

## Priok Steam Power Plant Unit 3 & 4 Rehabilitation Project

Report Date: November 2002

Field Survey: July 2001

### 1. Project Profile and Japan's ODA Loan



Location Map of the Project



Priok Steam Power Plant Unit 3

#### 1.1 Background

The Priok Steam Power Plant is situated in Jakarta Bay, close to the busiest international harbor in Indonesia, Tanjung Priok. The power station consists of four generating units (25MW x 2<sup>1</sup>, 50MW x 2), of which Unit 3 and 4 (50MW each) were constructed in 1972 with financial support from a Japanese ODA Loan. Both units had been in operation for more than 15 years at the time of appraisal in 1987, and had become decrepit. Thermal efficiency<sup>2</sup> had declined to 29% from the 32% level maintained at the beginning of operation.

According to Perusahaan Listrik Negara's (PLN) projection in 1987, electric power demand in Java was expected to increase, on average, 11% each year, from 13,426GWh in 1987 to 38,907GWh in 1997. At that time, there existed an energy conversion policy, and the PLN would substitute coal thermal power and hydroelectric power for oil thermal power. Based on this policy, the PLN planned to construct a large-scale hydro and coal-fired power plant, which would be connected to the Java-Bali System. Accordingly, the 50MW class oil-fired power units were in line to change from base load facilities<sup>3</sup> to middle and peak load facilities<sup>4</sup>.

Priok Unit 3 & 4 were expected to become the main middle/peak load generation facilities and to operate stably at 20-30% of plant load factor<sup>5</sup> throughout the 1990s. To sustain the target plant load factor, the rehabilitation of the Priok Unit 3 & 4 was indispensable.

#### 1.2 Objectives

To rehabilitate the Priok Steam Power Plant (Priok SPP) Unit 3 & 4, so these units could operate as the

<sup>1</sup> Units 1 and 2 had been not operated since 1989.

<sup>2</sup> Thermal Efficiency: Ability absorb heat from fuel sources and to transfer it into energy

<sup>3</sup> Base Load facility: A plant, which is normally operated to take all or part of the minimum load of a system.

<sup>4</sup> Middle and Peak Load facility: A plant normally used during peak-load periods.

<sup>5</sup> Plant Load Factor: The ratio of the electrical energy produced by a generating unit for a year to the electrical energy that could have been produced at continuous full-power operation during that year.

main middle/peak load generation facilities, steadily and reliably with high plant efficiency throughout the 1990s.

### 1.3 Project Scope

Rehabilitation of following components of the Priok Steam Power Plant Unit 3 & 4

- Boiler:  
Pendant Super-heater, Platen Super-heater, Air Pre-heater, Shoot Blower, Burner Diffuser, Burner Tip Plates, Feed Water Distributor, Flexible Air Duct, Flexible Gas Duct, and related parts.
- Turbine:  
Stationary Blades, High Temperature Bolts, Condenser Tube, House Water Cooler/ Line, Fresh Water Line, Boiler Feeder Water Pump, Sea Water Pump Casing, Main Stop Valve, and related parts.
- Electrical and Control System:  
Main Transformer, Motor, Steam Temperature Control, Air Pre-Heater Inlet Air Temperature Control, Generator, Flow Switch for CWP, Power Cable for CWP, and related parts.
- Miscellaneous:  
Drain Valve of Primary/ Secondary Super-heater, Boiler Outlet Main Steam Pipe, and related parts.

### 1.4 Borrower/Executing Agency

Government of the Republic of Indonesia/ Perusahaan Listrik Negara (PLN)<sup>6</sup>

### 1.5 Outline of Loan Agreement

Loan Amount	1,590 million yen
Loan Disbursed Amount	1,555 million yen
Exchange of Notes	April 1988
Loan Agreement	July 1988
Terms and Conditions	
Interest Rate	3.0 % p.a.
Repayment Period (Grace Period)	30 years (10 years)
Procurement	General Untied
Final Disbursement Date	January 1996

## 2. Results and Evaluation

### 2.1 Relevance

At the time of appraisal, the Government of Indonesia had decided to convert the energy source for their power stations from fuel oil to other sources. Large-scale hydroelectric and coal-fired power stations were planned for construction and for base load operation. Thus, in order to reduce oil consumption, middle-scale oil-fired power stations were required to change their role from base load facilities to middle and peak load facilities. When a power plant is used for middle and peak load operation, it has to withstand frequent startup and shutdown operation sequences. In order to comply with the energy policy, the PLN decided to rehabilitate Units 3 and 4, and to modify the units to enable WSS (weekly start and shutdown) operation. In light of the decreasing trend in the level of domestic oil reserves in the years preceding appraisal, it was estimated that Indonesia would soon cease to be a net oil exporter. The shift away from natural crude oil resources is very much in line with overall energy policy, which links energy resource diversification and energy conservation.

