Philippines

Substation Expansion Project

Report Date: August 2002
Field Survey: June 2001

1. Project Profile and Japan's ODA Loan

Location Map of the Project

The Concepcion substation

1.1 Background

The transmission system in the Philippines is divided into three grids: Luzon, Mindanao and Visayas. The Luzon grid supplies the Metropolitan area of Manila, which, at the time of appraisal, accounted for 70%[*1] of total energy demand in the Philippines.

While the installed capacity of the Luzon grid was 5,254 MW, as against peak demand of 3,100 MW in September 1993, the available capacity of the grid was only 2,652 MW that month. This insufficient operation or sub-performance resulted in a peak shortage of 448 MW. However, owing to the commissioning of the new power stations and the rise in the water level of reservoirs for hydroelectric power stations, by the end of April 1994, available capacity was increased to 3,614 MW, as against installed capacity of 5,778 MW and peak demand of 3,193 MW. This resulted in 421 MW of surplus capacity during the peak time and alleviated potential energy shortages, as the country had experienced in 1992 and 1993.

However, power demand within the Luzon grid, increased, on average, 4.6% per year from 1989 to 1993, and was estimated to grow 9.2% yearly from 1994 to 1998, at the time of appraisal. To cope with this estimated rapid increase in electricity demand, the Philippine government was proceeding to construct new power stations and associated transmission lines. In addition to these activities, expansion of existing substations was needed.

1.2 Objectives

To install additional transformers at existing NPC's substations located within the Luzon grid in order to meet increasing demand.

[1] At the time of appraisal

1.3 Project Scope

i) Procurement and installation of power transformers and related accessories for the following seven substations, located within the Luzon Grid.

Name of Substation	Transformer Capacity		Additional Transformer
	Before the project	After the project	
Laoag Substation	20 MVA	70 MVA	50 MVA, 115 kV- 69/ 13.8 kV 1 Unit
Dasmarinas Substation	200 MVA	500 MVA	300 MVA, 230kV- 115 kV 1 Unit
San Manuel Substation	100 MVA	150 MVA	50 MVA, 230kV- 69/13.8 kV 1 Unit
La Trinidad Substation	150 MVA	250 MVA	100 MVA, 230 kV- 69 kV 1 Unit
Concepcion Substation	100 MVA	200 MVA	100 MVA, 230 kV- 69 kV 1 Unit
Hermosa Substation	50 MVA	100 MVA	50 MVA, 230kV- 69 kV 1 Unit[*2]
San Jose Substation	100 MVA	150 MVA	50 MVA, 115kV- 34.5 kV 1 Unit

ii) Procurement of one reserve power transformer (100 MVA, 230 kV- 69/13.8 kV) for Luzon Grid.

1.4 Borrower/ Executing Agency

Republic of Philippines / National Power Corporation (NPC)

1.5 Outline of Loan Agreement

Loan Amount/ Loan Disbursed Amount	2,896 million yen/ 1,219 million yen
Exchange of Notes/ Loan Agreement	November, 1994/ December, 1994
Terms and Conditions Interest Rate Repayment Period (Grace Period) Procurement	 3.0 %. 30 years (10 years) General Untied
Final Disbursement Date	April, 1999

2. Results and Evaluation

2.1 Relevance

At the time of appraisal, the National Power Corporation (NPC) had constructed new power stations and transmission lines to cope with the increasing demand for electricity supplied by the Luzon grid. There were also forecasts of future capacity shortages in substations, and consequently NPC was promoting action to deal with this capacity shortage in the country's substations. Construction of new substations and/or expansion of existing substations were to be implemented in accordance with the Power Development Plan (1993-2005). However, as a result of budget constraints, the project was not proceeding on schedule. According to NPC's projection, seven substations (Laoag, Dasmarinas, San Manuel, La Trinidad, Concepcion, Hermosa, San Jose) in particular would not be able to meet future increases in power demand by the year 1997. Consequently, this project was consistent with the development policy of the Philippines at that time.

Currently, several independent power producers (IPPs[*3]) participate in power station development. Moreover, the generation function of the NPC has already been spun off from the organization and will eventually be privatized. The transmission function will also be privatized either through outright sale or concession contract later on. Given these conditions, the role of the transmission system in providing such generation companies, IPPs, with equal accessibility, adequate operation and maintenance of power becomes increasingly important. In addition, in order to provide for the high power demands deriving from

[2] One transformer unit with a capacity of 50 MVA was supposed to be relocated from Concepcion substation under the project. All other transformers were to be newly procured.

[3] IPP: A private entity that owns facilities to generate electric power for sale to utilities and end users.

future economic development, power generation capacity must be developed continually and transmission lines and substation facilities must be expanded. At present, NPC plans to deploy transformer substations with about 95,000 MVA in capacity, in the Luzon grids during the period 2000-2010. Viewed in this light, it can be said that the project objective is still relevant today.

2.2 Efficiency

2.2.1 Project Scope

The original project scope consisted of procurement and installation of power transformers, power circuit breakers and related accessories at the seven substations. In addition, one transformer was to be procured as a spare for the grid.

