

Indonesia

Java-Bali Transmission Line/Substation Development Project (East Java) (I & II)

Report Date: January 2003

Field Survey: November 2002

1. Project Profile and Japan's ODA Loan



Project site



Substation installed via the project

1.1 Background

The province of East Java is one of Indonesia's centers of commerce and industry, both mining and manufacturing, and is home to the country's second largest city of Surabaya. During the 1990s, East Java's population accounted for approximately 20% of the nation's total and the province was responsible for around 20% of total regional production. The decade also saw development of the region's manufacturing and mining industries. In preparation for predicted increases in economic activity during the 1990s, Indonesia's electric energy authority (P.T. PLN) was calculating on average annual increases of 18.5% in power demand in East Java during 1991-98.

In order to meet this growth in demand plans were laid to develop generation facilities and the transmission and distribution grid within the region, which called for an additional 6,078MW of generating capacity and 4,250MVA of medium voltage transformer capacity by the end of the Sixth Five-year Development Plan (1998). The current project was allied to the "East Java Electric Power Transmission and Distribution Network Project", which commenced in 1971 under funding from ODA loan, and targeted the expansion and improvement of transmission and transformer facilities within the region.

1.2 Objectives

Phase I: To improve the reliability of power supplies by meeting increases in demand from regions already linked to the grid, supplying power to new customers and enhancing the reliability of the transmission system.

Phase II: To improve the stability and reliability of power supplies in East Java via a combination of

investment in the region’s two large-scale power stations, Gresik combined cycle power plant and Paiton thermal power plant, and improvement/expansion of secondary power distribution system facilities.

1.3 Project Scope

The outline of the initial plans for the project was as follows:

Phase I:

- 1) Expansion of existing substations
 - Transformers: 70/20kV × 7 sites = total capacity of 150MVA
 - 150/20kV × 16 sites = total capacity of 820MVA
- 2) Consulting services

Phase II:

- 1) Expansion of existing substations
 - a) Transformers: 150/20kV × 10 sites (10 transformers) = total capacity of 410MVA
 - b) Construction of transmission line outlet (1 site)
- 2) Construction of substations:
 - 150/20kV × 3 sites (4 transformers) = total capacity of 150MVA
- 3) Construction of transmission lines:
 - 150kV-2CCT × 3 lines = total length of 25 km
- 4) Consulting services

1.4. Borrower/Executing Agency

Government of the Republic of Indonesia/P.T. PLN

1.5 Outline of Loan Agreement

Loan Amount / Loan Disbursed Amount	Phase I: 7,671 million yen / 3,223 million yen Phase II: 6,862 million yen / 3,236 million yen
Exchange of Notes / Loan Agreement	Phase I: September 1991 / September 1991 Phase II: September 1992 / October 1992
Terms and Conditions -Interest Rate -Repayment Period (Grace Period) -Procurement	2.6% 30 years(10 years) General untied (Consultant service is procured as partially untied aid)
Final Disbursement Date	Phase I: October 1997 Phase II: February 2001

2. Results and Evaluation

2.1 Relevance

The National Fifth Five-year Development Plan (1989-93: REPELITA V) outlined the following goals for the power sector:

- 1) Guarantee supply capacity in line with increases in power demand, primarily in industrial

sectors, as a means of sustaining economic development.

- 2) Boost development of power resources in line with non-oil policies.
- 3) Build up the foundations of regional development by promoting rural electrification.
- 4) Improve the reliability of power supplies by developing the transmission and distribution grid.
- 5) Effectuate cost reductions via decreases in transmission and distribution loss, improvements in thermal heating efficiency and the power load ratio and efficient management of demand and supply.

The current project involved the development of the power transmission grid in East Java with a focus on metropolitan Surabaya, with the aim of meeting forecast annual increases in demand for power of around 18.5% and improving the stability and reliability of power supplies in the region. At the time of project appraisal, plans to develop an industrial park on reclaimed land were stimulating active investment in industry within Surabaya and the province, however the majority of substations were either overloaded or forecast to become overloaded within the near future.

The PLN plan to develop additional supply capacity envisaged the installation of an additional 6,078MW in East Java by 1998 and included plans for new capacity installation at the Gresik combined cycle power plant (526MW × 3) and the Paiton thermal power plant (400MW × 2) at an early date. There was thus a need to develop the entire Java transmission and distribution grid, inclusive of East Java, in order to link the newly generated reserve margin with demand.

As stated above, the objectives of this project were consistent with the direction of the five-year development plan that was current at appraisal. Moreover, when this evaluation was conducted, population density in the province and the city of Surabaya continued to be high as compared to the rest of the country, and the region remains a center for the commercial, mining and manufacturing industries. The impact of the currency crisis and PLN's phased increases in electricity tariffs have served to depress growth in consumption when contrasted with that at appraisal, nevertheless, annual growth of around 7.5% has been recorded in recent years.

There are indications that supply capacity and the transmission and distribution network remain deficient, and discussions are focused on the potential for an energy crisis within the Java-Bali system, which includes the East Java region¹. Enhancing the stability and reliability of supplies continues to be an issue that requires resolution, particularly given the need to develop and sustain robust industrial activity, and in this respect, the objectives of this project are considered to have retained their relevancy. Although some delays occurred in the start of on-grid generation at both Gresik and Paiton, the two plants are essentially operating as planned at the present time.

2.2 Efficiency

2.2.1 Project Scope

According to the Project Completion Report (PCR) submitted by the executing agency the only

modification or revision made to initial plans concerned the positioning of the transformers. A number of substations that were initially targeted for capacity expansion/extension were dropped and the supplied transformers installed at other substations within the East Java province. At the start of the project a comparative study was made of predicted demand and existing capacity for each of the substations. This study yielded data on the number and capacity of transformers required at specific substations, which was used to modify the initial plans on transformer positioning.

The demand forecasts for individual substations were based on past demand increase ratios as well as the current demand-supply gap and prospects for new large-scale demand from industrial parks, etc. According to the Distribution and Load Control Center for Java-Bali (P3B), the PLN unit responsible for transmission and transformer facilities, the revisions to initial plans were based on the need to prioritize certain substations requiring urgent capacity additions as identified from demand prediction results.

2.2.2 Implementation Schedule

The implementation schedules for Phases I and II of the project were subject to delays totaling approximately 15 months. According to the PCR, these delays were generated by the additional time required to negotiate and conclude the contract with the supplier (contractor). In order to minimize the impact of these delays on demand-supply conditions, the executing agency instructed the scheduled contractor to initiate preparation of the construction sites and arrangements to procure supplies in tandem with contract negotiations. In consequence of which the delays to the implementation schedule were confined to the delays in the contract negotiation process.

2.2.3 Project Cost

A cost underrun was reported for both Phase I and Phase II (yen-based). This is attributed to reductions in the amount of ODA loan funding required for items procured in both foreign and local currency resulting from international competitive bidding for transformer equipment, which accounted for the bulk of project costs, and the substantial devaluation of the Indonesian rupiah.