Within 4 years of project completion, Units 3 and 4 of the Priok SPP were forced to shut down because of the deterioration of components that had not been included in the rehabilitation plan and because of the

<sup>6</sup> Perusahaan Listrik Negara (PLN), fully owned by the Government of Indonesia, was converted in 1994 from a public utility (Perum) to a public company (persero).

government's oil conservation policy. The deterioration of many different types of equipment had been predicted at the time of the feasibility study<sup>7</sup> for this rehabilitation project. However, according to PLN, the project targeted only some of the seriously deteriorated components due to their budget constraints. Because of the delay in implementing the project, though the rehabilitated components were successfully revitalized, components that were excluded from the project scope continued to deteriorate seriously. In light of these circumstances, the project scope proved to be insufficient for sustainable operation.

## **2.2 Efficiency in Project Implementation**

### **2.2.1 Project Scope**

The scope of the rehabilitation works focused on three components: the Boiler, the Turbine and the Electrical/Control System. The scope was determined by the condition of each of the facilities and the repair priority. As the delay of installation work led to considerable deterioration in the project facilities, especially boilers, the scope of work was modified. The Project, however, was implemented without major deviation from the design adopted at appraisal.

### **2.2.2 Implementation Schedule**

The rehabilitation of the units was completed in July 1994, 3 years and 7 months after the originally scheduled completion date of November 1990. Reasons for the substantial delay can be explained as follows:

The finalization of the implementation plan and bid documents took more time than expected. As a result, the entire tender process and selection of the contractor was delayed by 18 months. At appraisal, the spare parts for the rehabilitation works of Units 3 and 4 were to have been procured by December 1990 and June 1990, respectively. However, the actual procurement was completed in December 1992, owing to the delay of the bidding process.

In the meantime, the supply and demand balance of electricity in the Java-Bali system became serious. All power stations connected to the system were required to operate continuously from 1990 to 1993 in order to meet demand. Under this circumstance, shutting down the units to execute this project, and consequently installation work was postponed for 10 months.

### **2.2.3 Project Cost**

Implementation delays resulted in further deterioration of the power station equipment, an additional work was required. Moreover, project delays led to price escalation in the local portion. As a result, actual project cost reached 1,932 million yen equivalent, which was 342 million yen, or 21.5 percent higher than the appraisal estimate of 1,590 million yen equivalent.

At appraisal, all project costs were supposed to be covered by the Japanese ODA loan, while actual ODA loan disbursement was 1,555 million yen. This gap of 377 million yen equivalent was covered by funds from the Government of Indonesia and the PLN.

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<sup>7</sup> "Feasibility Study for Priok Thermal Power Plant Rehabilitation Project" Japanese International Cooperation Agency, February 1985.

## 2.3 Effectiveness

### 2.3.1 Project Outcome

Under the project, some of boilers and turbines in Units 3 and 4 of the Priok SPP were successfully rehabilitated and resumed commercial operation, at Unit 3 in early 1995 and in late 1994 at Unit 4. However, the project failed to achieve the following target levels: (1) achieving 20 - 30 % plant load factor (PLF), (2) improving thermal efficiency from 29% to 31.3%, and (3) prolonging plant life from 1997 to 2005 (see Figure 1 and Table 1 below<sup>8</sup>).

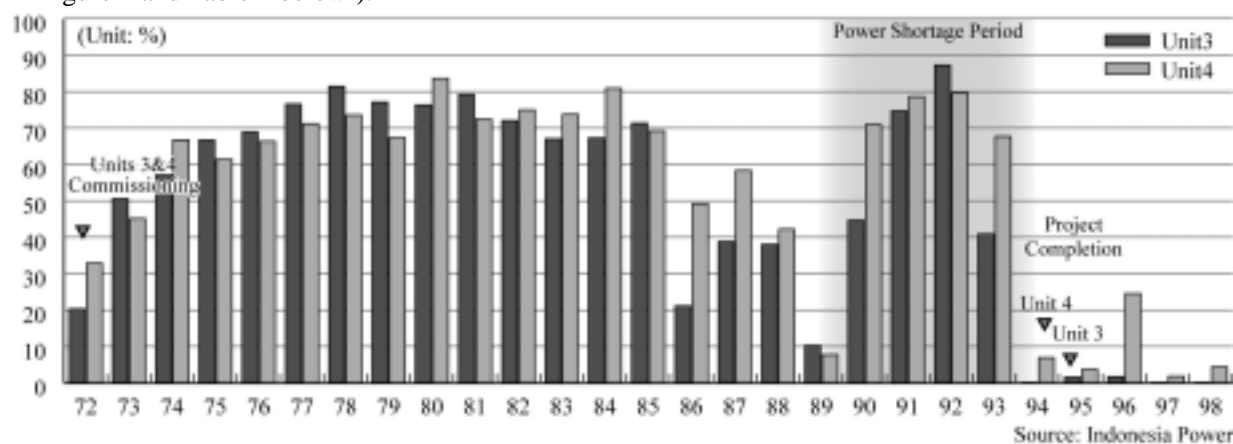


Figure-1 : Plant Load Factor of Units 3&4, Priok SSP

Table-1: Comparison Original Target Level with Actual Outcome

		Thermal Efficiency (%)	Peak Load (MW)	Plant Life
Original target level <sup>*1</sup>		29.0 → 31.3	40 → 50	Yr.1997 → Yr.2005
Actual	Unit 3	28.82 – 28.98	45	- <sup>*2</sup>
	Unit 4	28.52 – 30.88	45	- <sup>*2</sup>

Note: 1) Quoted from the JBIC documents

Source: Indonesia Power

2) Units 3 and 4 were shut down in 1996 and 1998 respectively.