The main segments of the facilities have in fact been procured for all substations except San Jose. The expansion project at the San Jose substation was excluded from the project scope and implemented under the financing of NPC. In the case of transformers -- a major portion of the project in terms of price and role -- the remaining six units were procured as planned. Of these, four were installed at the originally envisaged substations. The one transformer scheduled for installation at the La Trinidad substation was installed at the switchyard of the Calaca coal-fired power station because the actual load at the La Trinidad substation was lower than the appraisal estimate, while Calaca required an additional transformer immediately. The spare transformer was installed at the Cruz-Na-Daan substation, where a new transformer was urgently needed to cope with increasing load.

Regarding other related equipment -- power circuit breakers and disconnecting switches -- the number of procured facilities and their location were modified depending on the actual load requirement and situation of each substation. However, these facilities were, more or less, procured and installed in accordance with the original plan. When taking into account the actual load of each substation (please refer to 2.3 effectiveness), it can be said that the change of the scope was appropriate and effective in achieving the original objectives.

2.2.2 Implementation Schedule

Bid opening and evaluation for this project started in July 1996, 19 months behind the schedule set out at appraisal; it was completed in December 1999, 23 months behind schedule. This delay was brought about by the following factors:

i) A fire on the 3rd floor of the NPC building, which caused extensive damage to the Electrical Design Department and the evaluation work;
ii) Insufficient field data collection, which delayed the start of the detail design;
iii) Additional time required for application for a letter of credit, contract preparation and signing, which pushed back the schedule by four months; and
iv) Change from local competitive bidding for contracts to having independent installation by the NPC utility operation (While this change was made in order to compensate for delays in schedule that had already occurred, finalizing this amendment took more time than anticipated).

Except for the fire in the NPC building, these impeding factors resulted from the insufficient management ability of NPC. Originally target substations were classified into two categories, namely cluster-A and cluster-B, depending on their urgency.

2.2.3 Project Cost

The actual total project cost of 1,549 million yen equivalent was only 45% of the estimated cost of 3,430 million yen equivalent. The ODA loan portion actually disbursed was 1,219 million yen, which covered 79% of the total project cost and was 1,677 million yen lower than the approved amount of 2,896 million yen. This considerable cost under-run resulted partly from the cancellation of equipment and materials procurement for the San Jose substation. In addition, since international competitive bidding brought about severe competition, the contract amount was lower than the appraisal estimate. For example, the contract amount for transformers and power circuit breakers were, respectively, 40% and 42% lower than that of the appraisal estimate.

In the case of the local currency portion, actual expenditure was only 18% of the appraisal estimate. Most of the installation works were done by the NPC utility operation instead of being administered and assigned via local competitive bidding. The funding for these costs was disbursed from the administrative expense

budget of NPC, so it is difficult to segregate them from other expenses. Accordingly, it should be noted that the actual expense was much higher than the figure given.

2.3 Effectiveness

2.3.1 Meeting Increased Energy Demands at Individual Substations

The Substation Expansion Project (hereafter "the project") aimed to avert overloading of existing transformers in order to avoid system voltage collapse and to improve voltage regulation.

As shown in Figure 1, a transformer is able to operate even if its load factor[*4] is beyond 100%. However, transformer overload shortens the facility's durability, increases transformation loss, and causes a drop in voltage. If the overload conditions continue, brownout/ blackout of surrounding consumer coverage areas or breakdown of the transformer results. Thus, NPC postulates that the allowable load factor is 80%, when taking the stability of the grid condition and the forced outage of other transformers into consideration.

Under the project, six transformers and related facilities were installed at six substations to cope with increasing load. As a whole, the procured transformers have achieved their physical objectives. However, since the project was delayed, some existing transformers experienced overloads. People in the surrounding coverage area experienced frequent blackouts/ brownouts during the evening peak. However, owing to the procured transformers, all six substations have been able to keep up with the increasing demand and the probability of overload has been successfully diminished.

The detailed operational status and effectiveness of the seven targeted substations are described below.

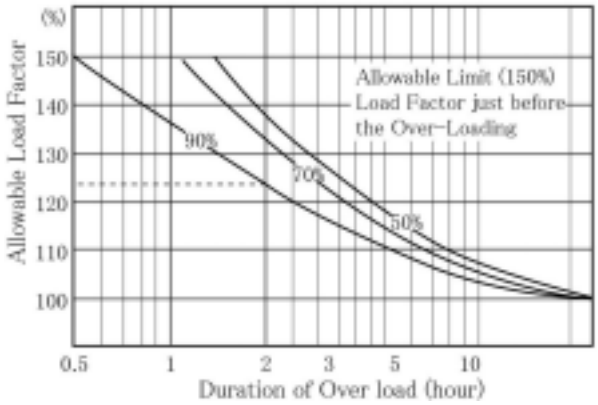

Figure-1: Allowable Load Factor of Transformer
Source: NPC Document

a) Concepcion Substation

The Concepcion substation is situated in Central Luzon. It receives energy mainly from the San Manuel substation through a 220 kV transmission line. Using the new transformer, voltage is stepped down to 69 kV, then 13.8 kV for distribution in Tarlac Province.

At the time of appraisal (December 1992), one 50 MVA transformer was operating. In 1994, an additional 50 MVA transformer was supposed to have been relocated from the Mexico substation by NPC. However, since this relocation project was not actualized, the load factor on the existing transformer exceeded its target of 80% from that year onward. In 1997, the existing transformer was overloaded, particularly during the evening peak. This resulted in frequent voltage collapse and blackouts in the surrounding area. Under the project, one 100 MVA transformer and related facilities were installed in the substation, and commissioned on 21st December 1998[*5]. As a result, overloading of the existing 50 MVA transformer was successfully averted, and electricity supply in the surrounding area stabilized.