2.3 Effectiveness

(1) Project contributions to increased substation capacity

Table 1 indicates the extent to which the expansions to substation facilities implemented via this project bolstered total medium voltage transformer capacity. As of 2001, medium voltage transformer capacity was 9,100MVA, with project facilities accounting for approximately 16% of cumulative capacity. Moreover, whilst the addition of 4,250MVA of medium voltage transformer capacity was scheduled during the sixth National Five-year Development Plan (1994-98), capacity was in fact increased by 4,871MVA. The additional capacity secured via this project accounts for approximately 30% of medium voltage transformer capacity expansions effectuated within the region during the implementation period.

¹ Source: PLN white paper, “Immediate and Critical Issues for Decision”, October 2000.

Table 1: Fluctuations in cumulative transformer capacity in the target region (Unit: MVA)

	1991	1993	1998	1999	2000	2001
500 / 150 kV (high voltage: excluded)	0	2,000	3,000	3,000	3,000	3,000
150 / 20 kV	1,398	2,408	6,264	6,279	6,484	6,176
70 / 20 kV	901	1,015	1,555	1,635	1,556	1,581
Other 150/70kV, etc.	544	829	1,304	1,354	1,304	1,344
Total for East Java (medium voltage)	2,843	4,252	9,123	9,268	9,344	9,101
Project capacity additions		1,470 (equivalent to 16.2% as of 2001)				

Source: PLN Unit Business P3B

(2) Transmissions from project transformers

Transitions in the volume of power supplied from medium voltage substations (all medium voltage transformers) in East Java to the region's transmission grid are shown in Table 2. According to the executing agency, transmissions from almost all substations are on the increase. As Table 3 indicates, roughly 21% of generated power is transmitted from transformers covered by the project.

Table 2: Transitions in transmission volumes from all substations in the target region (Unit: GWh)

	1993	1997	1998	1999	2000	2001
Transmissions from all East Java substations	7,601	11,656	11,775	13,047	14,395	15,611

Source: PLN Unit Business P3B

Table 3: Contribution to total of transmissions from project transformers (January & October 2001)

	Transmissions from project transformers	Transmissions from all transformers in the target region	Degree of contribution
January 2002 (MWh)	321,104	1,499,402	21.4%
October 2002 (MWh)	338,355	1,588,172	21.3%

Source: PLN Unit Business P3B

All transformers installed via this project are operational, which, given that project equipment accounts for approximately 20% (40/197) of all currently operational medium voltage transformers in the region, provides evidence that operating conditions are appropriate.

(3) Meeting demand for power in the target region

As shown in the following table, customer numbers and contract demand (MVA) in East Java have been on the increase during the past ten years. Industrial demand, which was most severely affected by the currency crisis, dropped in terms of both customer numbers and contract demand in 1998, however, general residential and commercial demand have posted remarkable increases, and total contract demand has been increasing continuously.

Table 4: Transitions in customer numbers and contract demand in the target region (Unit: MVA/customer)

	1991	1996	1997	1998	1999	2000	2001
Residential	1,167	2,324	2,642	2,918	3,127	3,443	3,710
(customer numbers)	2,064,714	4,002,311	4,506,729	4,935,027	5,090,348	5,236,232	5,391,876
Commercial	227	449	534	574	644	704	774
(customer numbers)	52,921	83,498	97,539	106,083	162,368	192,092	241,759
Industrial	1,310	2,131	2,381	2,165	2,254	2,321	2,395
(customer numbers)	5,962	8,742	9,860	9,321	9,325	9,794	10,181
Public and other	181	258	282	302	317	335	352
(customer numbers)	51,437	103,346	117,637	128,521	133,836	138,782	144,565
Total MVA	2,885	5,162	5,839	5,959	6,342	6,803	7,231

Source: PLN Unit Business Distribusi Jawa Timur

In response to this growth in contract demand, the executing agency has been expanding transformer facilities to effectuate improvements on its medium voltage transformer capacity (Table 1) well in excess of annual cumulative total contract demand. As of 2001, it was providing medium voltage transmissions of 9,100MVA against total contract demand of 7,231MVA. The expansions to transformer facilities covered by this project were thus crucial in this respect also.

The outcome has been annual growth in electricity consumption exceeding 10% and an increase in peak demand in the region of 7-8% during the past ten years (Table 5). Consumption growth came to a brief standstill after the currency crisis of 1997, but has been posting rapid increases in recent years. The expansions to transformer facilities effectuated via this project (accounting for some 30% of additions to medium voltage capacity in East Java during implementation) have increased the capacity and volume of transmissions to customers connected to the grid, and have made certain, limited contributions to supporting increases in demand.

Table 5: Transitions in power consumption by customer and peak demand on the system in the target region (Unit: GWh/MW)

	1991	1996	1997	1998	1999	2000	2001	Annual growth rate pre 1998	Annual growth rate post 1998
Residential	1,536	2,948	3,370	3,778	4,182	4,829	5,280	14.0%	11.9%
Commercial	266	583	641	779	854	1,097	1,178	16.0%	16.8%
Industrial	3,721	5,497	5,992	5,517	6,292	6,629	6,844	8.3%	3.9%
Public and other	280	435	459	507	521	579	640	8.7%	8.8%
Total	5,803	9,462	10,462	10,581	11,849	13,135	13,942	10.4%	7.5%
Average demand	1,103	1,818	2,092	2,273	2,231	-	2,481	10.9%	3.1%
Peak demand	-	2,162	2,359	2,482	2,794	2,942	3,129	7.2%	8.1%

Source: PLN Unit Business Distribusi Jawa Timur

However, it is necessary to heed the fact that peak demand, predicted at appraisal (1998) to increase to 3,628MW, has in fact leveled off at 3,129MW (2001). There has been some deviation in growth rates for peak demand, which was forecast to increase by around 18.5% per year but is only actually increasing in the region of 10% a year. Despite the absence of any notable problems with the total installed capacity of the medium voltage transformer facilities covered by the project (there are some substations that are forced to operate in overload), the executing agency has acknowledged that this deviation was the result of

problems with the accuracy of its predictions per se, and because insufficient expansions were made to the transformer capacity of high and low voltage facilities (500/150kV transformer equipment and distribution-use transformer equipment not covered by the project). In consequence, overload operation of grid facilities has resulted in service interruptions, industrial consumers choosing to operate privately owned generators, and the continued existence of customers who have applied for but have yet to be connected.

(4) Transitions in the demand-supply gap

The expansions to the medium voltage transformer facilities covered by this project have not, per se, had a direct link with a reduction in the demand-supply gap, aside from demand from certain industrial consumers receiving power of medium and higher voltage. Combined with expansions to the distribution grid, they have indirectly contributed to eliminating the demand-supply gap.