Delays in project completion, the deterioration of plant components that were not part of the project scope, low load requirements from the grid due to the change in the role of the power station, and other related factors prevented target operational levels from being reached. Weak financial viability of the project eventually led to the shutdown of Units 3 and 4, in 1996 and 1998, respectively. At present, there is no plan to resume operations. Detailed reasons for this unexpectedly low outcome will be explained in the following sections.

#### (1) Delays in Project Completion

Indonesia experienced severe power shortage from 1990 to 1993, mainly due to delays in various power plant implementation projects (for example, the Paiton coal-fired power station (400 MW x 2) and the Cirata hydroelectric power station (126 MW x 8)<sup>9</sup>. Units 3 and 4 were, originally, scheduled to resume operation after the rehabilitation (in August, 1990 and February, 1991, respectively), and were expected to contribute to alleviating the power shortage at peak times. However, the rehabilitation project was not completed until July 1994. If the project had been completed on schedule, the Units might have supplied electricity in a sound operational condition during the severe power shortage period. The completion delay forced Units 3 and 4 to operate continuously during the power shortage period without proper rehabilitation, which led to further deterioration and lower performance.

<sup>8</sup> Until 1994, PLN operations were based on a fiscal year that ended 31 March. From 1995, PLN adopted a fiscal year beginning in January. Fiscal year 1994 began 1 April and ended 31 December.

<sup>9</sup> At the time of this project's appraisal, Paiton and Cirata were scheduled for completion in 1992-1993 and 1988, respectively.

## (2) Deterioration of Plant Components

As power demand continued to increase, the power station, increasingly, had to operate during peak hours. However, the plant often stopped immediately after startup because of the leakage of steam from wall tubes. After such stoppages, the boilers were inspected, and some deteriorated wall tubes were replaced. Such accidents occurred as many as ten times from August 1994 to May 1998<sup>10</sup>.

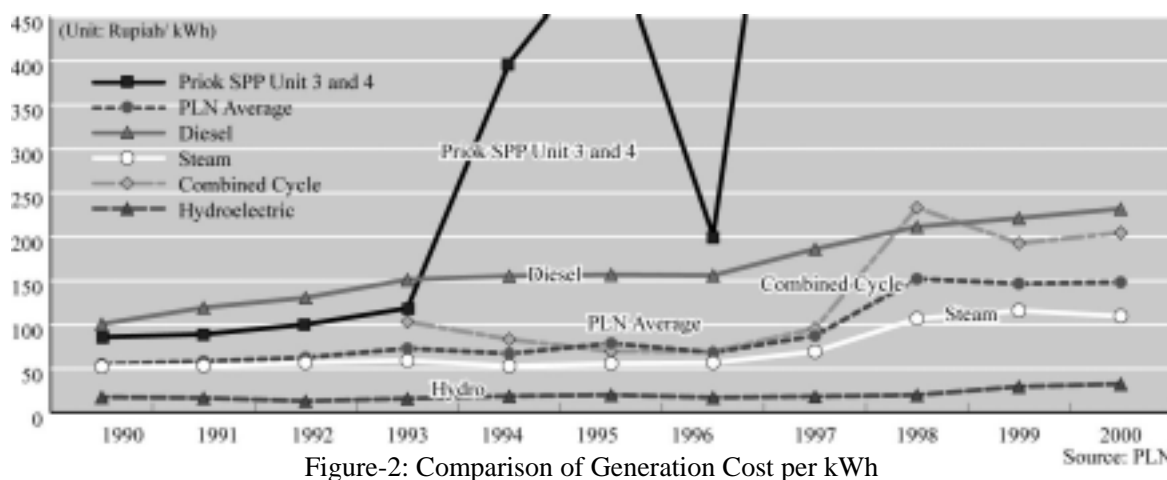
Prior to the rehabilitation, a few wall tubes were taken from the boilers and inspected. Damage to some wall tubes was identified, and some were replaced. There is a possibility that continuous operation without maintenance during the severe power shortage period accelerated the deterioration of the power plant and its wall tubes.

At the time of the feasibility study in 1984 (prior to the project appraisal), the development of corrosion at high temperatures and scale deposits had been predicted for the wall tubes. However, the scope of the rehabilitation was concentrated only on the critical components such as the boilers, owing to budget constraints. For that reason, replacement of the wall tubes was not included in the original project scope.

## (3) Weak Financial Viability

Mainly due to the above-mentioned deterioration of the plant components, the weak financial viability of the Priok SSP finally forced operators to shut down Units 3 and 4.

Figure 2 compares the generation cost per kWh of Priok SPP Units 3 and 4 with that of other PLN power plants. The unit generation cost of Units 3 and 4 was generally higher than PLN's average generation cost. In particular, since generated output at Priok SPP from 1994 to 1998 was quite small, the unit generation cost for the period was considerably higher than the PLN average.



If Units 3 & 4 are to resume operations, it will be necessary to replace all wall tubes (about 1,300) in the boilers. According to an Indonesia Power<sup>11</sup> estimate, made in 1999, the rehabilitation cost of Units 3 and 4 will be 32 billion rupiahs, in 1999 prices.

