff rationalization, and sector restructuring. At the sector level, the lending was successful in improving the overall operating efficiency of PLN, not just the efficiency of the individual projects. While the assistance and its accompanying covenants were efficacious in enabling PLN to minimize costs of supply, reduce system losses, improve collection efficiency and make well-developed tariff proposals, they were often not efficacious in securing government approvals of such tariff proposals fully or in time, thus leading to financial shortfalls of PLN. Notwithstanding the lack of financial achievement, the overall efficacy of ADB-financed projects is judged satisfactory.

3. Efficiency

81. By design, all projects were to produce a planned output and be implemented in a reasonable time at reasonable cost. Nonetheless the efficiency of ADB assistance in the power sector was mixed. Almost all completed projects experienced significant implementation delays, cost overruns prior to 1980, and cost underruns after 1980. Despite these shortcomings, most FIRR re-estimates of the sample projects are higher than appraisal and PCR estimates and compare favorably with the related WACCs. The results of the economic reevaluation demonstrates that EIRRs for most projects were also satisfactory even where projects fell short of expectations. Overall, the efficiency of ADB's assistance is judged to have been satisfactory.

4. Sustainability

82. Energy sales continue to grow in Indonesia at a high rate and the power system will not be able to support future demand without reinforcement and investment. Partly as a result of PLN's weakened financial position after the 1997 Asian financial crisis, and partly because the private sector is presently not attracted to investment opportunities in the country, it is not clear that PLN will be able to cope. Likewise, PLN's ability to maintain its completed projects adequately is jeopardized at present by its financial position. On the other hand, the technical capabilities of PLN give no cause for concern; and environmentally, overall, there are no significant foreseeable adverse impacts. The sustainability of ADB-financed projects depends largely on the financial performance of PLN in the future. While there is cause for reservation in this area in the short-to-medium term, in the longer term (when the investment climate improves), the study concludes that the assistance will prove to have been sustainable. Government measures to raise tariffs in every quarter during 2002 and its approval for such quarterly increases to enable PLN to break even soon and achieve an 8% rate of return on revalued assets by 2005 give room for further optimism in this regard.

5. Institutional and Other Development Impacts

83. ADB's efforts to help PLN become a technically competent and modern public utility were successful. Its assistance through loans and TAs and policy dialogue with the Government made important contributions to the improved technical capability of PLN and operational performance of the sector. Improvements in operations helped reduce production costs that would have otherwise been incurred due to high system losses and technical deficiencies. ADB's efforts also greatly improved the financial, accounting, and audit systems of PLN and

enabled it to measure and control costs and make meaningful tariff submissions to the Government. However, ADB efforts through policy dialogue and covenants did not always succeed in convincing the Government to approve these proposals fully or in a timely fashion.

84. ADB's involvement through policy-based lending in the Government's Power Sector Restructuring Program after the Asian financial crisis provided a sound basis for structural reforms that aimed to address fundamental sectoral issues relating to overregulation and inappropriate financial policies. The new Electricity Law enacted in September 2002 provides for a gradual transition to a fully competitive electricity market, starting with power generation. Enactment of the Electricity Law as covenanted under ADB's program loan is an important step forward in a far-reaching but lengthy and complicated reform process.

85. This study indicates that in all selected locations ADB-financed power projects had a likely positive poverty reduction impact through employment generation during project construction, creation of employment in power service delivery, and new economic opportunities in connection with the use of electricity after project completion. The increases in either quantity or quality of electricity supply have distinct benefits for people, including the poor. The TAs supported the capacity-building effort of PLN particularly in environmental planning and management. ADB has also promoted the development of renewable energy resources for power generation including geothermal and medium-scale hydropower.

86. The main conclusion derived from the study's findings is that ADB's conventional lending operations to the Indonesian power sector had significant impacts in terms of power system development, macroeconomic linkages, socioeconomic development, and institutional development but its sector reform assistance, the complexity of which is recognized in this study, has not met with the same level of success to date. Overall, ADB's assistance to the Indonesian power sector has been assessed as successful.

B. Lessons Learned

87. The results of ADB's operations reflect in large part the appropriateness of Government policies. Until 1997, the Government and PLN regularly prepared policy papers and power sector development plans to set objectives, identify investment program, and allocate resources. ADB operations were formulated in the light of such government policies and plans, reconciling them with ADB's sector and lending policies through policy dialogue during country programming and project processing missions. This highlights the importance of policy dialogue in ADB operations. When ADB was unable to secure the Government's compliance of tariff-related obligations, it wisely refrained from further lending to PLN after 1995. Lending resumed only in 1999 in the policy-based program lending modality mainly to restructure the sector. Further lending is considered⁴⁹ in the context of corrective action by the Government in relation to power tariffs. This highlights the importance of a clear focus on implementation of agreed policies.

88. While the targets prescribed in ADB's financial covenants had not often been reached, they have clearly helped PLN to press the Government to move in the right direction. Thus during 1990-1997 PLN achieved positive and moderate returns on its revalued assets (3.5% to 6.2%), good debt service coverage ratios, and reasonable self-financing ratios (22% to 37%). This was also the period when PLN was being given larger sized loans (average size \$295 million compared to \$39 million in the earlier years). When the Government appeared

⁴⁹ Two loans to the power sector in Indonesia were approved in December 2002, namely *Loan 1982-INO: Renewable Energy Development*, for \$161 million, and *Loan 1983-INO: Power Transmission Improvement*, for \$140 million.

unresponsive to the timely cost-recovery needs of the sector and was willing to let PLN incur losses, ADB ceased to lend to the sector. The lesson from this is that financial covenants could help move governments in the right direction, even if the exact targets are not often met. When this ceases to happen, there is no point in continuing to lend and repeating the same covenants.

89. Policy-based program lending has been only moderately efficacious and financial assistance alone clearly had only a limited impact on the speed and scope of sector reform. Program loans need to be disbursed fast, but the implementation of stipulated policies relating to structural changes need a much longer time frame. This calls for new and imaginative lending modalities, such as hybrid loans with both project and policy implementation components (sector development programs) or a cluster of program loans each tied to implementation of key specific milestones of the sector reform.