Table 6: Transitions in the demand-supply gap

	1989	2000	2001
Residential (MVA)	21	46	69
No. of applicants awaiting connection	n.a	79,369	127,324
Commercial (MVA)	13	3	4
No. of applicants awaiting connection	n.a	1,102	3,655
Industrial (MVA)	65	6	48
No. of applicants awaiting connection	n.a	87	165
Public and other (MVA)	8	5	3
No. of applicants awaiting connection	n.a	767	911
Total (MVA)	107	60	124

Source: Audit data, PLN Unit Business Distribusi Jawa Timur

According to figures for recent years, the demand-supply gap is on the increase. This is considered to be due to a renewed surge in demand for power in East Java, a region where latent demand for power was high to begin with, and where the economy is now on course for recovery after the currency crisis. Under such circumstances, installed capacity, primarily of transmission and distribution facilities handling high and low voltage power, is proving unable to keep pace with demand, and capacity expansions have virtually ground to a halt due to critical financial conditions at PLN in the wake of the currency crisis.

Even at the medium voltage level, there is a need to beef up transformer capacity at certain overloaded substations. Although the executing agency is monitoring the demand-supply balance at all substations, current circumstances preclude facilities investment forcing it to focus its response on the repositioning of existing transformers and leaving it incapable of sufficiently meeting new applications for supply.

Current PLN head office policy is to prioritize new off-peak customers (primarily commercial and industrial demand for daytime use). This “selective new connection” policy may in fact be termed a demand control policy and will not ultimately facilitate the process of supplying power to all potential customers.

(5) Easing of the transformer capacity operating ratios

Easing the capacity operating ratios of transformers has become an issue for the entire Java-Bali grid system. The same is true for the East Java region, where data for October (2002), a season marked by a surge in power demand as industrial production activities intensify in the run up to the Islamic New Year

when consumption flourishes, reveal high capacity operating ratios for approximately 83% of high voltage transformers (500/150kV: not covered) (Table 7).

Table 7: Number of medium/high voltage transformers working at different peak capacity operating ratios (Oct. 2002)

Capacity operating ratio (%)	500/150 kV		150/20 kV		70/20 kV	
	No. of units (ratio)	MVA	No. of units (ratio)	MVA	No. of units (ratio)	MVA
91 ~ 100	3 (50.0%)	1,500	3 (2.1%)	65	5 (9.6%)	60
81 ~ 90	2 (33.3%)	1,000	11 (7.6%)	350	9 (17.3%)	210
71 ~ 80	-	-	14 (9.7%)	520	7 (13.5%)	150
51 ~ 70	1 (17.7%)	500	67 (46.2%)	2,340	20 (38.5%)	372
31 ~ 50	-	-	35 (24.1%)	1,521	5 (9.6%)	130
0 ~ 30	-	-	15 (10.3%)	740	6 (11.5%)	65
Total	6 (100.0%)	3,000	145 (100.0%)	5,536	52 (100.0%)	987

Source: PLN Unit Business P3B

However, approximately 14% of the medium voltage transformers covered by the project record peak capacity operating ratios of 80% or more, with the majority being operated without constraint within a 31% - 70% range even at peak capacity operating ratios. The additional medium voltage transformers provided via this project are evaluated as having distributed and eased the load on existing facilities and of making it easier to operate substations without overburdening the equipment.

As indicated in Table 8, the average peak capacity operating ratio for all medium voltage substations for the month of October, when power demand is comparatively high, had decreased from their level at appraisal in 1991 (59.2%) to around 57% in fiscal 2002. The percentage of transformers recording peak period capacity operating ratios in excess of 80% has also dropped from 17.8% in 1991 to 14.2% in October 2002.

Table 8: Average capacity operating ratio (COR) for all medium voltage transformers & percentage recording peak operating ratios in excess of 80%

	1991	2001 May	2002 May	2002 October
a) Total number of medium voltage transformers (in operation)	81	197	196	197
b) Average peak period COR for all transformers	59.2%* ¹	55.3%	50.2%	56.8%
c) Percentage recording peak period COR of 80%+	17.8%* ¹	13.7%	2.0%	14.2%
d) Number of project transformers	-	40	40	40
e) Average peak period COR for project transformers	-	56.4%	55.1%	60.1%

Source: Audit data, PLN Unit Business P3B

Note: Data are for 150/20kV and 70/20kV medium voltage transformers only.

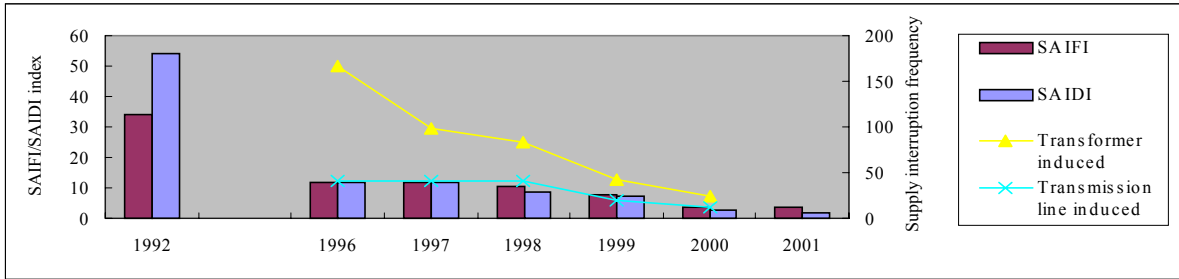
Note 1: Value for each substation.

When only project transformers are considered, the same figure increases slightly to around 60%. This is thought to be because consideration was given to urgency when positioning project transformers, thus the equipment was installed in regions predicted to see considerable growth in latent demand.

(6) Decreases in the frequency/duration of service interruptions

SAIFI and SAIDI² are cited as the indexes for examining changes in the frequency and duration of service interruptions. Service interruptions are primarily due to overloads on transformers and the transmission and distribution grid. Overload conditions are monitored by power supply personnel within the executing agency and if the facilities are operating close to capacity limit then supplies are interrupted (load shedding). Blackouts have also been caused by equipment failure (lightning damage to 70kV transmission lines, etc.)

Figure 1: Transitions in SAIFI/SAIDI and outage frequency (transmission system: caused by transformers/transmission lines)



Source: PLN Unit Business P3B
 Note: The number of failures per facility is the total for three transmission operation districts within East Java Province (i.e. Madiun, Surabaya and Malang).

As Figure 1 illustrates, the SAIFI and SAIDI indexes have improved remarkably during the past ten years, which may be partially attributed to the medium voltage transformer capacity expansions and easing of overload operation effected via this project. The frequency of service interruptions has similarly been on a downward trend and there have been marked improvements in the number of outages caused by transformers thanks to the work carried out through this project. According to the executing agency, service interruptions caused by transmission transformers of 20kV or less and capacity shortages on low voltage distribution lines currently account for 60% of all outages.