Table 2 shows the profit and loss forecast of Units 3 & 4, which assumed that further rehabilitation would be carried out. Indonesia Power predicted in 1999 that even after rehabilitation, operating revenue would not cover fuel expenses. As a result of their study, Indonesia Power abandoned operation of the existing generation system for these Units.

<sup>10</sup> These maintenance/restoration periods are usually categorized as forced outage, but not in the case of Indonesia Power.

<sup>11</sup> O&M agency of the Priok SPP, details in section 2.5.1 of this report.

Table-2: Profit and Loss Forecast of Priok SPP Unit 3 &amp; 4

(Unit: Rp)

	2001	2002	2003	2004
Revenue from Operations				
Sales Volume of Energy (kWh)*	700,800,000	700,800,000	700,800,000	700,800,000
Unit Selling Price (Rp./kWh)	164.88	164.88	164.88	164.88
Total Revenue from Operations	115,547,904,000	115,547,904,000	115,547,904,000	115,547,904,000
Operating Expenses				
Fuel and Oil	152,326,292,676	148,091,653,224	148,091,674,469	156,043,108,121
- Fuel Oil (Bunker Fuel Oil):	152,325,888,000	148,091,228,314	148,091,228,314	156,042,639,667
- Lubricant Oil:	404,676	424,910	446,156	468,453
Maintenance Cost	8,359,683,895	13,230,349,599	17,694,298,903	22,016,667,421
Personnel Expenses	2,518,692,162	2,896,495,987	3,330,970,385	3,330,970,385
Administration Expenses	796,351,199	875,986,319	963,584,951	963,584,951
Depreciation Cost	8,037,500,000	8,037,500,000	8,037,500,000	8,037,500,000
Total Operating Expenses	172,038,519,933	173,131,985,129	178,118,028,708	190,391,830,877
Net Income Before Tax	(56,490,615,933)	(57,584,081,129)	(62,570,124,708)	(74,843,926,877)

Note: \* Sales Volume of Energy was worked out based on the Plant Load Factor 80%

Source: Indonesia Power

In addition, the Government of Indonesia decided to withdraw its substantial subsidy for oil products, in order to ease its heavy financial burden. As a result of this government policy, oil product prices more than doubled between 1998 and 2002. The profit and loss forecast shown in Table 2 did not take these price increases into consideration. With the oil price increases, even if the Units were in sound condition, the power station would not be financially viable.

Table-3: Change in the Price of Oil Products in Indonesia (Unit: Rp./liter)

	May 1998	October 2000	June 2001	January 2002
Gasoline	1,000	1,150	1,450	1,550
Kerosene	280	350	400	600
Automotive Diesel Oil	550	600	900	1,150
Industrial Diesel Oil	500	550	1,000	1,100
Bunker Fuel Oil*	350	400	900	925

\* Fuel oil used for the Priok SPP

Source: Minister Directorate General of Oil and Gas

#### (4) Change in the Role of the Power Station in the Java-Bali Grid

Units 3 and 4 operated stably as base load plants until the middle of the 1980's. After the government placed a priority on using coal-fired and hydroelectric power stations as base load facilities, Units 3 and 4 started operating as middle/peak load facilities. Based on the policy, new plants such as Saguling Units 1-4 (797 MW) and Suralaya Units 3 and 4 (800 MW), and the aforementioned Paton and the Cirata were commissioned, and the grid's dependence on Units 3 and 4 fell. In addition, as a measure to alleviate the power shortage in 1990-1993, new gas-based combined power plants (CCPPs)<sup>12</sup> were constructed within the Grid. These four new power stations, with installed capacity of 4,302 MW, were commissioned from 1992 to 1994 and were expected to meet demand through mid-1996.

Although demand still surpasses the supply capability currently, the two Units were in reserved shutdown condition, and rarely had to operate after mid 1996, due to the availability of base-load facilities. Figures 3 and 4 show the high planned outage<sup>13</sup> factor from 1993 for the Units, which suggests low requirements from the grid.

<sup>12</sup> Priok CCPP (1,180 MW: Completed in 1993-1994), Tanjung Lorok CCPP (1,034 MW: Completed in 1993), Gresik CCPP (1,579 MW: Completed in 1992), Muara Karang CCPP (509 MW: Completed in 1992). Rapid development of domestic gas fields and a predicted energy crisis triggered the construction of these power plants in late 1980s. These projects materialized very quickly because of full turnkey base contracts.

<sup>13</sup> Planned Outage Factor: The rate of shutdown of a generating unit due to scheduled maintenance and/or non-requirement from the grid. Forced Outage Factor: The rate of shutdown of a generating unit for emergency reasons or when the generating equipment is unavailable for load because of unanticipated breakdown.