90. Despite the notable progress, the operational and financial performance of PLN and the sector still point to the need for continued effort in institutional strengthening and capacity building. The focus should clearly be on the evolution of a competent and independent regulatory body that respects the cost-recovery principle and allows tariffs to cover just and reasonable costs without getting entangled in the cumbersome and unpredictable political processes.

C. Implications for the Future

91. The significant cost underruns in projects seen in this study should not recur to the same extent. They suggest a systemic weakness in project planning, design, and implementation, and particularly in cost estimation, and a failure to learn from the lessons of earlier loans. There is room for improvement in PLN, the Government, and ADB in this regard.

92. Although the private sector is expected to play an increasing role in the future, PLN will still have to make significant investments in generation outside Java-Bali, as well as the transmission and distribution facilities throughout the country. Notwithstanding its ability to self-finance a proportion of its requirements, PLN is still expected to require further assistance from some or all of its traditional external sources including ADB.

93. Common understandings among aid agencies on broad sector issues are necessary ingredients for successful coordination of assistance. For the benefit of the borrowers, it is desirable that the main lending agencies assign sector leadership to a single agency with regard to policy formulation and take up different aspects of its implementation.

94. In light of the ongoing regional autonomy, PLN's reorganization and newly adopted geographical focus⁵⁰ for ADB operations in Indonesia, ADB's assistance in the power sector will favor provinces outside Java in the future. Different tactics and approaches from those adopted for Java-Bali and Sumatra are required to address the special features of the outer islands where technical, financial, and managerial capabilities of the local governments and strategic business units are relatively weak. For example, smaller loans using sector-lending modality may be more appropriate in most instances.

⁵⁰ ADB. 2002. *Indonesia: Country Strategy and Program (2003-2005)*. Manila.

ASIAN DEVELOPMENT BANK ASSISTANCE TO THE POWER SECTOR

Table A1.1: Loan Projects

Loan No.	Project	Loan Amount (\$ million)	Year Approved
ADF			
69 (SF)	Pontianak Power	4.6	1971
83 (SF)	West Sumatra Power Supply	7.1	1971
104 (SF)	Pekanbaru Power	2.6	1972
122 (SF)	Ujung Padang Power	5.3	1973
125 (SF)	Irian Jaya Power	2.6	1973
166 (SF)	Minahasa Power	5.1	1973
OCR			
167	Minahasa Power	2.8	1973
237	Garung Hydroelectric	19.8	1975
260	Maninjau Hydropower	39.7	1976
302	Power Distribution	45.0	1977
343	Second Power Distribution	31.4	1978
357	Ujung Pandang II Power	26.0	1978
430	Java EHV Transmission	83.6	1979
459	Second Java EHV Transmission	60.7	1980
544	Surabaya Distribution and Sulawesi Power	76.0	1981
569	Second Sulawesi Power	41.4	1982
600	Transmission and Distribution System Development	58.4	1982
674	Power XVIII	135.0	1983
835	Power XIX (Sector)	96.0	1987
1032	Power XX	235.0	1990
1092	Power XXI	300.0	1991
1172	Power XXII	350.0	1992
1271	Power XXIII	275.0	1993
1320	Sumatra Power Transmission	272.0	1994
1397	Power Development and Efficiency Enhancement	337.0	1995
1673	Power Sector Restructuring Program	380.0	1999
1674	Capacity Building for Establishment of a Competitive Electricity Market	20.0	1999

ADF = Asian Development Fund, OCR = ordinary capital resources.

Table A1.2: Technical Assistance

No.	Technical Assistance Name	Type	Amount (\$)	Year Approved
33	West Sumatra Electric Power Supply	PPTA	185,000	1970
53	West Irian Power Development	PPTA	85,000	1971
62	Ujung Pandang (Makassar) Power	PPTA	120,000	1972
82	Minahasa Power	PPTA	48,000	1973
432	PLN Design Unit	ADTA	149,000	1981
455	Tanggari II Hydropower Scheme	PPTA	150,000	1982
492	Mini Hydropower Development	PPTA	150,000	1982
524	Rural and Renewable Energy Development Study in Kalimantan	PPTA	450,000	1983
571	Dieng Geothermal	PPTA	150,000	1983
785	Power Development Study of Regions IX and XI	ADTA	350,000	1986
1330	Study on Electricity Tariff Adjustment Mechanism	ADTA	100,000	1990
1488	Geothermal Steam Pricing Study	ADTA	100,000	1991
1546	Power Demand Analysis for Java	ADTA	510,000	1991
1739	Environmental Planning and Management of Coal-Fired Power Plants	ADTA	200,000	1992
2171	Environment and Energy Efficiency	ADTA	416,000	1994
2227	Load Characteristics Survey Outside Java	ADTA	600,000	1994
2429	Strategic Planning for Power Sector Study	ADTA	590,000	1995
2430	Geothermal Power Development Study	ADTA	310,000	1995
2633	Electricity Tariff Rationalisation Study	ADTA	353,000	1996
3027	Revaluation of the Operating Assets of PLN	ADTA	938,000	1998
3083	Development of Power Sector Restructuring Policy	ADTA	150,000	1998
3481	Outer Island Electrification	PPTA	800,000	2000
3807	Regional Power Transmission and Competitive Market Development	PPTA	1,000,000	2001

ADTA = advisory technical assistance, PLN = P.T. Perusahaan Listrik Negara (Persero),
PPTA = project preparatory technical assistance.