(7) Decreases in transmission losses

This project mainly covered transformer facilities, thus although it was not anticipated to have much effect on reducing transmission losses, it was hoped that indirect improvements would result. As illustrated in Table 9, results show that the loss ratio had improved by 0.32 points in 2000 as compared to the figure for 1996.

² SAIFI (System Average Interruption Frequency Index): The average number of times each customer within an area experiences interruption during a year. SAIDI (System Average Interruption Duration Index): The cumulative length of power interruption, in hours, that a customer within a certain area experiences during a year, on average.

Table 9: Transitions in transmission loss (Unit: GWh)

	1996	1997	1998	1999	2000
P3B system receiving volume	52,782	59,677	59,570	65,386	72,196
Volume used by substations within P3B system	44	48	58	55	56
Transmissions to Java-Bali distribution system	52,738	59,629	59,512	65,331	72,134
Transmission loss on Java-Bali system (1)	1,504	1,456	1,376	1,704	1,826
	2.85%	2.44%	2.31%	2.61%	2.53%
Of which, transmission loss within East Java region (2)	306	291	278	349	372
Transmission loss ratio for East Java region (2)/(1)	20.3%	20.0%	20.2%	20.5%	20.4%
Java-Bali distribution system receiving volume	51,234	58,172	58,136	63,627	70,306
(East Java distribution system receiving volume)	10,444	11,656	11,775	13,047	14,395

Source: Audit data, PLN Unit Business P3B

(8) Overall project effects

As evidenced above, the medium voltage transformer facilities provided via this project are operating favorably and account for approximately 16% of medium voltage transformer capacity and approximately 20% of all transformers currently operating in the East Java region. The provision of these transformers is evaluated as having increased power demand and improved supply reliability within the region, thanks to increased supply volumes and the eased overload operation situation. However, inadequate expansions to other supply facilities (low/high voltage, etc.) and PLN's inability to continue shoring up some of the medium voltage substations since project completion mean that there is still room for improvement in terms of meeting latent demand and further stabilizing supplies.

2.4 Impact

(1) Contributions to industry sector development

Although affected by the currency crisis, economic activity in the East Java region has been growing at an annual rate of 3.9%, on average, during the period spanning the early 1990s through 2001. The average growth rate for the manufacturing industry reached 6.4% per year during the same period. The currency crisis of 1997-98 inflicted enormous damage on East Java's industrial sector, even causing it to post negative growth, however, it has since shown modest recovery.

Table 10: Growth in East Java's manufacturing sector (Unit: million Rp)

	1993	1996	1997	1998	1999	2000	2001
Total regional production (at current prices)	44,629	77,004	88,772	135,753	150,556	169,681	196,499
Of which, manufacturing industry	10,202	22,454	26,344	38,258	41,158	45,616	51,617
Of which, commercial/service industry	10,252	16,050	19,027	32,069	34,478	39,166	46,476
Total regional production (1993 fixed)	44,629	61,794	64,854	54,399	55,059	56,857	58,758
Average 1-year growth rate	-	11.5%	5.0%	-16.1%	1.2%	3.3%	3.3%
Of which, manufacturing industry	10,202	17,815	19,410	15,104	15,096	15,358	15,538
Average 1-year growth rate	-	20.4%	9.0%	-22.2%	0.0%	1.7%	1.2%
Of which, commercial/service industry	10,252	12,906	13,828	11,369	11,404	11,908	12,838
Average 1-year growth rate	-	8.0%	7.1%	-17.8%	3.1%	4.4%	7.8%

Source: BPS Propinsi Jawa Timur

Output and the amount of value-added have also posted remarkable growth in the manufacturing industry (Table 11), however, this is largely due to price increases, and performance is on a par with total

regional production. Although the currency crisis has caused increases in company numbers and investment totals to stagnate in recent years, there has been verifiable growth in the entire economy and in the manufacturing sector during the ten-year period since the early 1990s, with the percentage of total regional production occupied by the manufacturing industry increasing from 22.9% in 1993 to 27.0% in 2000 and industrialization accelerating.

Table 11: Transitions in manufacturing industry (medium-scale and above) performance in East Java (Unit: million Rp.)

	1992	1995	1998	2000
No. of medium & large-scale companies	3,997	4,742	5,004	4,999
Output	21,328	36,013	79,396	162,482
Value-added	8,733	17,393	34,516	98,256
Investment (incl. small-scale companies)	n.a	15,287	17,857	10,913

Source: BPS Propinsi Jawa Timur

It should be noted that the promotion of industrial sector development within the East Java region and metropolitan Surabaya in particular, was being focused on at the time of project appraisal. REPELITA V (the Fifth National Five-year Development Plan: 1989-93) envisioned sustainable growth in industrial investment in Surabaya city, and the districts of Sidoarjo and Gresik, whilst REPELITA VI (1994-98) envisioned accelerated investment in the Gresik district; moreover, it was acknowledged that the development plans were predicated on the development of power and communications infrastructure.

As a result, the districts that have seen the most conspicuous industrialization during the last ten years (excluding Surabaya) are Sidoarjo, Gresik and Pasuruan. As is clearly evidenced in Table 12, among these three, it is manufacturing industries in Gresik that have been most successful in overcoming the effects of the currency crisis to achieve sustainable growth.

In 1997, the ratio of manufacturing industries in each of the municipalities/districts had increased to 36.3% in Surabaya, 48.6% in Sidoarjo, and 46.5% in Gresik. These high growth rates have been sustained, reaching 31.9%, 46.2%, and 45.7%, respectively as of 2000, and the regions are developing as industrial centers. These municipalities/districts are favored by good access to ports, airports and highways, plans to build numerous industrial estates are being executed, and the region is the focus for a string of ODA loan funded projects, such as this one, targeting the development of power and communications infrastructure.

Table 12: Transitions in manufacturing industry performance in recent years in Surabaya and surrounding districts (Unit: million Rp.)

	1997	1998	1999	2000	2001
Surabaya					
Total regional production (1993 fixed)	15,373	11,933	11,904	12,303	n.a
Of which, manufacturing industry	5,586	3,957	3,862	3,919	n.a
No. of medium & large-scale companies	n.a	486	546	654	n.a
No. of employees (medium & large-scale companies)	n.a	88,252	92,720	97,512	n.a
Sidoarjo					
Total regional production (1993 fixed)	5,698	4,533	4,581	4,764	n.a
Of which, manufacturing industry	2,767	2,114	2,135	2,202	n.a
No. of medium & large-scale companies	325	325	336	341	351
No. of employees (medium & large-scale companies)	43,093	43,093	45,450	45,600	47,787
Gresik					
Total regional production (1993 fixed)	5,109	6,933	7,866	9,213	n.a
Of which, manufacturing industry	2,377	3,089	3,402	4,206	n.a
No. of medium & large-scale companies	n.a	n.a	n.a	433	472
No. of employees (medium & large-scale companies)	n.a	n.a	n.a	151,792	159,330
Pasuruan					
Total regional production (1993 fixed)	3,164	2,740	2,777	2,888	n.a
Of which, manufacturing industry	1,219	997	1,005	1,050	n.a

Source: BPS Propinsi Jawa Timur

Whilst it is difficult to extract specific contributions, it is clear that the provision of power infrastructure has supported and been a prerequisite for industrialization. The East Java Provincial Planning Authority (BAPEDA), the Chamber of Commerce and Industry, and the companies responsible for managing the industrial estates located in Surabaya have recognized ample improvement in power conditions within the region during the past ten years. To put it another way, prior to the currency crisis and in recent years when both the number of medium and large-scale companies (including industrial estate tenants) and output were increasing, there were no periods when power supplies or the supply capacity per se in metropolitan Surabaya become a bottleneck to growth, nor was power recognized as a major impediment to sound development and growth.