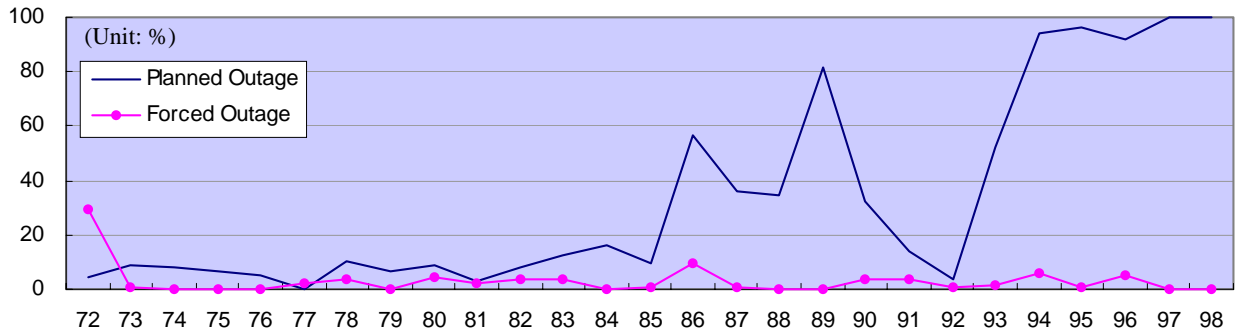


Figure-3: Planed and Forced Outage Factor of the Unit 3

Source: Indonesia Power

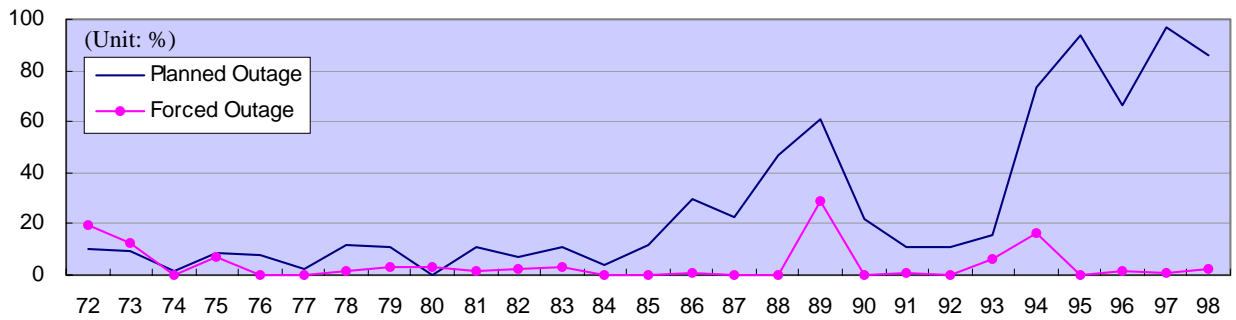


Figure-4: Planed and Forced Outage Factor of the Unit 4

Source: Indonesia Power

### 2.3.2 Financial Internal Rate of Return (FIRR)

At the time of appraisal, FIRR was estimated at 10.2%. In this calculation, the project's benefits consisted of: i) fuel cost savings resulting from improvements in thermal efficiency, and ii) the extension of plant life. However, as already mentioned in 2.3.1, project outcome was far below target levels, and project costs overran budget. In light of these conditions, it was concluded that the re-evaluated project's benefit was lower than the project's costs. Thus, project's FIRR could not be recalculated.

## 2.4 Impact

### 2.4.1 Social Impact

Originally, the project was expected to contribute to the reduction of the number and duration of blackouts caused by the forced shutdown of the units, to the stabilization of consumers' power-dependent livelihoods, and to the improvement of industrial production. However, the project's contribution in these areas cannot be observed.

The project scope encompassed rehabilitation of the existing power plant. Since it was not necessary to acquire additional land, no resettlement and relocation were implemented.

### 2.4.2 Environmental Impact

No data was available because of the shutdown.

## 2.5 Sustainability

### 2.5.1 Organization in Charge of Operation and Maintenance

#### a) Profile of O&M Agency

At the beginning of the 1990s, the Government of Indonesia deliberated on the need for deregulation in the power sector. Starting with the divesting of the now privately-owned Paiton I, and accelerated by the

issuance of Presidential Decree 37 of 1992, the use of private sector financing through IPPs<sup>14</sup> has become a major, integral part of meeting the sector's financing requirements. In late 1993, the Minister of Mines and Energy issued a broad policy framework to guide the longer term restructuring of the sector.

In the first stage, the PLN, fully owned by the Government, was converted in 1994 from a public utility to public company status. This was followed in 1995 by the unbundling of the PLN's Java-Bali generation companies. Priok SPP was transferred to one of the two generation companies consolidated and named PLN PJB 1. On 3 October 2000, its 5<sup>th</sup> anniversary, the PJB 1 changed its name to PT Indonesia Power.

Indonesia Power has a comprehensive structure, including a Board of Directors, a Corporate Secretary and an Internal Auditor. The Board of Directors consists of a president, a director and four directorates (production, development and commerce, system and human resources, and financial). Each directorate has several divisions, and a manager supervises each division.