COMPLETED PROJECT PERFORMANCE DATA

(\$ million)

Loan No.	Title	Loan Amount (\$ million)		Project Costs (\$ million)		Cost Overrun/ (Underrun)		Time Overrun/		EIRR		FIRR		Performance Ratings		
		Appraisal	Actual	Appraisal	Actual	Amount	%	years	%	Appraised	Actual	Appraised	Actual	PCR	PPAR	
1	69-INO(SF)	Pontianak Power	4.60	4.60	6.00	11.07	5.07	84.48	3.8	90.10	—	—	16.30	—	PS	PS
2	83-INO(SF)	West Sumatra Power Supply	7.10	7.10	9.90	20.62	10.72	108.25	1.6	41.60	—	—	13.90	—	a	PS
3	104-INO(SF)	Pekanbaru Power	2.60	2.60	2.93	5.28	2.35	80.20	2.4	71.70	17.50	—	—	—	GS	GS
4	122-INO(SF)	Ujung Pandang Power	5.30	5.16	7.00	6.50	(0.50)	(7.14)	2.4	67.20	18.10	—	—	—	a	PS
5	125-INO(SF)	Irian Jaya Power	2.60	—	4.30	—	(4.30)	#####	—	—	—	—	—	—	c	—
6	166-(SF)/167-INO	Minahasa Power	7.90	7.50	11.10	12.39	1.29	11.62	5.0	86.50	>18.8	9.40	18.80	11.40	a	GS
8	237-INO	Garung Hydroelectric	19.80	14.50	31.90	39.20	7.30	22.88	8.5	263.10	10.90	13.20	10.90	6.40	PS	GS
9	260-INO	Maninjau Hydropower	39.70	37.78	62.70	76.98	14.28	22.78	2.5	51.20	15.00	15.00	12.00	13.00	a	GS
10	302-INO	Power Distribution	45.00	30.60	68.20	45.70	(22.50)	(32.99)	6.7	165.80	24.00	16.30	22.00	10.60	a	GS
11	343-INO	Second Power Distribution	31.40	19.09	45.00	38.89	(6.11)	(13.58)	—	—	—	—	—	—	a	b
12	357-INO	Ujung Pandang II Power	26.00	18.55	27.00	23.57	(3.43)	(12.70)	2.3	56.50	18.50	13.10	24.30	4.70	a	GS
13	430-INO	Java EHV Transmission	83.60	50.13	149.90	80.85	(69.05)	(46.06)	2.4	67.10	5.0-5.4	—	6.5-10.0	—	a	GS
14	459-INO	Second Java EHV	60.70	37.82	103.70	70.79	(32.91)	(31.74)	—	—	—	—	—	—	a	GS
15	544-INO	Surabaya Distribution and Sulawesi Power	76.00	49.40	143.70	88.68	(55.02)	(38.29)	3.4	112.40	—	16.80	13.6-26.0	10.50	a	GS
16	569-INO	Second Sulawesi Power	41.35	26.28	60.45	33.90	(26.55)	(43.92)	7.0	202.60	—	27.90	—	26.30	a	GS
17	600-INO	Transmission and Distribution System Development	58.40	35.05	108.20	55.40	(52.80)	(48.80)	2.5	52.08	—	—	—	—	a	b
18	674-INO	Power XVIII	135.00	121.15	317.00	271.18	(45.82)	(14.45)	5.9	148.00	—	—	11.00	7.60	a	b
19	835-INO	Power XIX (Sector)	96.00	85.01	189.00	131.77	(57.23)	(30.28)	1.7	33.40	17.90	24.40	2.10	6.60	a	b
20	1032-INO	Power XX	235.00	227.97	450.00	472.33	22.33	4.96	2.0	38.76	16.20	9.60	10.40	5.80	PS	b
21	1092-INO	Power XXI	300.00	195.61	420.00	255.97	#####	(39.05)	3.4	82.01	18.00	17.10	7.70	2.50	GS	b
22	1172-INO	Power XXII	350.00	287.50	2360.50	1820.10	#####	(22.89)	-0.6	(0.14)	19.00	15.20	11.80	1.30	GS	b

— = not calculated, EIRR = economic internal rate of return, GS = generally successful, PCR = project completion report, PPAR = project performance audit report, and PS = partly successful

^a The PCR did not give an explicit rating.

^b The Project was not postevaluated.

^c Loan was cancelled.

EXTERNAL ASSISTANCE TO THE POWER SECTOR

(\$ million)

Source	FY1970– FY1974	FY1975– FY1979	FY1980– FY1984	FY1985– FY1989	FY1990– FY1994	FY1995– FY1999	Total
A. Multilateral	91.0	–	549.0	521.0	2,344.0	1,745.0	5,250.0
Asian Development Bank	5.0	–	–	93.0	913.0	717.0	1,728.0
World Bank	86.0	–	549.0	428.0	1,431.0	1,008.0	3,501.0
Others	–	–	–	8.0	–	21.0	29.0
B. Bilateral	160.0	660.0	1,117.0	389.0	818.0	1,064.0	4,208.0
Finland	–	–	–	–	2.80	–	2.0
Austria	–	–	–	–	90.0	75.0	164.0
Belgium	–	–	–	–	11.0	2.0	13.0
Canada	–	10.0	–	–	–	–	10.0
France	–	–	86.0	13.0	39.0	19.0	159.0
Germany	33.0	4.0	33.0	123.0	186.0	71.0	451.0
Italy	–	–	–	–	79.0	–	79.0
Japan	–	615.0	998.0	189.0	390.0	867.0	3,080.0
Netherlands	–	–	–	16.0	11.0	–	27.0
Rep. of Korea	–	–	–	–	–	–	–
Switzerland	–	–	–	34.0	–	–	34.0
United Kingdom	–	–	–	13.0	9.0	30.0	51.0
United States	127.0	30.0	750.0	–	–	–	158.0
C. Export Credit	–	–	466.0	55.0	3,694.0	2,044.0	6,260.0
Australia	–	–	–	–	–	173.0	173.0
Austria	–	–	–	55.0	114.0	20.0	188.0
Belgium	–	–	–	–	71.0	27.0	98.0
Canada	–	–	–	–	245.0	–	245.0
China	–	–	–	–	7.0	–	7.0
Denmark	–	–	–	–	32.0	–	32.0
Germany	–	–	–	–	365.0	201.0	586.0
France	–	–	–	–	505.0	69.0	574.0
Italy	–	–	–	–	5.0	32.0	37.0
Japan	–	–	–	–	1,569.0	880.0	2,450.0
Netherlands	–	–	–	–	207.0	–	207.0
Rep. of Korea	–	–	–	–	10.0	–	56.0
Sweden	–	–	171.0	–	–	–	171.0
Switzerland	–	–	–	–	242.0	232.0	474.0
United Kingdom	–	–	195.0	–	95.0	145.0	435.0
United States	–	–	99.0	–	207.0	219.0	524.0
One Bank Credit	–	–	–	–	20.0	–	20.0
D. Leasing	–	–	–	28.0	121.0	308.0	457.0
Japan	–	–	–	28.0	121.0	308.0	457.0
Total	251.2	659.6	2,132.0	993.1	6,978.0	5,181.0	16,175.0

Source: Government External Debt, Bank Indonesia.