Information on the status of industrial estate development offers a straightforward indication of the progress of industrialization. Table 13 shows a comparison of the number of plans being tabled by government organizations and industrial estate developers for Surabaya and surrounding districts in 1990 and the status of development in 2000. In terms of districts for which a data comparison is feasible, whilst total area is less than planned, the number of industrial estates per se is higher. To sum up, investment in the development of industrial estates in the Surabaya area during the 1990s may be evaluated affirmatively.

Table 13: Progress in new industrial estate development in Surabaya and surrounding districts

	Planned figures (1990)		Actual figures (2000)		Difference	
	No. of industrial estates	Area (Ha)	No. of industrial estates	Area (Ha)	No. of industrial estates	Area (Ha)
Surabaya	8	2,373	12	1,653	4	-720
Sidoarjo	n.a	n.a	6	813	n.a	n.a
Gresik	6	1,900	11	1,148	5	-752
Mojokerto	1	200	2	500	1	300
Bankalan	1	1,350	1	900	0	-450
Pasuruan	-	-	3	1,445	3	1,445
Total	16	5,823	35	6,459	13	-177

Source: BPS Propinsi Jawa Timur, BAPEDA Jawa Timur

According to a company³ that manages one of the industrial estates, visited independently, capacity expansions to power infrastructure have, in combination with industrial estate development progress and increases in tenant company numbers, been the result of appropriate developments by PLN. Development of this industrial estate commenced in 1990, and since numbers of tenant companies (including tenancy inquiries) increased dramatically between 1996-97 (approximately 120 companies had moved in as of 2002) thus overlapping with the implementation of this project, it is possible to form a connection between the two. Capacity at the Rungkut substation that supplies power to this industrial estate was expanded under this project, and whilst this is merely one example, it may be inferred that it has appropriately met forecast demand increases.

Rungkut substation

Located to the south of Surabaya, it mainly supplies power to large-scale industrial estates, such as the comparatively long-established Waru Industrial Estate and the recently established SIER Industrial Estate, it also transmits power to a number of 20kV+ industrial consumers. The project anticipated the plans to develop the industrial estate and connection applications from the managerial company and added three 50MVA transformers to the existing two, plus accessory equipment.

At the time of evaluation, Unit 2, Unit 4 and Unit 5, the transformers provided via the project, were respectively using 21MW, 36MW, and 33MW against a rated capacity of 50MVA (= approx. 40MW) during morning hours which see concentrated industrial activity, with similar levels after 7 p.m. when demand for household lighting increases. As a result, some transformers record capacity operating ratios of 90% during peak periods. The original plan was to add two transformers to the Rungkut substation, however, after the plans were reviewed, one of the transformers, originally scheduled for installation at another substation, was repositioned and measures were taken to further expand capacity, which given peak operating usage ratios in excess of 90%, more than justifies the revisions to positioning plans.

According to the management of this industrial estate, tenancy rates at other industrial estates in Surabaya and surrounding districts also apparently increased during 1996-97. Whilst the company has equipped the industrial estate with private generation facilities it has not experienced any problems with the status of power infrastructure since it began managing the industrial estate.

³ P.T. SIER Industrial Estate located in Rungkut district in southern Surabaya; 90% of tenant companies are Japanese affiliates.

(2) Power-related problems vis-à-vis industrial sector development

If the effects of the 1997 currency crisis are discounted, manufacturing and production industry development in the East Java region, and metropolitan Surabaya in particular, has tended to be quite rapid during the past ten years. Based on the this growth trend and the results from a hearing with a commerce and industry association, it would appear that supply capacity conditions have not caused a bottleneck at any time.

However, it is also true that supply to the industrial sector was not at a level that would sufficiently satisfy businesses in Surabaya and its environs. With supply interruptions inevitable at transformer facilities that become overloaded during peak periods and the demand-supply gap on the increase, the quantitative supply issue remains to be resolved. At the same time, further improvements must be made to the reliability of supplies. Power outages are an almost weekly occurrence during the rainy season and some businesses have been forced to shut down production for two days at a time. In addition, in the case of PLN there are instances when applications to increase contract capacity require a month to process.

In consequence, private generation facilities (captive power) continue to be an indispensable investment for businesses as a standby for peak periods and for use in emergencies. There are two types of industrial consumers owning private generation facilities. Those that use in-house generators as their main supply source and only rely on the grid for lighting demand, and those that use the grid as their main supply source and have private generators as a standby for peak periods and for use in emergencies. In terms of installed capacity of private generators, the latter group is dominant.

As illustrated in Table 14, until the mid 1990s, there was a progressive decrease in private generation capacity aimed at meeting main demand. The continuous development support provided by the ODA loan funded “East Java Electric Power Transmission and Distribution Network Project” was instrumental to these decreases. However, notwithstanding that a certain level of installed capacity is an essential emergency countermeasure for industrial production, the installed capacity of private generators used as the main supply source and for peak standby has been increasing since the mid 1990s. The East Java Chamber of Commerce and Industry has recognized recent increases in new private generation facilities and capacity expansions to existing generators due to higher electricity tariffs and fears of an energy crisis.

Table 14: Transitions in the installed capacity of private generation facilities (Unit: MVA)

		1992	1994	1995	1996	1997	1998	1999
Main	Installed captive capacity	197	201	150	142	126	122	188
Peak standby	Installed captive capacity	327	463	357	593	589	618	657
Emergency	Installed captive capacity	301	391	617	507	650	657	947
Total	Installed captive capacity	825	1,055	1,124	1,243	1,365	1,397	1,492

Source: PLN Unit Business Distribusi Jawa Timur

There are indications that, should electricity tariffs continue to rise, supplies from private generators will end up being cheaper and more efficient. According to the executing agency, grid supplies continue to be cheap and efficient, however, they are aware of the need to improve supply conditions so as to prevent