The substation supplies electricity mainly to residential consumers of the Tarlac Electricity Corporation (Tarelco)[*6] and industrial and commercial consumers of the Luisita Industrial Park Corporation (LIPCO)[*7].

50 MVA Transformer

[4] Load Factor: A ratio of actual load levied on a transformer to rated capacity of the transformer.

[5] Subsequent to the installation of the new transformer, the existing 50 MVA transformer was relocated to the Tuguegarao substation, in order to cope with the increasing demand within its supply area.

[6] Tarelco, a semi-governmental distribution corporation, is responsible for supplying electricity in Tarlac Province. As of July 2001, the corporation supplied 47,240 residential consumers, 2,398 commercial and 82 industrial entities, 319 public buildings and 73 street lighting facilities.

[7] Luisita Industrial Park Corporation (LIPCO), the developer and manager of Luisita Industrial Park (LIP) I and II, is a consortium of leading Japanese and Philippine corporations. The 120-hectare LIP I is home to 13 manufacturing and distribution firms employing close to 5,000 workers. It also includes a special Export Processing Zone that offers fiscal and non-fiscal incentives to locators. This huge industrial park is already populated with businesses and factories engaged in light, non-polluting manufacturing services for domestic and foreign

With the development of the Luisita Industrial Park II, demand from the area is expected to increase rapidly, reaching 67 MVA by the end of 2002. To keep up with this incremental demand, an additional 100 MVA transformer was installed in the substation under another project in December 1999. The project's facility, together with this additional transformer, will contribute to meeting increasing demand in the future.

Table-1: Peak Load on Each Transformer in the Concepcion Substation (Unit: MVA)

	Rated Capacity	1994	1995	1996	1997	1998	1999	2000
Transformer-A	50	**45.2**	**45.7**	**47.2**	**56.9**	-	-	-
Transformer-B	100	-	-	-	-	56.2	68.9	46.9
Transformer-C	100	-	-	-	-	-	-	29.7

Note: Bold frame indicates the project facility Source: NPC
Bold figures indicate when the transformer exceeded the NPC's allowable load factor of 80%.

b) Laoag Substation

The Laoag substation, located in North Ilocos Province, receives electricity from the San Esteban substation through a 115 kV and 69 kV transmission line. According to the Power Development Plan 1993-2005, expansion of the Laoag substation should have been completed in 1994. Owing to budgetary constraints, however, it was recognized at appraisal that there was no likelihood of this happening. Thus, the project was implemented under the Japanese ODA loan and was planned for completion in 1996. However, since project implementation was delayed, the existing transformer began overloading during peak times in 1999. During peak time, 3- 4 MW of load shedding was implemented in Laoag City.

The procured transformer, 50 MVA, 115 kV- 69/13.8 kV, was put into service in October 1999. After commissioning, the substation's entire load was switched to the new transformer, successfully alleviating overload. As a result, load shedding due to lack of transformer capacity has not been required since then.

In addition, installation of compensating capacitors, an additional 115 kV transmission line and an on-load tap changer in the Bantay substation[*8], a related facility, brought about an improvement of voltage regulation (supply capacity of the substation increased from 15 MW at appraisal to 45 MW in 2002) and subsequent reduction in transmission loss. According to the NPC's forecast, load on the Laoag substation will steadily increase with the development of the Laoag Economic Export Processing Zone (LEEPZ)[*9], which is located near to Laoag City. The installed 50 MVA transformer will be able to meet demand up to 2010, and NPC will install an additional 50 MVA transformer in 2011.

Transformer Control Panel

Table-2: Peak Load on Each Transformer in the Laoag Substation (Unit: MVA)

	Rated Capacity	1994	1995	1996	1997	1998	1999	2000
Transformer-A	20.0	**16.8**	**17.4**	**18.3**	**19.9**	**20.8**	-	-
Transformer-B	50.0	-	-	-	-	-	21.4	22.0

Note: Bold frame indicates the project facility Source: NPC
Bold figures indicate when the transformer exceeded the NPC's allowable load factor of 80%.

c) New San Manuel Substation

The New San Manuel substation is situated in Pangasinan Province and plays an important role in the Luzon Grid. It receives electricity from the Labrador substation at 500 kV level, most of which it transmits to the San Jose Substation at the same voltage level. In addition, some of electricity is stepped down to a lower voltage level for distribution to surrounding area.

Before the project, the existing San Manuel substation supplied electricity to Northern Cement Corporation through a 100 MVA transformer. The peak load on the existing transformer reached 85.1 MVA in 1998, which exceeded the NPC's allowable load factor of 80%. Under the project, a 50 MVA

markets. Luisita Industrial Park II is currently being developed just a few kilometers east of LIP I. The 300-hectare light industrial estate is a joint venture between a Japanese business company, Rizal Commercial Banking Corporation, and Agila Holdings.

8 An additional 115 kV transmission line from Bantay – Currimao – Laoag and its related facilities was constructed/installed in August 1996 under financing from the World Bank.