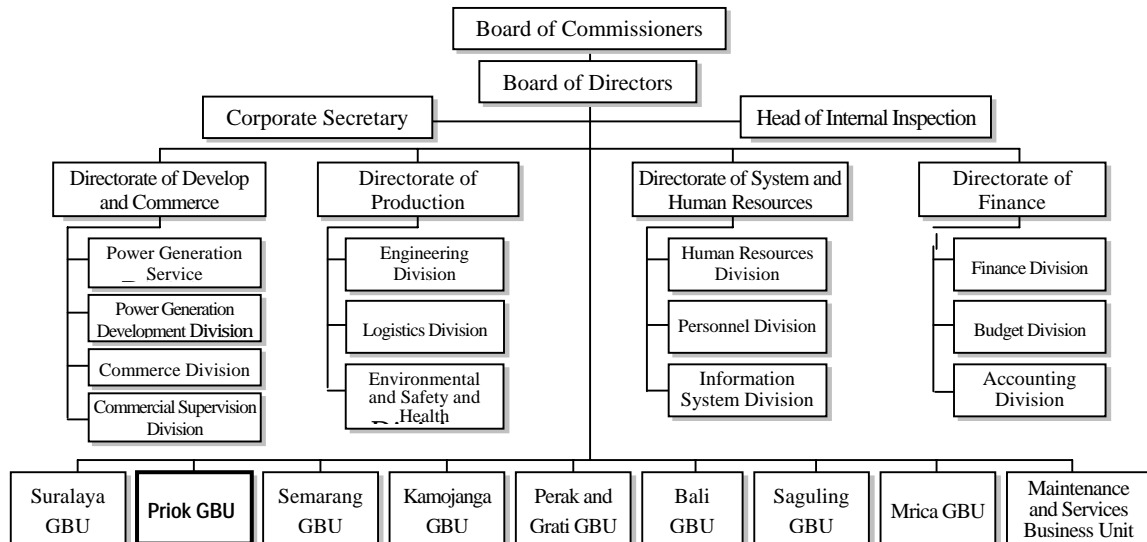


Figure 5: Organizational Chart of Indonesia Power

Source: Indonesia Power

For the generating units owned by the company, which are in various locations, the management has stressed decentralization of authority. As of now, there are eight Generation Business Units (GBU) under the company umbrella: Priok, Suralaya, Saguling, Kamojang, Mrica, Semarang, Perak and Grati and Bali. The GBU manages and operates some power plants; they are responsible for the operation and routine maintenance of power stations.

Besides the GBU, the Maintenance Service Business Unit (MSBU) focuses on business related to power plants. The MSBU is in charge of periodic maintenance and overhaul of power plants, procurement of tools, equipment testing, calibration and commissioning.

#### b) Operation and Maintenance of Units 3 and 4

Priok GBU was in charge of operation and routine maintenance of Units 3 and 4. Priok GBU has 412 personnel, consisting of 81 operators, 117 maintenance staff members, 64 administrators and 150 people in other capacities. Before shutdown, operation was managed by 22 people and routine maintenance undertaken by 12 personnel. In addition, the common operational and maintenance staff of the Priok Complex<sup>15</sup> and contract laborers were in charge of operation and maintenance of Units 3 and 4. Since the shutdown, only 3 operations personnel and 8 maintenance staff have looked after the project facilities.

#### c) Current Conditions of the Project Facilities

The Steam turbines of Units 3 and 4 have been maintained properly since their shutdown. Since the operation test and inspections are carried out periodically as the need arises, the units are kept in good condition. However, since the boilers, the water intake system, and the control system had seriously deteriorated, they were left "as is" at the time of shutdown. The boilers' insides and surfaces, in particular, became rusty, and part of the outer casings fell in.

<sup>14</sup> IPP (Independent Power Produce): A private entity that owns facilities to generate electric power for sale to utilities and end users.

<sup>15</sup> Priok Complex consists of a steam power plant (2 units x 50MW), a gas power plant (1 unit x 20MW, 2 units x 26MW, 4 units x 48.8MW), a combined cycle power plant (6 units x 130MW gas turbine, 2 units x 200MW steam turbine), and a diesel power plant (4 units x 2.5MW, 2 units x 3.0MW).



## 2.5.2 Financial Viability of Indonesia Power

At present, the energy generated by Indonesia Power, PJB II, and IPPs, are sold to a single buyer, known as PLN P3B<sup>16</sup> (Figure 6). The amount and price of electricity purchased, as well as other specific terms of contracted purchases, are regulated in the agreements between the PLN and other generation companies.

Indonesia Power generates revenue mainly from the sales of electricity to the PLN, although it does receive additional income from its other business. As the unit-selling price of energy to the PLN is decided based on the actual generation cost, it has been maintained at a commercially viable level. Thus, the current balance sheet of Indonesia Power has been positive since its establishment, in spite of the Monetary Crisis in 1998 (see Table 4). Also, funds that the company borrowed were denominated in the Indonesia Rupiah, and as such, were not affected by the fluctuating exchange rate of the Rupiah against foreign currency. However, accounts receivable of 2,616.3 billion were recorded in 1999, a 41.7% increase from previous year, and a turnover period of 6.08 month was recorded. This performance is mainly attributable to the increase in accounts receivable from the PLN.