MACROECONOMIC IMPACT

A. Introduction

1. Since 1980, Asian Development (ADB) assistance to the Indonesian power sector has been focusing on the augmentation of capacity, improved efficiency of supply, and on sector reform. With these objectives, ADB loans and technical assistance have had an important impact on the economy. An improvement in the capacity of P.T. Perusahaan Listrik Negara (Persero) (PLN) allowed for better electricity access for both household and business users. In addition, the power sector is an important part in the national production linkages. An improvement in PLN's operating efficiency will benefit not only the power sector but also the economy as a whole. ADB-financed projects accounted for about 14% of the total increase in PLN's generation capacity, 26% of the circuit-kilometer increase in transmission, and a 4% increase in distribution between 1980 and 2000.

B. Macroeconomic Impacts

2. In measuring the macroeconomic impacts of ADB's assistance, a general equilibrium model calibrated with a database representing the Indonesian economy in the year 2000 was used. To project the macroeconomic impact of ADB assistance to the power sector in Indonesia, shocks were introduced to represent changes in the sector potentially driven by the assistance, such as an increase in PLN's power supply capacity, improvement in PLN's operating efficiency, and tariff adjustment. To separate the impact of each change, the model was used to run different simulations representing the three different shocks.

3. The first simulation was used to project the macroeconomic impacts of an increase in PLN's supply capacity. This was done by introducing a negative shock of 10% to the PLN's capacity in year 2000. The simulation projects the costs of losing 10% of PLN's capacity in terms of macroeconomic conditions such as economic growth, employment, inflation, and growth.

4. The exact data to show the efficiency impact of ADB's assistance to PLN was not available. The second simulation attempted to provide a rule of thumb in projecting a macroeconomic impact of an improvement in PLN operating efficiency. The model projected the macroeconomic impact of 2% improvement in PLN's operating efficiency.

5. The third simulation computed the macroeconomic impact of electricity tariff adjustment. In this simulation a shock representing an increase of electricity tariff by 10% across all consumer classes was introduced.

6. The macroeconomic effects that arise from different shocks are presented in the following table.

Summary of Simulation Results

Variable Change %	Simulation 1 (10% decrease in generation)	Simulation 2 (2% increase in efficiency)	Simulation 3 (10% increase in average tariff)
Macro Indicator			
Real GDP	-0.126	0.030	-0.042
Export Volume	-0.194	0.048	-0.114
Import Volume	0.108	-0.048	0.003
Balance of Trade	-0.108	0.026	-0.044
Employment	-0.066	0.016	-0.116
Consumer Price Index	0.054	-0.014	0.193

GDP = gross domestic product.

Source: General equilibrium model simulation results.

7. The first simulation showed that 10% reduction in PLN's capacity, in general, reduces gross domestic product (GDP) by 0.126%. It also reduced export volume by 0.194%, but increased imports by approximately the same percentage. As a result, the balance of trade worsened by 0.108% of GDP. In line with negative GDP growth, the employment rate also declined by 0.066%. The reduction in PLN's capacity also would cause an increase in the inflation rate by 0.054%.

8. A 2% improvement in PLN's efficiency generated an opposite pattern of macroeconomic effects. As shown in the third column of the table, it improved economic growth and employment. An improvement in PLN's efficiency also reduced inflation and improved domestic competitiveness, which would help the balance of trade position.

9. Simulation 3 showed that 10% increase of electricity price across all PLN's consumers increased the level of inflation by 0.2%. Export volumes declined by 0.11%, while import volumes increased slightly.

10. An improvement in PLN's capacity, operating efficiency, and increase in electricity prices have both direct and indirect impacts on the domestic price level. An increase (decrease) in the price of electricity directly influences inflation through higher (lower) costs of household electricity consumption, and indirectly through increases (decreases) in the prices of other consumer goods produced by industries using electricity as an input. Since it was assumed in the simulation that the rupiah exchange rate remains constant, the rising domestic prices following the electricity price adjustments adversely affect the country's competitiveness.

11. The macroeconomic effects of power sector-related changes are not large. First, in the input-output data used in the model the share of electricity spending for both producers (industries) cost and consumers spending are only around 1%. The underlying model incorporates only usual forms of inputs between sectors, and not the impact of investment expenditures. Second, there is also a lag in the electricity tariff adjustment compared to other prices after the crisis. Third, the impacts presented do not represent the accumulative effect of the ADB's assistance, but annual macroeconomic effects.

FINANCIAL AND ECONOMIC REEVALUATION OF SAMPLE PROJECTS

1. The financial and economic internal rates of return (FIRRs/EIRRs) and weighted average cost of capital (WACC) of the following four projects were recalculated: (i) Power Distribution Expansion Project, (ii) Singkarak Hydropower Project, (iii) Darajat Geothermal Power Project, and (iv) Suralaya Coal-Fired Power Plant Expansion Project. In accordance with Asian Development Bank guidelines for the preparation of project performance audit reports, the base year of analysis was taken as the year of commissioning in each case. The analyses for the generation projects were converted into rupiah at the exchange rate applying in the year of commissioning, but the analysis of the distribution expansion project was left in United States dollars because of the method of calculation used in the project completion reports. Distribution costs were removed from the three generation project analyses and their economic benefits were reduced commensurately. The calculated EIRR is therefore a lower bound. Otherwise, similar methodology as in the project completion report calculations was used. The recalculation results are shown in the following tables.