9 Laoag Economic Export Processing Zone

transformer was installed in the New San Manuel substation, which is located just beside the existing San Manuel substation and which was commissioned in January 1999.

Since, the load for the cement corporation has been handled exclusively by the new transformer, relieving the load on the existing transformer. In addition, with the installation of the new transformer, supply to the cement corporation has stabilized.

Table-3: Peak Load on the Selected Transformers in New/Existing San Manuel (Unit: MVA)

	Rated Capacity	1998	1999	2000	2001
Transformer-A (San Manuel)	100.0	**85.1**	66.0	53.8	57.2
Transformer-B (New San Manuel)	50.0	-	22.3	21.7	22.5

Note: Bold frame indicates the project facility Source: NPC
Bold figures indicates that the transformer exceeded the NPC's allowable load factor of 80%

d) Dasmarinas Substation

The Dasmarinas Substation, situated about 35 km south of Metro Manila, supplies electricity to Meralco's[*10] 34.5 kV substation directly and through three 115 kV substations. Meralco then distributes electricity to its consumers in Cavite Province. Dasmarinas also supplies electricity to the Cavite Export Processing Zone[*11] through the 115 kV NPC Rosario Substation.

At the time of appraisal, the Dasmarinas substation had two deteriorated 50 MVA transformers. Prior to the project, plans had been made to install two 100 MVA transformers in the substation at the end of 1995, with financial support from the World Bank. The project was to implement the installation of one 300 MVA transformer in 1996. However, both projects were delayed. Meanwhile, in order to prevent overloading in the Dasmarinas Substation, part of load was suppressed or switched to the Binan substation, 14 km away. But even so the transformers could not meet demand. As a result, there were frequent brownouts, blackouts and load shedding in the surrounding in 1996 and 1997.

After the installation of the two transformers under the World Bank project in July 1997, the existing 50 MVA transformers were removed and the load that had been rerouted to the Binan substation was switched back to the Dasmarinas substation. Thus, the brownouts/ blackouts were successfully halted. In addition, installation of an additional 300 MVA transformer under the project has successfully met the rapid increasing demand from the Cavite Export Processing Zone.

Figure-5: 300 MVA Transformer

Table-4: Peak Load on Each Transformer in the Dasmarinas Substation (Unit: MVA)

	Rated Capacity	1994	1995	1996	1997	1998	1999	2000	2001
Transformer-A	50	35.6	33.9	24.2	-	-	-	-	-
Transformer-B	50	17.2	14.4	21.1	-	-	-	-	-
Transformer-C	100	-	-	-	52.2	58.9	60.0	-	-
Transformer-D	300	-	-	-	201.1	224.4	236.7	171.1	180.0
Transformer-E	300	-	-	-	-	-	-	197.8	210.6

Note: Bold frame indicates the project facility Source: NPC

e) Hermosa Substation

Under the project, two sets of power circuit breakers and five sets of disconnecting switches were installed in the end of 1998. At the same time, the existing 100 MVA transformer was relocated from the Mexico Substation and installed.

Before the installation of the 100 MVA transformer, the existing 50 MVA transformer was regularly overloaded, resulting in voltage drops during evening peak time. Accordingly, the surrounding area experienced frequent brownouts and blackouts during the peak hours. The newly installed transformer has

[10] Meralco: Manila Electric Company

[11] CEPZ, a government–run export-processing zone, is a specially designated industrial center with tax incentives whose objective is the development and support of export-oriented businesses. It is located in approximately 30 kilometers south of Manila and is one of the largest export processing zones in the country.

successfully settled this problem[*12]. Moreover, installation of power circuit breakers and disconnecting switches enabled flexible system operation, e.g. the ability to switch load to another transformer and/or other substations during power outages or regular maintenance. Thus it has become possible to avoid blackouts in the event of a problem with a transformer.

Table-5: Peak Load on Each Transformer in the Hermosa Substation (Unit: MVA)

	Rated Capacity	1994	1995	1996	1997	1998	1999	2000
Transformer-A	50	32.6	**43.7**	**42.3**	**46.0**	**55.6**	24.7	30.2
Transformer-B	100	-	-	-	-	-	24.4	22.1

Note: Bold frame indicates the transformer, which was installed under the project Source: NPC
Bold figures indicate qhwn the transformer exceeded the NPC's allowable load factor of 80%.

f) Cruz-Na-Daan Substation

Cruz-Na-Daan substation is located in Central Luzon and receives electricity from the Mexico substation through a 230 kV transmission line, which is then stepped down to 69/13.8 kV for distribution. Originally, this substation was not included in the project. However, the development of mass housing facilities emerged in the surrounding area. In order to meet demand, one spare transformer (100 MVA, 230 kV-69/13.8 kV) was installed in the substation and was commissioned in April 1999. Since then, the substation has supplied electricity to existing 69 kV substations, which are situated near the substation but receive electricity from the San Jose or Mexico substations. This arrangement has decreased the distance required for electricity transmission, thus reducing transmission loss. Moreover, electricity supply to these 69 kV substations became more stable.

