Philippines

Extra High Voltage Transmission Line Project Stage I, II

Report Date: October, 2002
Field Survey: June, 2001

1. Project Profile and Japan's ODA Loan

Location Map of the Project


Project Site: Transmit Tower

1.1 Background

The electric power transmission system in the Philippines was divided into three grids: Luzon, Mindanao and Visayas. The Luzon grid supplied Metropolitan Manila, which accounted for about 70% of the total power demand in the Philippines in 1981. The annual rate of increase in power demand in the Luzon Grid from 1971 to 1980 was 6.5%, on average; at the time of appraisal, it was estimated that the rate for the 1980s would increase to 7.0%.

At the end of 1980, the Luzon grid had a generating capacity of 3,212 MW, of which oil-fired power stations comprised about 70%. In order to meet the country's increasing demands for energy, the Philippine Government developed a national policy to reduce the country's heavy dependency on imported oil and to increase self-reliance through exploitation of alternative indigenous sources of energy. In line with the policy, The National Power Corporation (NPC) developed the 10-Year Power Development Plan (1981-1990), which aimed to harness water and geothermal resources to the maximum extent possible.

Southern Luzon was particularly favored because of its abundant geothermal potential, which is most apparent at the southern tip of the island, in areas such as Tiwi and Manito. At the time of the appraisal, six geothermal generation units at Tiwi[*1] were in operation, supplying the base energy requirement to the Southern Luzon area. NPC planned to construct geothermal power plants with total additional capacity of 1,430 MW in the Southern Luzon/Visayas area. The generated output at these geothermal power plants in Southern Luzon would then be transmitted to the country's heaviest load center, namely the Metro Manila area, through the Luzon grid --a distance of more than 300km. Transmitting this large block of power over such long distances necessitated the introduction of an Extra High Voltage (EHV) level transmission system from Naga in Southern Luzon to Manila.

1.2 Objective

Stage I: To transmit the power generated at the Tiwi Geothermal Power Plant in the south of Luzon and at the Tongonan Geothermal Power Plant in Leyte to Manila by constructing an EHV transmission line between Kalayaan and Naga, in order to meet increasing power demand on the Luzon Grid.

Stage II: To transmit the power generated at the Manito Geothermal Power Plant in the south of Luzon and

[1] Each unit has rated capacity of 50 MW; they were commissioned between 1979 and 1982.

at the Tongonan Geothermal Power Plant in Leyte to Manila in order to meet increasing power demand on the Luzon Grid, by extending Extra High Voltage Transmission Line Project Stage I.

1.3 Project Scope

Stage I: Construction of Kalayaan – Naga 500kV design double circuit T/L (245km), and installation of disconnecting switch, protection relay and circuit breaker in Kalayaan and Naga Substations.

Stage II: Construction of Kalayaan – San Jose 500kV design double circuit T/L (81km), and installation of protection relay and circuit breaker in Kalayaan and San Jose Substations, following the completion of Stage I development of the Kalayaan – Naga line, which will be initially operated at 230kV.

1.4 Borrower/ Executing Agency/ Implementing Agency

The Republic of the Philippines / National Power Corporation (NPC)

1.5 Outline of Loan Agreement

	Stage I	Stage II
Loan Amount	32,420 million yen	9,900 million yen
Loan Disbursed Amount	25,490 million yen	6,510 million yen
Exchange of Notes	May, 1982	July, 1983
Loan Agreement	May, 1982	September, 1983
Terms and Conditions Interest Rate Repayment Period (Grace Period) Procurement	 3.0 % p.a. 30 years (10 years) General Untied (Partially Untied for Consulting Services)	 3.0 % p.a. 30 years (10 years) General Untied (Partially Untied for Consulting Services)
Final Disbursement Date	November, 1989	December, 1992