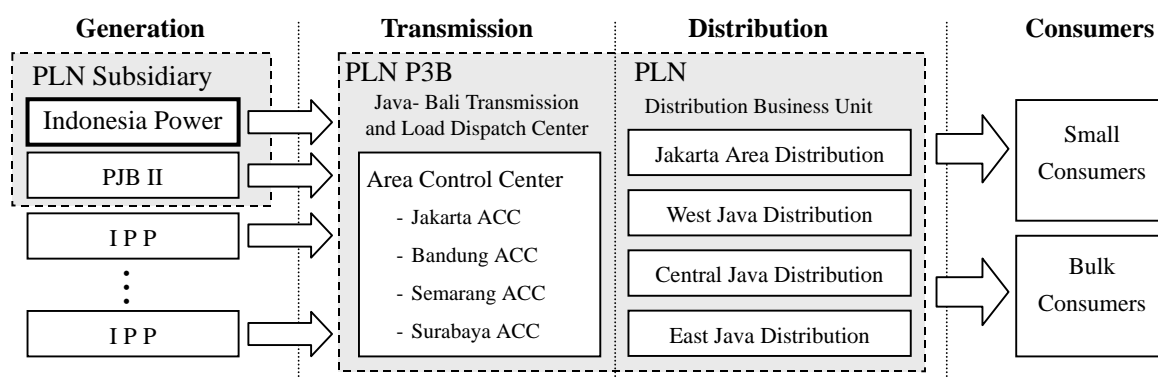


Figure 6: Electricity Supply Structure of Java- Bali System

Financial weakening of the PLN was mainly caused by the Monetary Crisis in Indonesia. At that time, rapid inflation, coupled with a significant devaluation of Indonesia's Rupiah, resulted in the soaring cost of purchasing energy from IPPs, and in escalating operational and maintenance expenses. However, the Government of Indonesia, because of socio-economic concerns, did not allow the PLN to increase tariffs. The PLN's financial condition turned critical. In light of PLN's role as the single buyer, Indonesia Power's commercial sustainability could not be accomplished without the amelioration of the PLN's financial condition.

Table 4: Profit and Loss Indicators for Indonesia Power

(unit: million Rs.)

	1995*	1996	1997	1998	1999
Revenue from Operation	482,536	2,170,356	2,315,092	4,501,731	5,163,296
Operating Expenses	394,485	1,788,448	2,187,802	3,885,011	4,294,882
Income from Operations	88,051	381,908	127,290	616,720	868,414
Other Income (Charges)	(10,881)	(38,462)	(52,005)	(533,309)	(455,774)
Loss of Subsidiaries and Tax Expense	25,219	111,628	29,145	18,909	124,772
Net Income Before Tax	51,951	231,818	46,140	64,502	287,868

Note)\*: From 3<sup>rd</sup> October 1995 to 31<sup>st</sup> December 1995

Source: Indonesia Power

Currently, in order to restore the PLN to financial health, the following plans have been put into effect: (i) increase electricity tariffs gradually over a period of years, (ii) if the tariffs cannot be increased for socio-economic reasons, the PLN may request revenue support, called social electricity-economic development funds, from the Government, (iii) renegotiation of the power purchase agreement between PLN and IPPs to reduce the electricity purchase cost<sup>17</sup>, and (iv) to propose the Pertamina<sup>18</sup> to reduce the

<sup>16</sup> PLN P3B: Java- Bali Transmission and Load Dispatch Center which is in charge of operates, maintains and develops the transmission infrastructure which generators with distributors and consumers in Java- Bali Area.

<sup>17</sup> During the crisis the Rupiah fell sharply against the U.S. dollar, thus raising the price of power sold by IPPs to PLN. PLN, according to the contracts, is required to buy electricity from IPPs at an average of 6 U.S. cents per kWh (about Rp 680 at the current exchange rate), as compared to its average selling price of Rp 219.7 per kWh and purchase cost of Rp 155 per kWh from Indonesia Power in 1999.

price of natural gas, (v) establishing a technical efficiency drive audit team to improve technically related aspects.

### 2.5.3 Future Utilization Plan

According to the forecast of the PLN's planning division, the Java-Bali system's supply will hardly meet demand, even if new power plants now under construction or being planned are completed on schedule. If power demand increases in accordance with the forecast, a power shortage will occur in 2004. To avoid the probable energy crisis, the Java-Bali grid needs additional generating capacity of approximately 1,500MW per year.

Units 3 and 4 have not been earning revenue, but rather have been incurring expenses, including, but not limited to, maintenance costs, land rent fees and salaries. Thus, Indonesia Power is examining a future utilization plan. as follows:

- (i) Reconstruction and upgrading to combined cycle plant with a rated capacity of 322 MW (ST: 42.7MW x 2, GT: 237MW x 1). In this case, although the boilers and other related facilities are removed, the turbines of Unit 3 or 4 are reusable as steam turbines.
- (ii) Construction of a new combined cycle plant with a rated capacity of 732 MW (ST: 258MW x 1, GT: 237MW x 2). In this case, all the existing facilities, including the building, will be decommissioned; thereafter, the turbines of Unit 3 or 4 are to be transferred to other plants for reuse.

## 3. Lessons Learned

### 3.1 Importance of Timely Implementation of Rehabilitation Project

If this project were completed as planned, the power plant might have successfully met power demand during the severe power shortage period. In actuality, the power plant had to operate continuously during the period, prior to the rehabilitation work. Such over-operating induced considerable deterioration of the project facilities.