Table-6: Peak Load on the Cruz-Na-Daan Substation (Unit: MVA)

	Rated Capacity	1997	1998	1999	2000
Transformer-A	10	5.8	7.9	4.4	4.8
Transformer-B	100	-	-	44.4	50.0

Note: Bold frame indicates the project facility Source: NPC

g) Calaca Substation

Since the expected demand at the La Trinidad substation did not materialize, the planned transformer (100 MVA, 230 kV-69 kV) intended for the La Trinidad was installed at the switchyard of the Calaca coal-fired power station instead. Electricity demand of two big steel companies, namely Phil-Steel and Bacnotan Steel, required immediate expansion of the switchyard of the power station. In order to meet this demand, one transformer (100 MVA, 230 kV-69/13.8 kV) was installed in the switchyard, and commissioned in September 1999. Since then, the transformer has supplied electricity only for the two steel companies.

Table-7: Peak Load on Each Transformer in the Calaca Substation (Unit: MVA)

	Rated Capacity	1995	1996	1997	1998	1999	2000
Transformer-A	50	20.0	25.7	26.8	27.7	30.9	34.1
Transformer-B	100	-	-	-	-	2.0	55.0

Note: Bold frame indicates the project facility Source: NPC

[12] The 100 MVA transformer exploded and caught fire on 25th February 2000. The transformer was completely damaged and because of the extreme heat, associated lightning arresters, the overhead conductor, and the shunt reactor were also severely damaged. A new transformer was later installed to replace the one that had been damaged.

2.4 Impact

2.4.1 Positive Impacts on the Population in the Luzon Gird

a) Reduction of Brownouts/Blackouts at Respective Supply Areas

As mentioned already, before the project, existing transformers were overloaded, which resulted in voltage drops, especially during the evening peak, in most of the targeted substations. As a result, the electricity supply to the surrounding area was not stable. The newly installed transformers have successfully solved this problem. Moreover, the installation of power circuit breakers and disconnecting switches has enabled flexible system operation, making it possible to avoid blackouts and brownouts when problems with the transformers occur.

b) Contribution to Promoting Industrialization of Surrounding Area

In order to provide jobs, especially in rural areas, and improve the level and quality of local living conditions, the Government of the Philippines has created "Special Economic Zones" in suitable and strategic locations throughout the country. These Special Economic Zones are selected areas that are or have the potential to become agro-industrial, industrial, tourist/recreational, commercial, banking, investment or financial centers. They may contain any or all of the following: industrial estates, export processing zones, free trade zones and tourist/recreational centers.

The substations that were expanded under the project supply electricity to several Special Economic Zones, including the Laoag Economic Export Processing Zone, Cavite Export Processing Zone and Luisita Industrial Estate. In addition, these substations supply electricity directly to large-scale industrial consumers and to medium/ small-scale industry through distribution companies.

Generally speaking, stable electricity supply is one of the essential factors for attracting industry to an area. Viewed in this light, the project has contributed to promoting industrialization of the surrounding area by improving electricity supply and meeting increasing demand from industrial consumers.

2.4.2 Contribution to Reduction of Transmission Loss

Transformer overload results in a drop of the voltage on the transmission line and, subsequently, transmission loss. Transformation loss is minimized when the load factor is between 60% and80%. As shown in the previous section, overloading of some existing transformers has been alleviated by the project. Thus, it can be said that the project has contributed to expanding capacity and to the reduction of transmission losses at respective substations.

Table 8 shows energy production and transmission loss figures for the Luzon grid. Since the total capacity of the project facilities (700 MVA) accounted for only 3.73% of the grid total (18,784 MVA in end of 2001), the project's effects on limiting transmission loss cannot be observed. In fact, on the whole, the Luzon Grid's transmission losses have increased progressively since 1996[*13] as a result of transmission line expansion and the deterioration of existing facilities.

Table-8: Energy Production and Transmission Loss of the Luzon Grid

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Net Electric Energy Production (GWh)	18,712	19,280	19,201	22,606	24,332	25,583	27,926	29,284	29,564	29,323	15,755
Sales Volume of Electricity (GWh)	18,123	18,728	18,673	22,057	23,498	25,072	27,325	28,455	28,657	28,310	15,173
Transmission Loss (GWh)	589	552	528	549	834	511	601	791	887	968	582
Transmission Loss in Percentage (%)	3.15%	2.86%	2.75%	2.43%	3.43%	2.00%	2.15%	2.70%	3.00%	3.30%	3.55%

Source: NPC

2.4.3 Impact on Local Socio-economic Conditions

In the case of the Laoag substation, fresh land was required for expansion. Acquisition of farmland was

[13] Along with the deterioration of old power stations such as the Manila Thermal Power Station (200 MW) and Sucat Coal Fired Power Station (850 MW), which is located in the vicinity of Metro Manila, energy production from these power stations was reduced. They were decommissioned in 1998 and 2001, respectively. Instead of these power stations, electricity is transmitted far away from the Metro Manila, such as Batangas, Pangasinan Province. This change in energy sources considered to be resulted in increasing in transmission loss.

executed by NPC. A landowner received monetary compensation, according to government regulation, from NPC. No conflicts were reported. Project facilities were installed on the existing substation sites in all other cases.

2.4.4 Environmental Impacts

Since the project just required the acquisition of farmland for the Laoag substation, there was no deforestation. And during the implementation stage, there was no conterminous work. In addition, transformers and related facilities do not generally emit contaminants; there have been no reports of negative environmental impacts so far.