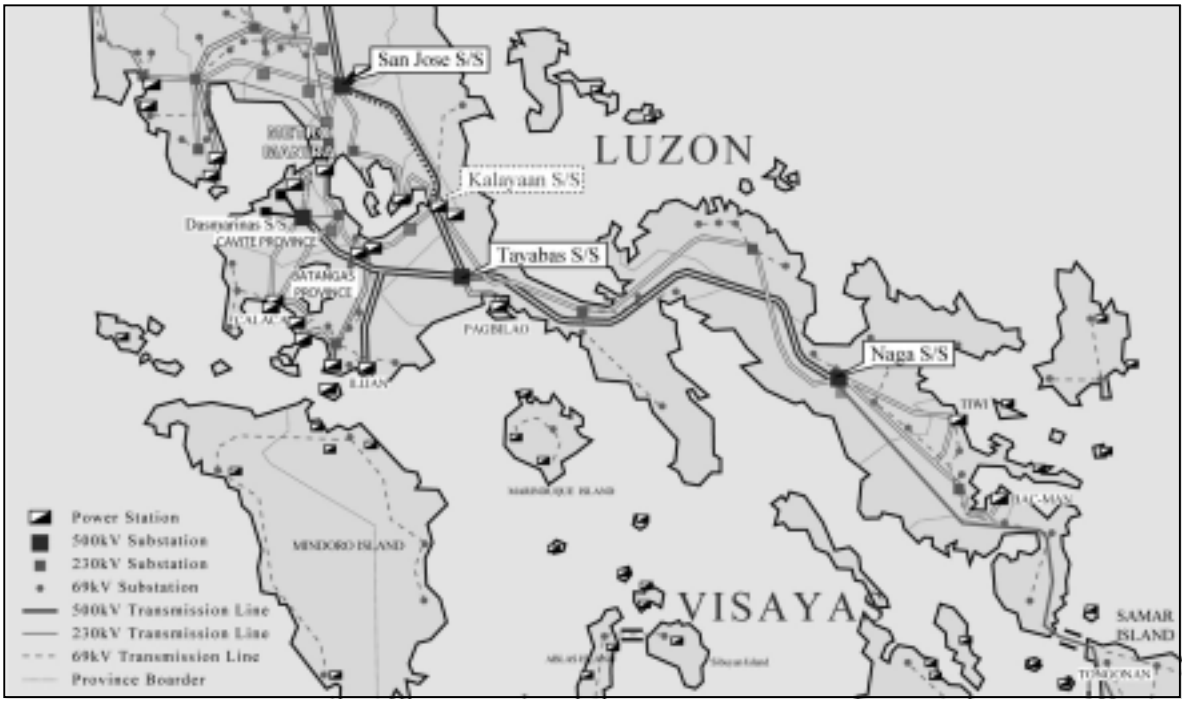

Figure-1: Map of the Central and Southern Luzon Grid

2. Results and Evaluation

2.1 Relevance

At the time of project appraisal, in order to achieve the Philippine Government's policy to reduce the country's heavy dependence on imported oil and increase self-reliance on alternative, indigenous sources of energy, The National Power Corporation (NPC) developed the 10-Year Power Development Plan (1981-1990), which aimed to harness water and geothermal resources to the maximum extent possible. NPC planned to construct geothermal power plants, with a total additional capacity of 1,430 MW, and associated transmission lines, in the Southern Luzon/ Visayas area. This EHV transmission project, which would make it possible to transmit energy from Southern Luzon and Leyte Island to Metro Manila, was an indispensable part of the Power Development Plan. Accordingly, this Project was fully consistent with the Philippine power development policy at that time. At present, the Government of the Philippines continues to promote the development of indigenous source of energy, and the project objective remains relevant.

However, since appraisal, development plans for some power stations in Southern Luzon and Visayas have been cancelled or postponed unexpectedly, owing to the lack of the national budget[2] and insufficient steam pressure at Tiwi (Refer to Table-1). In order to fill gap between power demand and supply, coal and oil-fired power stations were subsquently developed in Central Luzon. As a result, some of the EHV transmission line route was altered after the Project completion to transmit power from those new plants in Central Luzon. In addition, according to the NPC's Power Development Plan 2000, except for the Mambucal Geothermal Power Plant[3] (40 MW), there are no plans for construction of a large-scale geothermal power plant in the Southern Luzon and Visayas area[4]. Currently the Tayabas–Naga section has a low load requirement, and there is, at present, no plan to step it up to 500 kV, as envisioned at the time of appraisal. Thus, the original project design has become less relevant in conjunction with overall power development plan.