Table A5.1: Recalculated Financial Internal Rates of Return

Project	PCR Estimates of FIRR (%)	WACC (%)	Recalculated FIRR (%)
Expansion of Suralaya Coal-Fired Plant (Loan 1172-INO)	7.1	4.0	6.1
Darajat Geothermal Plant (Loan 1092-INO)	2.5	3.3	1.7
Singkarak Hydropower Plant (Loan 1032-INO)	5.8	3.4	3.2
Distribution Expansion Outside Java (Loan 835-INO)	6.6	3.9	5.7

FIRR = financial internal rate of return, PCR = project completion report, WACC = weighted average cost of capital.

Table A5.2: Recalculated Economic Internal Rates of Return

Project	PCR Estimates of EIRR (%)	Recalculated EIRR (%)
Expansion of Suralaya Coal-Fired Plant (Loan 1172-INO)	14.8	12.0 ^a
Darajat Geothermal Plant (Loan 1092-INO)	16.8	11.2 ^a
Singkarak Hydropower Plant (Loan 1032-INO)	9.6	4.6 ^a
Distribution Expansion Outside Java (Loan 835-INO)	24.4	28.4

EIRR = economic internal rate of return, PCR = project completion report.

^a Distribution costs were removed from the generation project analyses and their economic benefits were reduced commensurately.

A. Distribution Expansion Project (Loan 853-INO)

1. Financial Analysis

2. The main assumptions for FIRR and WACC recalculations were as follows:

- (i) Benefits: Estimates of project benefits were based on P.T. Perusahaan Listrik Negara (Persero) (PLN) distribution system statistics, the tariffs applying at the time and cost of supply data. Benefits included system loss reduction, outage reduction, and incremental new connections achieved as a result of the project.

- (ii) Costs: Capital costs included only the distribution capital costs before interest during construction, and were expressed in constant 1995 prices. A 1.5% of the capital cost was used for operation and maintenance costs.
- (iii) WACC: ADB loan for 65% of the total project cost with interest rates 6% per annum, foreign loan for 15% with interest rate 8% per annum, government funds for 10% with nominal cost of 15% per annum, tax rate of 30%, and inflation rate of 10% per annum for local cost were used.

2. Economic Analysis

3. The main assumptions for EIRR recalculations were as follows:

- (i) The standard conversion factor of 0.9 was applied to convert financial prices to economic prices.
- (ii) As a transfer payment, consumer contribution connection charges were not included in economic analysis.
- (iii) The incremental sales were valued at the consumer willingness to pay.

B. Singkarak Hydropower Project (Loan 1032-INO)

1. Financial Analysis

4. The main assumptions for FIRR and WACC recalculations were as follows:

- (i) Benefits: Project benefits comprise revenues from incremental energy sales attributable to the operation of Singkarak hydropower plant. Losses due to transmission and distribution were estimated at 12% of electricity generated. The design output of the station was 986 gigawatt hours (GWh) per annum but the plant has not delivered this output to date. Outputs in 1999, 2000, and 2001 were 656 GWh, 632 GWh, and 557 GWh, respectively. For evaluation purposes, a 10% reduction in the design output was assumed.
- (ii) Costs: Capital costs included the actual project costs before interest during construction, and were expressed in constant 1999 prices. A 0.75% of the capital cost was used for operation and maintenance costs.
- (iii) WACC: ADB loan for 56% of the total project cost with interest rates 6% per annum, foreign loan for 18% with interest rate 8% per annum, and government funds for 26% with nominal cost of 15% per annum, tax rate of 30%, and inflation rate of 10% per annum for local cost were used.

2. Economic Analysis

5. The main assumptions for EIRR recalculations were as follows:

- (i) The standard conversion factor of 0.9 was applied to convert financial prices to economic prices.
- (ii) The incremental sales were valued at willingness to pay.

C. Darajat Geothermal Power Project (Loan 1092-INO)

1. Financial Analysis

6. The main assumptions for FIRR and WACC recalculations were as follows:

- (i) Benefits: Project benefits comprised revenues from incremental energy sales attributable to the operation of Darajat geothermal power plant.
- (ii) Costs: Capital costs included the actual project costs before interest during construction, and were expressed in constant 1998 prices. Operation and maintenance costs were revised to 0.5 % of total capital costs plus 12.5 % of the cost of steam used.
- (iii) WACC: ADB loan for 76% of the total project cost with interest rates 6% per annum, and government funds for 24% with nominal cost of 15% per annum, tax rate of 30%, and inflation rate of 10% per annum for local cost were used.

2. Economic Analysis

7. The main assumptions for EIRR recalculations were as follows:

- (i) The standard conversion factor of 0.9 was applied to convert financial prices to economic prices.
- (ii) The incremental sales were valued at willingness to pay.

D. Expansion of Suralaya Thermal Power Plant Units 5, 6, and 7 (Loan 1172-INO)

1. Financial Analysis

8. The main assumptions for FIRR and WACC recalculations were as follows:

- (i) Benefits: Project benefits comprise revenues from incremental sales attributable to the operation of units 5–7 of the Suralaya thermal power plant. Losses due to transmission and distribution have been estimated at 18% of the electricity generated. Generation in 1997 was changed to match actual data. Generation in subsequent years assumes a 73% plant factor.
- (ii) Costs: Capital costs included the actual project costs before interest during construction, and were expressed in constant 1999 prices. Operation and maintenance costs were estimated at 1% of total capital cost plus a quarter of the fuel cost. Fuel costs were assumed to be \$35 per metric ton.
- (iii) WACC: ADB loan for 37% of the total project cost with interest rates 6% per annum, foreign loan for 43% with interest rate 8% per annum, and government funds for 20% with nominal cost of 15% per annum, tax rate of 30%, and inflation rate of 10% per annum for local cost were used.

2. Economic Analysis

9. The main assumptions for EIRR recalculations were as follows:

- (i) The standard conversion factor of 0.9 was applied to convert financial prices to economic prices.
- (ii) The incremental sales were valued at willingness to pay.