2.5 Sustainability

2.5.1 Profile and Financial Viability of the O&M Agency

a) Profile of the O&M Agency

Operation and maintenance of the project facilities are executed by the government-owned National Power Corporation (NPC).

The NPC's total generating capacity at the end of 2000 was 7,055.46 MWh[*14], which accounted for 62.1% of generating capacity within the country. NPC generates electricity from its own power plants and purchases additional electricity from IPPs. NPC transmits this electricity, which it then sells at wholesale prices to distribution companies: 119 rural electric cooperatives, 17 investor-owned utilities (including Meralco), 9 municipal/ provincial distribution systems and selected industrial bulk consumers.

b) Financial Viability of the NPC

Table 9 shows NPC's profits and losses for the most recent five-year period. While operating revenues increased favorably, NPC was not able to fully pass on its added costs to power users; consequently, it has not offset operating expenses, which increased rapidly over that period. NPC's financial position has been in the red since 1998. NPC's financial hardship resulted mainly from the Asian Currency Crisis. As shown in Figure 2, the crisis caused rapid depreciation of the peso vis-à-vis the U.S. dollar.

This caused an increase in interest payments on foreign loans[*15], in the procurement cost of materials/ facilities from overseas, and in the cost of procuring electricity from the IPPs[*16]. In order to comply with World Bank recommendations, NPC aims to achieve more than 8.0% on a Rate of Return Base[*17]. However, based on these conditions, the company's Rate of Return Base has steadily decreased, hovering below the minimum target level of 8.0% since 1997.

Along with a deterioration in profitability, the financial stability of NPC has worsened (see the Table 10), which resulted in a lack of funding for long-term investment requirements. NPC's financial deterioration is thought to have had an adverse impact on budget allocations for operation and maintenance.

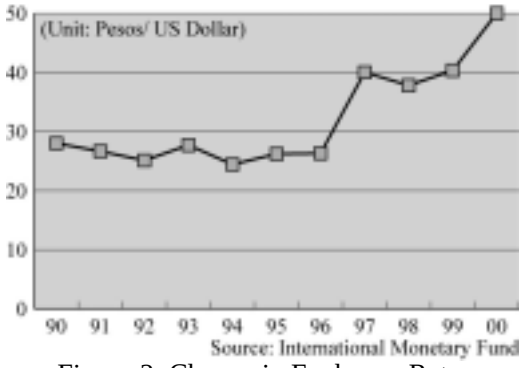

Figure-2: Change in Exchange Rate

[14] Comprising NPC owned/operated power plants of 5,156.0 MW, and NPC owned and IPPs operated power plants of 1899.5 MW
[15] As of December 31st 2000, foreign loan accounted for 72.7% of NPC's long-term debts.
[16] In most cases the Power Purchase Agreements between NPC and the IPPs are based on U.S. dollar.
[17] The ratio of allowed operating income to a specified rate base, expressed as a percentage. (Specified rate base represents the utility's appraised asset value - or investment in facilities, equipment and other property used in the provision of electric service - and one-sixth of the utility's annual operation and maintenance cost)

Table-9: Summary of NPC's Profit & Loss in Past Five Years (Unit: million peso)

	1996	1997	1998	1999	2000
Operating Revenue	63,635	77,144	86,611	89,686	100,119
Operating Expense	50,318	65,519	79,697	81,197	94,682
Operating Income	13,317	11,625	6,915	8,489	5,438
Other Income	9,268	2,968	11,095	9,427	16,488
Interest and Other Charges	17,044	11,537	21,627	23,869	34,890
Net Income/(Loss)	5,541	3,056	(3,617)	(5,953)	(12,964)

Source: NPC

Table-10: Indicators of Measures of Financial Stability and Profitability in Past Five Years

	1996	1997	1998	1999	2000
Return on Rate Base	8.24%	7.25%	3.22%	3.37%	2.22%
Current Ratio[*18]	0.58	0.52	0.52	0.38	0.42
Debt Equity Ratio[*19]	3.55	4.56	4.00	5.67	8.09
Account Receivables Turnover Period	N.A	1.38 month	1.47 month	1.70 month	2.03 month

Source: NPC

2.5.2 Restructuring of the NPC and Financial Viability of Newly Established O&M Agency

In order to ameliorate the financial condition of NPC and the Philippine power sector, the Philippine energy sector, as that of other countries, is in the process of privatization. It is hoped that the introduction of competitive markets in electricity will improve governance, shift market risks -- such as changes in exchange rate and fuel price -- to the private sector and exert downward pressures on the electricity tariff. In line with this policy, most of the NPC's power stations were grouped into 6 categories by location and generation type; these groups are supposed to be spun off and subsequently corporatized. The government intends to sell these generation companies, the so-called Genco, to private investors.

NPC's transmission-related sections are scheduled to be spun off by December 2002 into a government-owned and controlled corporation named the National Transmission Corporation (Transco). Subsequent to corporatization, all transmission substations and related facilities of NPC, including the project facilities, will be transferred to Transco. Part of the sub-transmission[*20] related facilities will be sold to qualified distribution companies by June 2004.