Table-1: Planned and Actual Implementation of Geothermal Power Plants in Southern Luzon and Visayas

Name	Plan (at the time of 2nd phase appraisal)		Actual	
	Capacity	Completion	Capacity	Completion
Manito 1-2	110 MW	1985	110 MW[*5]	1993
Tongonan 4-5	110 MW	1985	640 MW[*6]	1997
Tongonan 6-11	330 MW	1985		
Tongonan 12-19	440 MW	1990		
Tiwi 7-8	110 MW	1990	Not Actualized	
Manito 3-4	110 MW	1990	40 MW[*4]	1994, 1998
Tiwi 9-10	110 MW	1990	Not Actualized	
Tiwi 11-12	110 MW	1991	Not Actualized	
Total Geothermal	1,430 MW	1985-1991	790 MW	1993-1998

Source: NPC

2.2 Efficiency

2.2.1 Project Scope

a) Stage I

The number and type of transmission towers and the type of material used for their foundations were modified according to actual soil conditions. Aside from this, however, the original scope was

[2] At the end of the President Marcos regime (early and middle of 1980's), the Philippines encountered serious civil disturbance and intense financial deterioration.

[3] The power station will be constructed at Bacolod, Negros Island, and completed in January 2009, and its construction is assisted under Japan's ODA loan as a part of Northern Negros Geothermal Project.

[4] *Power Development Plan 2000*: NPC and *Philippine Energy Plan 2002-2011*: The Ministry of Energy

[5] Actualized as a Leyte-A Geothermal Power Station

[6] Actualized as a Bac Man Geothermal 1 & 2

implemented as planned, and the installation of the transmission line and construction of its towers were completed in May 1987. However, subsequent to completion, the line suffered attacks by antiestablishment elements, and much of the tower materials were pilfered. In order to rehabilitate the damaged sections, additional materials were procured under the 1st phase of the Project.

b) Stage II

The original project scope was actualized without major modification. In addition, i) construction of a tie line with the Kalayaan substation and the Kalayaan power station (about 2.5 km), ii) installation of associated substation facilities in Kalayaan substation, iii) installation of a shunt reactor in the Naga substation, and iv) installation of additional protection relays in the related three substations were executed under the 2nd phase of the Project. None of these elements was planned at the time of appraisal.

Originally, construction of the tie line and the installation of associated substation facilities were to be financed by the Asian Development Bank (ADB) or by the NPC itself. These additional works were indispensable to the EHV project. However, since neither institution could finance it, these components were included in the project scope of the 2nd stage. A shunt reactor was needed in the Naga substation to enable it to operate stably in a low load mode; NPC was compelled to operate in a low load mode as a result of delays in the development of power stations in Southern Luzon and Visayas. The protection relays were also required to secure stable operation under the circumstances.

2.2.2 Implementation Schedule

a) Stage I

The 1st stage of the Project was completed in May 1987, 18 months behind the original schedule. The delay was attributed to the following factors: i) a prolonged approval process for permission to cut trees in Quezon National Park[*7] before construction of the transmission towers; ii) frequent pilferage of materials from the Project site; and iii) the lack of local funds for the Project, which should have been prepared beforehand by the relevant Philippine authorities.

b) Stage II

The considerable delay in the 1st stage of the Project, coupled with the lack of funds in the Philippines, pushed back the commencement of the 2nd stage of the Project 5 years and one month. Eventually it was completed in July 1994, 8 years and 7 month after the originally scheduled completion date of March 1986.

2.2.3 Project Cost

Japan's ODA portion of the 1st stage of the Project, 25,490 million yen, accounts for 78.6% of the approved amount (32,420 million yen).

As for the 2nd stage, 6,510 million yen, or 65.8% of the approved amount (9,900 million yen), was disbursed by Japan.

2.3 Effectiveness

2.3.1 Operational Status of the Project Facilities

a) Kalayaan–Naga Section (1st Stage)

The Kalayaan–Naga section was completed in May 1987 under the 1st stage of the Project. However, before the facility was inaugurated, 11 towers collapsed due to pilferage and sabotage carried out by such elements as guerrilla. Though NPC initially tried to rehabilitate/restore the damaged transmission lines, after repeated attacks and the cancellation/postponement of related geothermal power plants, it eventually left the Project facilities in disrepair. Part of the transmission line (36 km) was rehabilitated in 1996 in order to siphon off the newly constructed coal-fired power stations in Central Luzon. Rehabilitation work for the remaining section (205 km) was completed in 1998 with international assistance (details are discussed in 2.5. *Sustainability*).

b) San Jose–Kalayaan Section (2nd Stage)

[7] Quezon National Park: The park lies about 180-km southeast of Manila, and has one of the most beautiful mountain forests, teeming with numerous forms of wildlife like monkeys, deer, wild pigs and monitor lizards. The present area of the park is 984 hectares.