SOCIOECONOMIC IMPACT

A. Introduction

1. In order to gain some insight into the socioeconomic impacts of Asian Development Bank (ADB) financed power sector projects, a sample of completed projects, namely Power XVIII Project (Loan No. 835-INO), Power XIX Project (Loan No. 1032-INO), Power XXI Project (Loan No. 1092-INO), and Power XXII Project (Loan No. 1172-INO) were selected as case studies. These case study projects, for which project completion reports (PCRs) were prepared most recently, covered all major components of ADB's power sector interventions in Indonesia.

2. The basic methodology used included:

- (i) individual in-depth interviews with local people (the ultimate stakeholders) in areas included under or adjacent to the projects, as well as with key people in P.T. Perusahaan Listrik Negara (Persero) (PLN) offices;
- (ii) group discussions with selected groups of local people; and
- (iii) observation of living styles and conditions in areas directly or indirectly affected by project activities.

3. Three field trips were made: to West Sumatra, North Sumatra, and West Java. During these trips a total of 142 individual interviews and 18 group discussions were undertaken.

4. The social impact of the power sector projects in this study is interpreted in terms of perceived and measurable benefits as well as negative impacts on local people in the selected areas. In addition, the study also highlights some issues related to the quality of PLN's service.

B. Project Benefits

5. Electricity makes life more convenient, particularly for women. It makes utilization of a variety of electrical appliances possible that are widely perceived to make housework easier, such as water pumps, refrigerators, fans, irons, and rice cookers. Electrification allows expanded use of these conveniences. "It was the first time in 1993 that people bought rice cookers here," said a shop owner in Bukit Tinggi, West Sumatra. Rice cookers are not just a convenience, but also, by keeping rice warm, help to reduce women's overall workload at home. "It helps me in preparing breakfast, especially when the children have to leave early to go to school," said Mr. Sindi, a resident of Rantau Jaya, Sukadana Village, in Lampung.

6. Electric irons are also widely used and, due to their relatively low price, are often one of the first electrical appliances acquired, particularly by poorer households. But they are not always used on a daily basis as with some other appliances. "I iron my children's school uniform once a week," said a housewife in Kampung Tanang, Ombilin Village West Sumatra.

7. Computers are less widely used, but demand is growing, particularly among the younger generation and those in high school and university. Typing with a computer is definitely faster than using a manual typewriter. Computer rental and typing services are available. According to one respondent working at a computer rental shop, more people ask for typing services than rental. The price for computer rental is Rp1,000 per hour; however, people still have to pay if the electricity is disrupted due to blackout before the hour is up. Over the past few years, the number of computer rental shops in Labuan Ratu has increased rapidly as this is an area where

a number of educational institutions such as STMIK Darma Jaya and the Bandar Lampung University are located.

8. Having a television (TV) at home is now common among virtually all of the households visited during the field visit. It represents an important welfare choice given the relatively high cost of a TV set (more than RP1 million for even a small color TV). TV has become a major source of entertainment in these areas and many people even bought parabola antennas for access to foreign stations. At least among urban households in the areas examined in Northern Sumatra, women and children are the primary beneficiaries of TV as men spend more of their time outside of the house. It was reported, for example, that one food stall in Siabu Village in North Sumatra was even forced to close because the owner did not provide a TV with a decoder. People simply went to the coffee shop where the service was being provided.

9. Electricity expands employment opportunity in various ways. There are direct project impacts as occurred around Lubuk Alung (a small town about 35 kilometers [km] north of Padang, the capital of West Sumatra) during the construction of the Singkarak hydropower project. The project hired many local people to work directly on the project or they found work in Dumes (a special housing area for the projects' consultants) located in Asem Pulau Village, about 5 km from Lubuk Alung. After the completion of project, many of these workers were able to find work in an expanded local economy. Some, for example, were able to buy motorcycles with their project earnings and become *tukang ojek*, motorcycle taxi drivers.

10. In Singguling Village, located about 3 km from Lubuk Alung, there are many people who benefited directly from the hydropower project due to the diversion of water from the Ombilin into the Anai River. Before, people had to share water flowing down from the nearby mountain. "Sometimes we had to fight simply to get the water," a local farmer from Sangguling explained. The water for farming in the area is now only about 25% of the availability. Additional water is now used to develop fishponds (*tambak ikan*) for special species such as goldfish. Today, fishermen from Singguling and Asem Pulau villages can get more fish and shellfish from the river than before.

11. The hydropower project also provided other benefits in terms of infrastructure improvements, particularly roads. After the project, the road from Lubuk Alung to Singguling was asphalted, public transportation such as motorcycles and taxis have become more plentiful.

12. The Suralaya power plant has had both direct and indirect impacts on local employment. During project construction, many local people were able to find work. Even after the project was completed in 1999, some are still able to find occasional work for contractors tied to PLN.

13. As with the Singkarak hydropower project, there are employment opportunities for a range of small-scale service activities. These are generally not very lucrative, but better than nothing. For example, young women from Suralaya have found work as house helpers in the residential area of PLN workers in Suralaya Village. One negative offshoot, however, is that many of these girls drop out of school because of poverty and the need to work for money. "Only 30% of them continue their study," according to a primary school teacher in Suralaya.

14. Ojek driving is another occupation that has developed in the area. Local people formed a cooperative of drivers in the mid 1990s. Members of the cooperative contribute Rp1,000 per week to a common fund that is used to help members who have accidents. "Though the income is not much, it is better than stealing," said one motorcycle driver.

15. Industrial development in Banten has also benefited from the presence of electricity. For example, since in the late 1980s, many chemical industries have been established along the major road connecting Merak to Bojonegoro, Banten. Local people from Salira are able to find work in these factories. Also, the industrial growth has sparked the growth of food stalls along the road as well as leasing of houses and rooms to workers. Interestingly, the growth has not been as great in Suralaya Village where the Suralaya West Java Steam Power Plant (PLTU) is located, since it is not located on the main road. Without electricity, none of this is possible.