Transco is said, though it may not be a final decision by the Philippine government, to be authorized to award, in open competitive bidding, a concession contract to a qualified party for the operation, maintenance, improvement, and expansion of its transmission/substation assets and the operation of any related business for a maximum period of 25 years under an O&M concessionaire contract. However, it is a possibility that the transmission facilities will be privatized through outright sale. The sources Transco's income will be transmission fees and concessionaire fees. After the Energy Regulatory Commission[*21] holds a public hearing, it will set and then approve electric transmission fees based on the Return on Rate Base. When the current rates were approved June 6, 2002, the Return on Rate Base was 12.31 percent. Moreover, in order to enable Transco to start its operation in sound financial condition, most of NPC's liabilities have already been transferred to a newly established government- owned and controlled corporation known as the Power Sector Assets and Liabilities Management Corporation (PSALM) [*22].

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[18] Current assets divided by current liabilities. A financial ratio which shows how easily the company could pay its bills if all its creditors demanded payment at once. In theory this figure should be at least 1.0, and a figure lower than 1 means that the company does not have the liquidity to pay all its creditors straight away.

[19] Net borrowings of a company divided by shareholders' funds. This ratio shows the amount of financing that is provided by sources other than the shareholders. The higher the percentage, the more risky for lenders to the company. Most lenders like the percentage to be below 0.5. If it is above 1.0, the company is said to be highly geared.

[20] In the case of Luzon Grid, a sub-transmission line is defined as below the 132 kV transmission line.

[21] ERC (Energy Regulatory Commission): Newly established independent, regulatory body. The commission will promote competition, encourage market development, ensure customer choice and penalize abuse of market power in the restructured electricity industry. For this purpose, the existing Energy Regulatory Board (ERB) is to be abolished.

[22] A corporation will take ownership of all existing NPC generation assets, liabilities, IPP contracts, real estate and all other disposable assets and other liabilities as validated by NPC. All outstanding obligations of the NPC arising from loans, issuances of bonds, securities and other instruments of indebtedness shall be assumed by the PSALM.

2.5.3 Capability for Operation and Maintenance of the Project Facilities

In each substation, operation was executed by four groups in three shifts, in accordance with operation manuals prepared by the respective suppliers and standardized procedures[*23] prepared by NPC. An operations group for a substation used to consist of one engineer and one operator. However, along with the NPC's special disengagement plan[*24], some of these positions have been filled by contract workers. Since most contract laborers are well-experienced, and trained through on-the-job training, there have been no reports of problems concerning their capabilities.

Maintenance of the project facilities is executed by the South and North Luzon power transmission groups. Each group consists of a number of district offices and a power system maintenance department (PSMD). District offices are responsible for preventive maintenance for main substation facilities; technical services departments in each substation are in charge of patrol checks and routine maintenance. If a serious problem arises, PSMD will dispatch a skilled engineer to the site.

Maintenance of substations has been carried out systematically and on schedule as per maintenance manuals supplied by the respective contractors, and there have been no particular difficulties in the maintenance activities. In addition, it is expected that the O&M concessionaire of transmission/ substation facilities to the foreign entities will enhance efficiency of the operation and maintenance activities.

2.5.4 Future Prospects of Substation Expansion Project

To support the build-up of programmed generation capacity, substation expansion projects and transmission reinforcement projects were planned in the Power Development Program 2000 of NPC. After restructuring under the Electric Power Industry Reform Act, Transco will be mandated to prepare an annual Transmission Development Plan (TDP) in consultation with industry participants. The Department of Energy (DOE) will incorporate the TDP in the Power Development Program and the Philippine Energy Plan.

The transmission system will remain as a regulated common carrier business providing open and non-discriminatory access to any generator, distributor, supplier or end-user. It would also act as the system operator and would be responsible for central dispatch in accordance with the rules of the Wholesale Electricity Spot Market (WESM). As system operator, Transco would have the obligation to provide ancillary services using its own facilities or by procuring services from others, based on the rules adopted by the WESM. Equal access to the transmission facilities for the generation companies is considered one of the keys to the success for liberalization of the electricity market. Given these conditions, further expansion of transmission and substation facilities will be required on an ongoing basis.

Table-12: Transmission and Substation Expansion Plan (2000-2010)

	Transmission Line (Circuit-km)					Substation	Cost
	69kV and below	115kV	230kV	500kV	Total Length	Capacity (MVA)	(Mil. Peso)
Ongoing Projects	237	0	704	116	1,057	5,300	12,300
Projects for Implementation	46	0	471	0	516	0	2,814
Indicative Projects	20	160	2,100	20	2,300	4,200	20,257
Total	303	160	3,276	136	3,874	9,500	35,371

Source: NPC Power Development Program 2000

[23] Lines and Substation Energizing/Shutdown Procedure

[24] Along with the special disengagement plan, the number of the NPC's employee has decreased: the company's workforce in end of 2000 (8,850) was 55.1%, when compared with its peak workforce of 16,056 in end of 1990.