The San Jose–Kalayaan section was completed in July 1994 under the 2nd stage of the Project. Subsequent to completion, this section also suffered from pilferage and was left unused until 1997. Of two circuits, only one circuit was rehabilitated and energized at the 230 kV level in 1997. However, another circuit has been not in use to date (Present conditions are discussed in 2.5. *Sustainability*).

2.3.2 FIRR (Financial Rate of Return)

The Project's objective was to transmit power generated from geothermal power plants in Leyte and Southern Luzon to Manila. As discussed above, however, the project facilities had been left unused for more than 10 years after completion. Only after the completion of rehabilitation in 1998 did the project facilities begin to convey electricity from Southern Luzon/Visayas to Central Luzon, but it was being transmitted at the 230 kV level, which is half of planned capacity. In light of the considerable delay in making the project functional, achievement of project objective is judged to be limited. As a result, in this evaluation FIRR is not recalculated.

2.4 Impact

2.4.1 Social Impacts

The Project acquired land for the construction of substations and transmission towers and required right of way for transmission lines. A total of 86 people were relocated, 82 for the construction of the transmission towers and 4 for the Kalayaan substation. The procedure for land acquisition and resettlement were carried out according to "*Standard Operating Procedures of NPC for Land and Land Right Acquisition*". Landowners and those who were resettled received monetary compensation, the amount of which was determined according to NPC regulations and related government guidelines. Some parties disputed the amount of compensation offered by NPC, and several cases were brought to the solicitor general.

In the end, the amount of compensation was arbitrated by the provincial court, and land acquisition procedures were implemented according to Philippine domestic law. The construction workforce was made up largely of people living in the affected areas. According to NPC, no subsequent legal dispute and public objection for the relocation have been reported so far.

2.4.2 Environmental Impacts

The transmission line traverses Quezon National Park, and one steel tower was constructed in the Park. During project implementation, a certain number of trees in the park were cut down. NPC proceeded with permission from the Forestry Department. In addition, care was taken to minimize the number of trees/branches cut.

2.5 Sustainability

2.5.1 Current Condition of Project Facilities

a) Kalayaan–Naga Section (1st Stage)

From 1991 to 1993, Luzon Island faced a serious energy shortage. In Metro Manila, power shortages and brownouts of 10-12 hours occurred daily. To cope with the energy crisis in the Luzon grid, the Government of the Philippines decided to introduce private companies, known as Independent Power Producers (IPPs), into the power generating sector. The emergence of IPPs in the 1990s led to the development of coal and imported oil-fired power stations in Central Luzon[8] (Batangas and the Cavite Province). Accordingly, transmission network constructed under the Project was modified in order to accommodate to the newly developed power plants in Central Luzon.

In 1996, NPC constructed a new substation in Tayabas with financial assistance from ADB in order to siphon electricity from the newly constructed Pagbilao coal-fired power station in Central Luzon (refer to

[8] For example, the FELS 1&2 oil-fired power station in 1993 (180 MW), the Bataan oil-fired power station in 1993–94 (620 MW), the Calaca II coal-fired power station in 1995 (300MW), and the Pagbilao coal-fired power plants in 1996 (700MW).

Figure-2) and transmit to Luzon grid. The Project's transmission line was connected to the Tayabas substation. The Tayabas-Kalayaan section was rehabilitated using the NPC's own funds, and energized at the 230kV level in 1996. After the completion of the Tayabas substation, the project facilities installed in the Kalayaan substation were relocated to another substation[*9:] the Kalayaan substation was abolished in 1999.