As the scope of rehabilitation work is determined based on the condition at the time of appraisal, the longer the delay in the implementation, the greater the chance of further deterioration of the facilities. Generally speaking, once the condition worsens, deterioration of the facility may accelerate. With delay of the implementation and forced modification of the project scope, the project cost will increase. Therefore, planning and monitoring of rehabilitation work should be carefully conducted if operation of the existing facilities cannot be stopped during the course of the rehabilitation work.

### 3.2 Consideration for Reexamination of the Scope of Work on the Delayed Rehabilitation Project

If delay in implementation of rehabilitation work worsens the existing facilities, re-appraisal of the project to adjust scope of works for the rehabilitation should be conducted.

### 3.3 The need for precise estimates and efficient operations of overall grid.

The over-use of the project facilities and subsequent deterioration could have been avoided and/or foreseen. To this end, the precise estimates and efficient operation of overall grid are necessary such as: more deliberate demand-supply estimates; more proper project implementation ability on the part of PLN; and more efficient power supply operations in managing and operating the overall Java-Bali grid.

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<sup>18</sup> Pertamina: Indonesia National Oil Company.

## Comparison of Original and Actual Scope

Item	Plan	Actual
<b>1. Project Scope</b>		
(1) Boiler	<p>Replacement of, Platen Super-heater, Pendant Super-heater, De Super-heater Nozzle, Air Pre-heater and Flexible Gas Duct Joint</p> <p>Repair of Soot Blower, Replacement, Burner Diffuser, Water Distributor and Burner Tip Plates, and Feed Repair,</p>	<p>As Planned</p> <p>Additional Item: Partial restoration of wall tubes, Replacement of Flexible Air Duct Joint, and Boiler Roof Castable Refractory, etc.</p> <p>As Planned</p>
(2) Turbine	<p>Replacement of Stationary Blades, Condenser Tube, House Water Cooler/Line Overhaul, Boiler Feed Water Pump Spare Rotor, Driving and High Temperature Bolts, and Boiler Feed Water Pump Modification</p> <p>Sea Water Pump Casing Replacement, Cathodic Protection Repair Repair of Main Stop Valve,</p>	<p>As Planned</p> <p>Additional Item: Replacement of High Temperature Bolts, Fresh Water Line, Traveling Screen, etc.</p> <p>Not implemented</p> <p>As Planned</p> <p>Additional Item: Repair of Throttle Valve/Servo Motor, and Traveling Screen, Procurement of Parts etc.</p>
3) Electrical and Control System	<p>Repair of Main Transformer Oil Leakage and Motor</p> <p>Modification of Steam / Air Heater Inlet Air Temperature Control</p> <p>Repair of Generator</p>	<p>As Planned</p> <p>As Planned</p> <p>As Planned</p> <p>Additional Item: Procurement of Flow Switch and Power Cable for CWP, Rewinding of stator coil, etc.</p>
4) Modernization	Weekly start stop Modification	As Planned
<b>2. Implementation Schedule</b>		
1) Selection of Consultant	Oct 1987 – Mar 1988	Sep 1988 – July 1989
2) Review of scope	Apr 1988 – June 1988	Aug 1989 – Sep 1989
3) Tender and contract	July 1988 – Dec 1989	July 1990 – June 1991
4) Equipment & Factory const.		
- Manufacturing	Apr 1989 – May 1990	Aug 1991 – Oct 1992
- Design	Jan 1989 – Oct 1989	July 1991 – Feb 1992
- Shipping	Mar 1990 – Dec 1990	June 1992 – Dec 1992
- Installation works	Oct 1990 – Sep 1990	Oct 1993 – May 1994
- Adjusting & Testing	Apr 1990 – Nov 1990	Jan 1994 – July 1994
- Preparation of Final Report	Nov 1990 – Dec 1990	September 1994
<b>3. Project Cost</b>		
Foreign currency	1,515 million yen	1,800 million yen
Local currency	851 million Rs.	2,633 million Rs.
Total	1,590 million yen	1,932 million yen
ODA Loan Portion	1,590 million yen	1,555 million yen
Exchange Rate	1Rp = 0.088 yen	1Rp = 0.05 yen

**Independent Evaluator's Opinion on  
Priok Steam Power Plant Unit 3 & 4 Rehabilitation Project**

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As stated in the evaluation report, this project is intended to achieve several objectives, i.e.

- a. To convert the energy sources from fuel oil to other sources to meet an improvement in efficiency objective in energy consumption;
- b. To reduce oil consumption in order to maintain net oil exporter status of Indonesia.

This project is not only important for the energy diversification objective but also to reduce the cost of electricity supplied. This is because fuel type of electricity generator is typically expensive compared to other type electricity generator. Thus, the relevance of the project is mainly maintained even though with some delay, which has some impacts on deterioration of plant components. The direct impact of the project will appear in the reduction of fuel cost of the PLN and hence improve the financial viability of the PLN.

Indirectly, it also reduces the domestic oil consumption and raises the use of other primary energy sources like coal. More importantly, this project has also contributed to improving and maintaining electrification ratio in Java and Bali islands.

Overall, the evaluator-based on my professional judgment concluded the project has met its intended objectives.