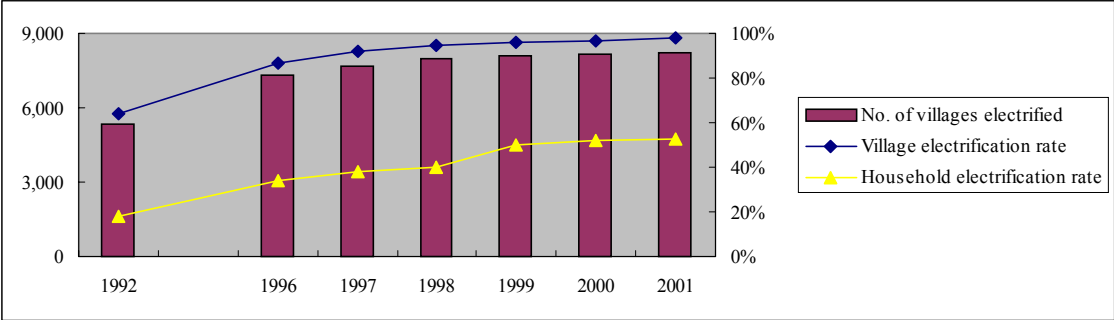
any further increase in the burden on industrial consumers to install, operate and maintain captive power facilities. Businesses have been highly vocal regarding the need for the executing agency to improve its management policies (particularly in terms of the private-sector commissioning of its distribution business).

Many industrial estate tenants own captive power facilities. According to the industrial estate management company we visited, whilst all its tenant companies are grid contractors they have captive power facilities as a standby for peak periods. Power outages in the early stages of the rainy season are frequently accompanied by supply disruptions, and use of captive power is particularly heavy during this season.

(3) Changes in village and household electrification rates

As shown in Figure 2, both village (the percentage of all villages that have been electrified) and household (the percentage increase in contracted households) electrification rates in East Java increased by a wide margin during the 1990s. The village electrification rate has almost reached 100%, whilst the household electrification rate evidences that over half the households have been electrified.

Figure 2: Fluctuations in village and household electrification rates in East Java



Source: PLN Unit Business Distribusi Jawa Timur

Note: The number of electrified villages refers, albeit in part, to those villages (Desa) that have been reached by the power grid.

The expansions to transformer facilities implemented via this project have been partially responsible for facilitating increases in the supply of power to general consumers and have contributed to per customer increases in power consumption and the improvements in the village and household electrification rates. At appraisal, this project was targeted toward improving power conditions with a view to facilitating industrial growth, however, the additional transformers and appropriate operations that were implemented conjunctively are evaluated as having been contributory in terms of supporting the increases in numbers of contracts for general consumers.

(4) Other impacts (land acquisition)

Some privately owned land was acquired for the construction of new substations, however, the process was conducted in accordance with government guidelines, including financial compensation, and did not result in any delays to the implementation schedule or affect the outcome of the project. It should be noted that the land acquisition did not entail the relocation of any residents.

2.5 Sustainability

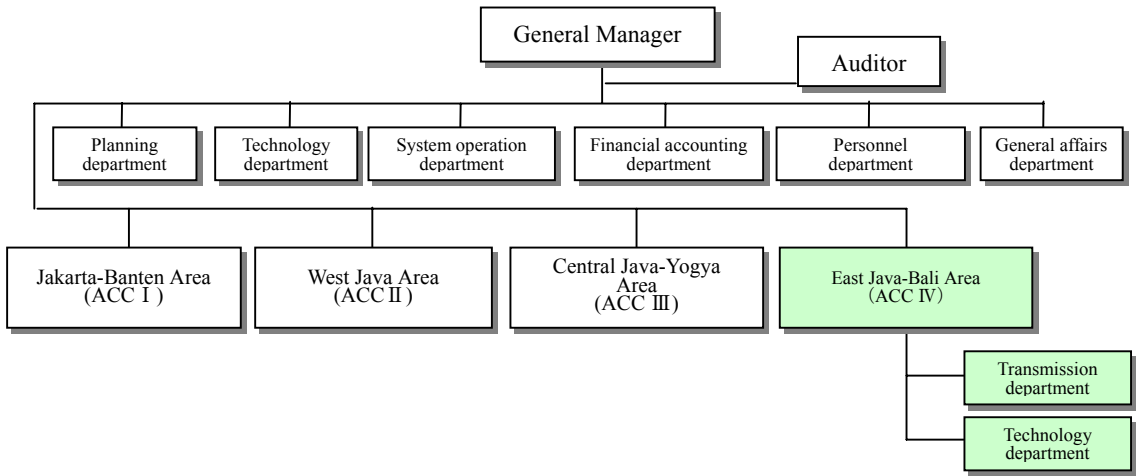
2.5.1 Operation and Maintenance

(1) Organization and personnel systems

In 1994, PLN, the project’s executing agency, was transformed from a state-owned enterprise into a public corporation (PERSERO) with all of its stock is held by government. In recent years, the Java-Bali system has also felt the current of structural reforms in the power sector and has been promoting organizational reform. PLN has positioned its transmission and distribution department as a strategic business unit and is pushing ahead with a view towards spinning off the department as a separate business in the future. The operation and maintenance of the transmission and transfer facilities provided via this project has been conducted by the Distribution and Load Control Center for Java-Bali (P3B), one of PLN’s strategic business units, since it was established in 1995.

500kV facilities within the Java-Bali system are managed by the P3B head office, however, all 150kV and 70kV transformer facilities are administered by P3B Area Control Centers (ACC⁴). These ACC transmit power to the distribution units in their area, which are also strategic business units.

Figure 3: Organizational chart of P3B



The East Java-Bali ACC of P3B operates in suburban Surabaya and has further divided its operations into four areas (Madiun, Surabaya, Malang and Denpasar) in order to manage the substations and transmission lines under its control. As of the end of 2000, the East Java area had 1,266 employees. The P3B East Java area manager has not recognized any specific issues with the technical abilities of personnel but is aware that there are surplus numbers.

In recent years, personnel numbers in PLN have been decreasing rapidly thanks to its early retirement program and a non-recruit policy. The payroll in 1995 numbered 54,790 employees but had dropped to

⁴ The main functions of ACC are 1) 150kV and 70kV system operation targeting supply and voltage management, and 2) maintenance of supply security within the region.

46,016 by the end of 2000, and the company has introduced a system of contract labor covering engineers and technicians.

(2) Business operations

P3B, which is positioned as one of PLN's strategic business units, is a business organization that is exclusively involved in the transmission and transformer operations that will form the groundwork for achieving the total spin-off of the business, i.e. the future vision for structural reorganization of the power sector, and for realizing the multi-seller/multi-buyer model⁵, however, at the time of evaluation it is still no more than an internal division of PLN. Decisions on business plans and fund procurement are made by the PLN head office, and whilst P3B drafts plans for investment and the recruitment and allocation of personnel, these matters require head office approval. Accordingly, P3B is responsible for facilities operation and maintenance and for procuring resources.