16. Without doubt, the greatest advantage of electrification lies in the ability to extend working hours well into the evening. "If electric lighting is available, I can do my embroidery until midnight. Otherwise, I can do nothing except sitting in front of my house. I just go to bed earlier if the electricity is out." said a housewife in Rantau Jaya, Sukadana Village, East Lampung.

C. Negative Impacts of Projects

1. Singkarak Hydropower Project under Loan 1032-INO

17. The Singkarak Dam diverted water from the Ombilin to the Anai River, accruing benefits to those living along the Anai, but severely reducing economic opportunity from the former. Before the water from Singkarak Lake was diverted to the Anai River, one mother of seven living in Kampung Tanag, Ombilin Village, used to collect shellfish (*pensi* or *ikan bilih*) from the Ombilin River. She said: "Before, I could get Rp30,000 to Rp40,000 per day by selling *pensi*. The price for one liter was Rp8,000. *Pensi* is good for jaundice or rheumatism. After the project, the river became shallow, so I was forced to change business and open a food stall. Some people have had to become farmers and plant cassava. As you know, for cassava they need capital to buy seeds and fertilizer and to pay workers. For *pensi*, no such capital is required."

18. Another housewife living near the Ombilin Weir noted: "I could do nothing after the water was diverted and could not get any more *pensi* from the river. Before I could get 20 glasses per day and sell each of them for Rp500." Collecting *pensi* was also an entertainment and income earning activity for school children. A 16-year-old senior secondary school student noted that when he was in primary school, he used to collect *pensi* after school. "Today, I cannot find any more *pensi*, *ikan bilih*, or turtles in the river," he said.

19. Rice fields in Malalo Village have also become more dependent on rainfall as opposed to irrigation. "If there is no rain, I have to plant less water-demanding crops instead of rice," said a farmer from Malalo. "But my income is much reduced due to the change."

20. Before the project, people along the Ombilin River used the water for drinking, cooking, washing, and bathing. Today, people around the Ombilin Weir have to spend around Rp25,000 per month for drinking water. "After the project, many small shops sprang up around the T-intersection of the Ombilin Dam. These have created a very dirty environment around the Singkarak Lake floodgate. People throw rubbish into the lake so that bathing now makes my skin feel very itchy. I also have to use body lotion or my skin will feel very dry", a young woman who lives 20 meters from the Ombilin Weir commented.

21. The project did provide five public bathrooms and toilets for people living around the dam. But, unfortunately, they are not used, as there is no consistent water supply. This would have required a jet pump to draw deep groundwater and this was apparently not included in the arrangement. In this area, richer people now increasingly rely on jet pumps to obtain water.

2. Suralaya Power Plant under Loan 1172-INO

22. Negative social impacts from the Suralaya power plant have been less than along the Ombilin River, but some still occurred. Land acquisition has led to a decrease in agricultural land, forcing people to look elsewhere for income. According to some people in Suralaya Village, this has forced some local farmers to encroach on Gunung Kahal, a local protected forest area, where they are now cultivating cassava, banana, and peanuts. "It is a restricted area, but we do not have any other place to plant things. It is our source of income," said a local resident in Suralaya Village.

23. Complaints were also heard about decreased fish production from the Kahal River. As a teacher at the Kahal public primary school noted, "Earlier, people had income from their rice field and other sources. Nowadays, only about half of them have money for paying school fees, which are only Rp2,000 per month for a student in public primary school."

24. Although it cannot be directly blamed on Suralaya, the presence of the power plant has had an impact on local industrial development and that, in turn, has led to increased pollution problems, particularly from the chemical factories in and around Salira Village. The factories have clearly provided economic benefits, but also some negative impacts.

25. As indicated earlier, Suralaya Village has not had the industrial development of Salira, and people here seem to be more concerned with jobs and responsibility of the power plant in terms of their basic economic welfare. During construction of the Suralaya project, many local residents were hired as project workers. After the project ended, they were released and few can find work as regular workers in the Suralaya PLTU.

26. According to a senior supervisor for employee affairs for Indonesia Power the company had only undertaken recruitment drives twice, once in 1991 and again in 2002. In 1991, the company only brought in workers from other company units that were overstaffed and did not recruit locally. In 2002, PLN gave more attention to local recruitment. Of 35 new workers hired, 75% were from Banten Province, including three from Suralaya Village and one from Salira Village. In fact, they even extended the age limit from 21 years or under to 24 years in order to expand the opportunity for local people.

3. Extra High Voltage Transmission Lines under 1092-INO

27. Compensation to land owners along construction lines is commonly provided. However, at least in the eyes of recipients, it is considered below market prices or below income that can be generated from the land. This is particularly true where people have been using the land for high-value tree crops that, for obvious reasons, cannot be sustained around high-voltage lines. "I don't really remember the year. What I do remember is that I received only Rp200,000. And during construction I lost around 30 fruit trees, including rambutan, durian, cempedak, nangka, and jengkol. The selling price for cempedak is Rp5000 per kilogram and one tree can produce 500 to 6,000 fruits at harvest. And that is only cempedak. I can get up to Rp800,000 from each tree when harvesting. Besides the trees, I also lost 200 square meters of land for road widening." (An 87 year-old widower who has lived in Kampung Jambang, Kalisuren Village, West Java since 1945.)

28. Another issue is that land under and adjacent to the power lines tends to decrease in value. "Land prices here have declined since the towers and lines were constructed. My nephew almost sold the land. But when the potential buyer came and saw the land he cancelled the deal

because the land was located too close to the high-voltage line,” according to a local resident of Kampung Jampang, Kalisuren Village, West Java.

29. Reasons for this are not exactly clear, but it may be at least partly associated with fears of potential health problems. Still, this has not deterred other people from moving adjacent to these lines, particularly where there is scope for economic activity. The fieldwork found two such cases. A furniture parts maker moved to an area close to a high-voltage tower in Jampang Pintu Air 4 years ago. This was due to its strategic location along the main road from Parung to Bogor. A housewife moved to Kampung Serua, Serua Village 4 years ago with her house now located only about 10 meters from a high voltage tower.