Comparison of Original and Actual Scope

Items/Activities	Original	Actual
(1) Project Scope		
A. Laoag Substation		
- Transformer	- 50 MVA, 115 kV- 69/ 13.8 kV: 1 set	As planned
- Power Circuit Breaker	- 115 kV: 1 set, 69 kV: 3 sets	115 kV: 2 sets, 69 kV: 2 sets
- Disconnecting Switch	- 115 kV: 2 sets, 69 kV: 6 sets	115 kV: 4 sets, 69 kV: 5 sets
- Shunt Capacitor	- 7.5 MVAR, 69 kV: 1 set	As planned
B. Dasmarinas Substation		
- Transformer	- 300 MVA, 230kV- 115 kV: 1 set	As Planned
- Power Circuit Breaker	- 230 kV: 2 set, 115 kV: 2 sets	As Planned (Not yet installed)
- Disconnecting Switch	- 230 kV: 5 set, 115 kV: 5 sets	230 kV: 4 sets, 115 kV: 4 sets (Not yet installed)
C. San Manuel Substation		
- Transformer	- 50 MVA, 230kV- 69/13.8 kV: 1 set	As Planned
- Power Circuit Breaker	- 230 kV: 2 sets, 69 kV: 3 sets	As Planned
- Disconnecting Switch	- 230 kV: 4 sets, 69 kV: 6 sets	230 kV: 5 sets, 69 kV: 7 sets
D. La Trinidad Substation		
- Transformer	- 100 MVA, 230 kV- 69 kV: 1 set	As Planned (Installed at Calaca Power Plant's Switchyard)
- Power Circuit Breaker	- 230 kV: 2 sets, 69kV: 3 sets	As Planned (Installed at Santiago S/S and Beckel S/S)
- Disconnecting Switch	- 230 kV: 4 sets, 69kV: 6 sets	Canceled
E. Concepcion Substation		
- Transformer	- 100 MVA, 230 kV- 69 kV: 1 set	As Planned
- Power Circuit Breaker	- 230 kV: 2 sets, 69 kV: 3 sets	230 kV: 1 set, 69 kV: 3 sets
- Disconnecting Switch	- 230 kV: 4 sets, 69 kV: 6 sets	230 kV: 3 sets, 69 kV: 7 sets
F. Hermosa Substation		
- Transformer	- Relocation of existing one transformer (50 MVA) from the Conception substation	Relocation of existing one transformer (100 MVA) from the Mexico substation
- Power Circuit Breaker	- 230 kV: 2 sets, 69 kV: 3 sets	230kV: 2 sets, 69 kV: 2 sets
- Disconnecting Switch	- 230 kV: 4 sets, 69 kV: 6 sets	230kV: 4 sets, 69 kV: 5 sets
G. San Jose Substation		
- Transformer	- 50MVA, 115kV- 34.5kV: 1 set	Canceled
- Power Circuit Breaker	- 115 kV: 2 sets, 34.5 kV: 2 sets	
- Disconnecting Switch	- 115 kV: 4 sets, 34.5 kV: 4 sets	
H. Reserve Transformer for Luzon Grid	- 100MVA, 230 kV-69/ 13.8kV: 1 set	As Planned (Installed at Cruz-Na-Daan S/S)
(2) Implementation Schedule		
Cluster A substation**[25]		
・Supply and Delivery	Jan. 1994 – Feb. 1996	Jul. 1996 – July 1998
・Erection and Installation	Feb. 1995 – Nov. 1996	Aug. 1998 – Mar. 2000
Cluster B substation**[26]		
・Supply and Delivery	Jan. 1995 – Jul. 1996	Jul. 1996 – July 1998
・Erection and Installation	Aug. 1995 – Jan. 1997	Jun. 1998 - Dec. 1999
(3) Project Cost		
Foreign Currency	2,896 million yen	1,466 million yen
Local Currency	534 million yen (142 million peso)	83 million yen (26 million peso)
Total	3,430 million yen	1,549 million yen
ODA Loan Portion	2,896 million yen	1,219 million yen
Exchange Rate	1.0 Peso = 3.76 yen (As of January 1994)	1.0 Peso = 3.19 yen (As of May 1999)

[25] Cluster A substation (Laoag, Dasmarinas and San Manuel) was necessary to expand by 1996 at the time of appraisal.
[26] Cluster B substation (La Trinidad, Conception, Hermosa and San Jose) was necessary to expand by 1997 at the time of appraisal.

Independent Evaluator's Opinion on Substation Expansion Project

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1. The project is relevant to the infrastructure development policy of the Philippines. Increasing power generation capacity was relevant at the time the project was conceived and implemented. Expanding transmission lines and substation facilities are even more relevant today when NPC's transmission functions are spun-off into a government corporation called the National Transmission Corporaton. Both the Philippine National Development Plan and the Philippine Energy Plan have stressed the importance of constructing/rehabilitating power plants and transmission lines to enhance greater accessibility and reliability of power supply.

2. The positive impacts of the project are: (1) reduction of brownouts/blackouts at project surrounding areas, (2) contribution to the promotion of productive economic activities in the surrounding areas because of stable electricity supply, and (3) reduction of transmission loss by avoiding transformer overload. Negative environmental impacts are negligible.

3. The project was inefficiently implemented by NPC. NPC's project management capacity is weak and needs to be improved.

4. Overall, the project was effective in its ability to meet the increasing demand and to reduce the probability of overload at individual substations.

5. The sustainability of the project will depend on whether the National Transmission Company (or Transco) or its concessionaire will behave more efficiently and not just duplicate NPC's past rent-seeking corporate behavior. For instance, NPC-SPUG (small power utilities group) is now in charge of missionary electrification. But if it commits the same mistake as their mother NPC by pursuing the missionary electrification goal in a highly-leveraged function, then it will end up in the same worsening financial stability as the existing (and soon to be privatized) NPC.