It should be noted that the business operations of P3B are subject to performance targets set by PLN head office. P3B operations involve the monitoring of the duration and frequency of system faults as well as transmission loss. It also establishes the selling price for the Distribution Business Units and targets for the asset turnover ratio, etc. As explained in section 2.3, although it has been possible to confirm a certain level of improvement in the duration and frequency of system failures and in transmission loss, in terms of financial targets, the nature of P3B's organization means that the unit is not sufficiently motivated to effectuate improvements.

Operations at each of the substations in the East Java region are conducted by four groups in three daily shifts under the control of the East Java ACC. The operational setup of transmission and transformer facilities has a direct impact on the reliability of supply (particularly the occurrence of disruptions). The causes of supply interruptions for each substation are as shown in Table 15. In terms of P3B-wide transmission operations, the overwhelming majority of disruptions are caused by external factors, such as lightning, as opposed to human factors relating to operational skills or facilities-related factors; however, the opposite is true for transformer operations. Thus it may be inferred that there is a pressing need for P3B to improve its facilities operation and maintenance techniques.

⁵ One form of supplying power, which involves multiple generation operators selling power to transmission and transformer operators which is then bought by multiple distributors and supplied to consumers.

Table 15: Causes (and number) of supply disruptions: FY 2000

		Transmission line		Transformer	
		1996	2000	1996	2000
Internal causes	•Facilities-related problem	43	27	140	56
	•Operational problem	8	0	16	1
	•Faulty protective transmitter	8	2	47	2
	•Faulty feeder	0	0	133	101
External causes	•Lightning	144	55	33	2
	•Kites	15	5	1	2
	•Falling tree	3	2	-	-
	•Animals	7	1	24	4
	•Other cause beyond PLN control	32	7	55	19

Source: PLN Unit Business P3B

Note: Causes are based on executing agency classifications

(3) Maintenance and Management

Servicing and maintenance management involves the periodic implementation of preventative maintenance in addition to follow-up maintenance, work that is carried out using the operation and maintenance manual provided by the equipment supplier and the guidebook compiled by the executing agency. These activities are executed regardless of the financial status of the organization as a minimal responsibility of the executing agency.

In terms of spare parts for transmission and transformer facilities, efforts are made to maintain a stock equivalent to around 2-3% of the parts necessary for all installed facilities. In order to maintain stocks, supply requisitions are periodically dispatched to PLN head office, however, their delivery is dependant on the head office budget, and excluding emergency requests for breakdowns and so forth, parts are only supplied when budgetary measures permit. Accordingly, it is difficult to ensure a sufficient volume and variety of spare parts. Moreover, according to the executing agency, the depreciation of the local currency is making it difficult to procure a sufficient stock of those parts necessary for communications equipment, etc., that have to be procured overseas.

2.5.2 Technical Capacity

PLN is actively working to expand the opportunities for staff training. In fiscal 2000, 51,763 staff members participated in various training courses. PLN offers the following training courses in connection with this project:

- Substation/transmission line operation and maintenance management
- High voltage transmission line maintenance management
- Communications and SCADA⁶ system operation

The executing agency has indicated a need to improve the technical abilities of its workers in respect of protective transmitter management and SCADA system operation, and is endeavoring to effectuate this by

⁶ The Supervisory Control and Data Acquisition (SCADA) system refers to a communications system that is used to remotely control a power supply system. It allows operators to ascertain transformer load conditions and transmission line current from the Supply Command Center and to perform remote load switching operations in response to demand.

providing more training opportunities.

The employee evaluation standards used when promoting or reallocating staff are based on years of experience, however, the results of various technical examinations (whether the staff member has any in-house technical qualifications), participation in training courses, educational history and attitudes towards work are also considered. The manager of the P3B East Java area has recognized a strong desire among personnel to improve their technical skills. All personnel involved in operation and maintenance activities attend weekly meetings during which the week's duties and responsibilities are clarified and tasks assigned.

2.5.3 Financial Status

PLN has already separated the transmission and transformer facilities assets, liabilities and funds to be controlled by the P3B Strategic Business Unit, and has charged P3B to compile various independent financial statements. However, the P3B Transmission Business Unit has not been completely spun off from PLN, and ultimately continues to be an internal organization. Thus P3B's selling/buying price is directly affected by the average power delivery price agreed on between the PLN head office and Independent Power Producers (IPP) or PLN generation subsidiaries, and by retail electricity tariffs.

In addition, revenue from electricity tariffs collected by the Distribution Business Unit is initially delivered to the PLN head office after which operational and investment funds are extracted and redistributed as budget to all Strategic Business Units, including P3B. In other words, P3B operations are contingent upon the price decision authority and earnings allocation system of PLN. In consequence, P3B is not sufficiently motivated with regard to appropriate cash flow or profit and loss management and entrusts its financial affairs to PLN head office. It is considered that the P3B business is operating in the red. In terms of PLN's finances, it is frequently pointed out that in as far as generation costs are higher than retail electricity tariffs (a situation underpinned by the high transaction fees levied by IPPs, soaring fuel prices and interest payments due to the depreciation of the rupiah, and retail electricity tariffs that are maintained at low levels under government policy), it is unable to establish a sufficiently wide margin for the Transmission Business Division.

Table 16: Fluctuations in PLN's financial status (Unit: billion Rp.)

	1995	1997	1998	1999	2000	2001
Operating earnings	8,306	11,126	14,036	15,997	22,557	28,625
Average earnings (Rp./kWh)	163.0	169.1	211.3	220.7	279.7	334.2
Operating expenses	6,537	9,450	16,809	21,503	27,216	31,993
Ratio of earnings/expenses	78.7%	84.9%	119.8%	134.4%	120.7%	111.6%
Income prior to interest/tax payments	1,769	1,676	-2,773	-5,506	-4,659	-3,315
Interest payments	576	3,435	1,602	4,043	3,894	6,805
Disposable cash for in-house spending	3,328	5,833	269	1,426	-7,474	6,739
Principal and interest repayment ratio (double)	5.78	1.70	0.17	0.35	-1.92	0.99

Source: PLN Pusut

P3B works with the PLN head office to prepare investment building plans for transmission and

transformer facilities, formulating three scenarios⁷: a limited, low and high case, based on fundraising constraints. P3B has indicated that it will be necessary to continuously expand installed capacity in order to meet future increases in demand, but unless PLN's finances recover it will be no easy matter to procure the necessary funds to improve and replace equipment. At present, since it is virtually impossible to invest in transformer capacity expansion, P3B is forced to reject applications for connection in areas serviced by overloaded substations. If PLN's financial status fails to improve, it is predicted that it will eventually become difficult even to find the funds to cover operation and maintenance costs.

Post-decentralization changes to the system have not seemingly had any particular impact on the operation and maintenance activities of the executing agency. In addition to decentralization, the Indonesian parliament approved a new electricity bill in September 2002, under which licenses identical to that issued to PLN are to be issued to private sector operators in each of the different power businesses (generation, transmission, distribution, facilities operation and retail sales), and PLN's monopolistic "special license" is to be revoked. Provincial and district governors will have the authority to issue these licenses, and it is expected that, in the distant future, activities to establish privately owned power businesses handling the distribution and retail sales for a certain district or municipality will begin to take place.