D. Quality of PLN's Service

30. Many people now see electricity almost as a basic human need so that provision or access is taken for granted. They are more concerned with quality of supply. There is ample evidence that PLN's service has been deteriorating in some areas since 1998. However, PLN's service is still better than that from privately or community-based systems. Experience with frequent blackouts led people in Pekalongan, a small town about 70 km north of Bandar Lampung, to change their service from the locally run Koperatsi Listrik Pedesaan (Rural Electricity Cooperative) to PLN. Subsidies given to small customers from PLN are also an added incentive.

E. Conclusions

31. Electrification has important social and economic impacts and, in this sense, virtually any project that has a net effect of increasing the quantity or quality of electricity supply to a broader base of households and enterprises can be regarded as socially and economically beneficial. ADB's support to the Indonesian power sector has certainly contributed to this end.

**OPERATIONAL AND FINANCIAL PERFORMANCE OF
P.T. PERUSAHAAN LISTRIK NEGARA (PERSERO)**

Item	Unit	1991/92	1992/93	1993/94	1994	1995	1996	1997	1998	1999	2000	2001
Operational Performance PLN Consolidated												
Generating Capacity (excluding IPPs)	MW	9,188	10,874	13,600	14,327	14,986	16,109	18,946	20,581	20,592	20,762	21,003
Generating Capacity Java – Bali	MW											15,492
Energy Sales	GWh	31,481	34,965	38,962	43,061	49,749	56,932	64,312	65,261	71,332	79,165	84,607
Growth in Sales	% p.a.		11.1	11.4	10.5	15.5	14.4	13.0	1.5	9.3	11.0	6.9
T&D Losses (% energy entering grid)	%	14.8	13.0	13.1	(107.9)	12.2	12.1	12.1	12.3	12.2	11.5	13.5
No. of Customers	million	12.3	13.5	15.2	16.9	19.5	22.0	24.6	26.4	27.5	28.6	30
Financial Performance PLN Consolidated												
Ave. Selling Price	Rp/kWh	129	137	152	154	163	165	169	211	220	280	334
Ave. Selling Price 1990												
Const	Rp/kWh	119	120	122	115	110	103	93	67	60	0	76
Ave. Selling Price	cents/kWh	6.6	6.8	7.3	7.1	7.2	7.1	5.8	2.1	2.8	3.3	3.6
Operating Revenues	Rp billion	4,178	4,917	6,063	6,787	8,306	9,646	11,126	14,036	15,997	22,557	28,625
Operating Profit (After Tax)	Rp billion	888	925	993	1,171	1,769	2,003	1,676	(2,773)	(6,020)	(5,280)	(3,884)
Net Profit After Tax	Rp billion	544	563	584	635	1,020	1,166	(579)	(9,156)	(11,368)	(24,611)	180
Ratios												
Covenant												
Power Purchases/Operating Revenue	(%)	1	0	1	1	1	2	3	13	32	42	30
Operating Ratio		79	81	84	83	79	79	85	120	138	123	114
RNFA (Historic Costs)		8.4	7.7	6.4	6.4	7.6	7.0	4.6	(5.9)	(11.7)	(10.1)	(7.3)
RNFA (Revalued) ^a	> 8 from 94	5.7	4.8	3.5		6.2	5.2	3.5	(4.4)			
Debt:Equity		31:69	38:62	37:63	34:66	30:70	35:65	40:60	53:47	64:36	61:39	59:41
Self-Financing Ratio (%)		22	24	22	0	37	23	28	0	0	0	59
Debt Service Cover	> 1.5	2.3	2.4	2.0	(3.0)	2.6	1.9	1.4	0.4	(0.2)	(0.1)	1.0
Accounts Receivable (Months)	<3.0	1.4	1.4	1.3	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.3
Current		1.6	1.3	1.4	0.8	0.6	1.0	0.6	0.4	0.2	0.4	0.5

GWh = gigawatt-hour, IPP = independent power producer, kWh = kilowatt-hour, MW = megawatt, p.a. = per annum,
PLN = P.T.Perusahaan Listrik Negara (Persero), RNFA = return on net fixed assets, T&D = transmission and distribution.

^a RNFA reported in Report and Recommendation of the President and Project Completion Reports.

Source: PT Perusahaan Listrik Negara (Persero) audited financial statements.

INDEPENDENT POWER PRODUCERS IN INDONESIA

	Plant Capacity	Plant Type
A. Operating IPPs		
Paiton I	1,230 MW	Coal Fired
Paiton II	1,220 MW	Coal Fired
Sengkang	135 MW	CCGT
Suppa	60 MW	Diesel
Darajat	75 MW	Geothermal
Salak	165 MW	Geothermal
Dieng	60 MW	Geothermal
Wayang Windu	110 MW	Geothermal
Total Wattage Produced by (A)	3,055 MW	
B. IPPs being (re) negotiated		
Cibuni	10 MW	Geothermal
Sibayak	120 MW	Geothermal
Tanjung Jati B	1,320 MW	Coal
Sibolga A	200 MW	Coal
Amurang	110 MW	Coal
Palembang	270 MW	CCGT
Ashan	180 MW	Hydro
Sengkang II	60 MW	CCGT
Bedugul	220 MW	Geothermal
Sarulla	330 MW	Geothermal
Wayang Windu U2	110 MW	Geothermal
Kamojang U4	60 MW	Geothermal
Total Wattage Renegotiated	2,990 MW	
C. Cancelled IPPs		
Karaha	220 MW	Geothermal
Banten	400 MW	Coal
Cilacap	400 MW	Coal
Tanjung Jati A	1,320 MW	Coal
Tanjung Jati C	1,320 MW	Coal
Serang	400 MW	Coal
Patuha	150 MW	Geothermal
Total Wattage Cancelled	4,210 MW	
Total Wattage Proposed by IPPs	10,255 MW	

CCGT = combined cycle gas turbine, IPP = independent power producer, MW = megawatt.

Source: PT Perusahaan Listrik Negara.