3. Feedback

3.1 Lessons Learned

Although the current project promoted the capacity expansion of medium voltage transformer facilities, since the expansions were not continued after project completion and insufficient expansions have been made to other supply facilities (low/high voltage, etc.), there is still room to achieve results in terms of meeting latent demand and supply stability. The significant revisions to project plans are considered to have been an inevitable consequence of the currency crisis, however, a more in-depth study of facilities infrastructure not covered by the project and of the financial status of the executing agency would have been beneficial in terms of deriving greater effect from the project.

⁷ Under the high scenario there are no financing constraints and it covers "all planned improvement projects in line with predicted demand"; under the low scenario a partial injection of funds is possible but some constraints remain and it covers "in-progress improvement projects and those to which funds have been committed, as well as those additional facilities investment funding projects for which positive funds can be allocated"; under the limited scenario there is no injection of new funds and "only in-progress improvement projects and those to which funds have been committed" are covered.

Comparison of Original and Actual Scope

Item	Plan	Actual
1. Project Scope Phase I 1. Expansion of existing substations Transformers: 70/20kV 150/20kV 2. Consulting services Phase II 1. Expansion of existing substations a. Transformers: 150/20kV b. Transmission line outlet construction 2. Substation construction: 150/20kV 3. Transmission line construction: 150kV-2CCT 4. Consulting services	7 sites; total capacity 150MVA 16 sites; total capacity 820MVA Foreign: 80 M/M Domestic: 92 M/M 10 sites; total capacity 410MVA 1 site 3 sites; total capacity 150MVA 3 lines; total length 25km Foreign: 92 M/M Domestic: 93 M/M	7 sites; total capacity 150MVA 16 sites; total capacity 820MVA n.a n.a 10 sites; total capacity 410MVA 1 site 3 sites; total capacity 150MVA 3 lines; total length 25km Foreign: 58 M/M Domestic: 93 M/M
2. Implementation Schedule Phase I: 1. L/A conclusion 2. Consultant selection 3. Feasibility study 4. Preparation of tender documents 5. Tender & contract closing 6. Design/manufacture 7. Procurement 8. Installation & set up Phase II: 1. L/A conclusion 2. Consultant selection 3. Feasibility study 4. Preparation of tender documents 5. Tender & contract closing 6. Land acquisition 7. Design/manufacture 8. Procurement 9. Installation & set up	Sep. 1991 Nov. 1991 - Oct. 1992 Oct. 1991 - Dec. 1991 Dec. 1991 - Jan. 1992 Feb. 1992 - Oct. 1992 Nov. 1992 - Nov. 1993 Jun. 1993 - Jun. 1994 Jan. 1993 - Oct. 1995 Sep. 1992 Sep. 1992 - Aug. 1993 Apr. 1992 - Jun. 1992 May 1992 - Jul. 1992 Aug. 1992 - Sep. 1993 Jul. 1992 - Sep. 1994 Oct. 1993 - Mar. 1995 Oct. 1994 - Jun. 1995 May 1994 - Sep. 1995	Sep. 1991 Mar. 1992 - Oct. 1992 Jul. 1992 Jun. 1992 - Aug. 1992 Jul. 1992 - Oct. 1992 Dec. 1993 - Apr. 1996 Dec. 1994 - Jan. 1996 Nov. 1994 - Jan. 1997 Oct. 1992 Sep. 1992 - Sep. 1993 n.a n.a n.a n.a n.a n.a n.a
3. Project Cost Phase I: Foreign currency Local currency Total ODA loan portion Exchange rate Phase II: Foreign currency Local currency Total ODA loan portion Exchange rate	6,615 million yen 2,410 million yen (35,431 million Rp.) 9,025 million yen 7,671 million yen Rp.1 = 0.068 yen (as of Apr. 1991) 5,841 million yen 2,233 million yen (34,880 million Rp.) 8,074 million yen 6,862 million yen Rp.1 = 0.064 yen (as of Apr. 1992)	5,123 million yen 2,077 million yen (32,087 million Rp.) 7,200 million yen 3,223 million yen Rp.1 = 0.064 yen (weighted average for 1992 - 1997) n.a n.a n.a n.a 3,236 million yen n.a

**Third Party Evaluator's Opinion on
Java-Bali Transmission Line/Substation Development Project (East Java) (I&II)**

Dr. Pande Radja Silalahi

Vice Chairman/ Indonesia Antimonopoly Authority

Staff/ Center for Strategic and International Studies-Jakarta

Relevance

The report is concise and covers all the relevant subjects set out in the DAC Evaluation Criteria. Development of the power transmission and distribution grid in East –Java has very high relevance especially in supporting or facilitating the power demand from industry, both mining and manufacturing. In fact, it could be argued that the development of the power transmission and distribution grid will become even more important as the economy of Indonesia and East Java is now on course for recovery after the economic crisis in 1997. Enhancing the stability and reliability of power supplies continues to be an critical issue especially due to the potential an energy crisis within Java-Bali, even though there are indications at this stage that supply capacity and the transmission and distribution network remain deficient.

By improving of the reliability and stability of power supplies by meeting increase in demand it might be expected that economic activities will increase and as a result the added value received by the people at large or companies in the region will increase significantly. This project had positive impacts on local economic activities due to the cost reductions, which achieved via decreases in transmission and distribution loss. The actual cost of the projects was much lower than the estimate at the time of appraisal (about 44,47%) resulted mainly from international competitive bidding for transformer equipment, followed by, depreciation of local currency. Even though that the project was completed approximately 15 month behind schedule this project had contributed in guaranteeing better supply capacity in East Java.

Impact

It might be admitted that the project resulted in positive economics and social impacts. The project resulted in regional development in terms of improved availability and continuity of power supply to household as well as companies in the targeted region (East-Java).

The increase in the substation capacity by approximately 30% of medium voltage transformer capacity expansions, increase in transmissions from all substations, increase in the number of customer handling capacity, improvement of SAIFI and SAIDI indexes, decreases in transmission loss had contributed to development of industrial sector in East Java. However, the economic crisis in 1997 resulted in the demand for power dropped and standstill after the year of crisis. This development had an impact on the calculation of the effectiveness of this project. Due to the impact of economic crisis and the price policy of electricity applied by government, the accurate economic benefit derived from this project is very difficult to quantify, and as a consequences the estimated economic rates of return (EIRR) also is very difficult to calculate. Therefore, in order to show whether this project was cost-efficient accurately, we need to compare the unit cost of the project with unit cost of a similar project and taken into account the subsidy policy implemented by government.

The report pointed out that the actual cost was much lower than the estimate at the time of appraisal (about 44,47%). The significant cost under-run, about 44,47% lower than originally estimated, resulted from the excessive competition among bidders and the appreciation of the Yen vis-à-vis the Indonesian Rupiah.