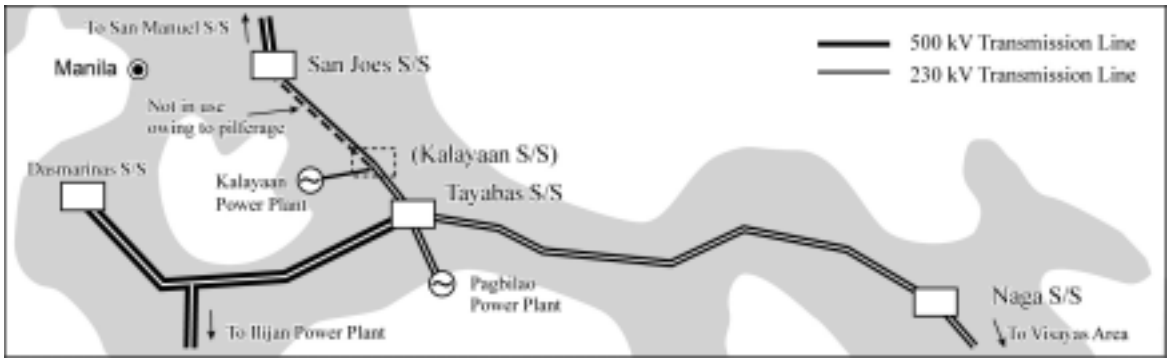

Figure-2: Schematic Diagram of the "San Jose – Kalayaan – Naga" Section

NPC resumed rehabilitation work on the Naga-Tayabas section with financial support from the World Bank, completing it in 1998. Since then, electricity has been transmitted at the 230kV level from Naga to Tayabas. Since 1999, electricity has been transmitted in both directions, from Naga to Tayabas and from Tayabas to Naga, though volume is low. The Naga substation doesn't have a 230/500 kV transformer and related facilities, which are necessary for upgrading to 500 kV to make full use of the transmission line capacity constructed under the Project. As a result, the line has been operated at only 230 kV. There is, at present, no plan to energize the line at the 500 kV level. Current operational performance of the facilities is summarized in the tables below.

Table-2: Operational Performance of Naga – Tayabas Section

	1998	1999	2000	2001
Energy Transmitted				
Naga → Tayabas	1,479	3,304	3,187	3,147
Tayabas → Naga (GWh)	0	12	552	220
Number of Forced Outage (no.)	5	5	14	10
Duration of Forced Outage (hrs)	0.48	0.88	19.11	49.45

Source: NPC

b) San Jose–Kalayaan Section (2nd Stage)

Of the two circuits constructed under the Project in this section, only one was rehabilitated and energized at the 230 kV level in 1997. The San Jose–Tayabas section is scheduled for an upgrade to 500 kV with the commissioning of the Ilijan natural gas-based power station (1,200 MW) (cf. 2.5.4). Another circuit in the section from the Kalayaan power plant to the San Jose substation is not in use because the conductors were stolen. This section traverses a mountainous area where social conditions are particularly unstable, and has suffered repeated pilferage. It is currently under rehabilitation.

Table-3: Operational Performance of San Jose – Tayabas/Kalayaan Section

[9] The project facilities were relocated to switch yards in the Bataan thermal power station, Calaca coal-fired power plant, Mak-Ban geothermal power station and Kalayaan hydro power station in Central Luzon.

	1997	1998	1999	2000	2001
Energy Transmitted					
San Joes → Tayabas	0.02	-	0.002	0.14	0.15
Tayabas → San Jose (GWh)	-	908.79	1589.66	1583.87	1331.23
Number of Forced Outage (no.)	1	2	2	1	9
Duration of Forced Outage (hrs)	0.18	2.32	0.98	4.5	87.7

Source: NPC

2.5.2 Change in the Operation and Maintenance Agency

Operation and maintenance of the Project facilities are executed by the government-owned National Power Corporation (NPC). As in many other countries, the energy sector in the Philippines is undergoing privatization. The Electric Power Industry Reform Act of 2001 took effect in June 2001. Under the Act, NPC's transmission-related sections are scheduled to be spun off by December 2002 into a government-owned and controlled corporation named National Transmission Corporation (Transco). Subsequent to the corporatization, all NPC-owned transmission lines, substations and related assets, including Project facilities, will be transferred to Transco. Transco is virtually formed, and has 3,394 employees, including a System Operation group with 458 employees and a Power Transmission group with 2,732 in December 2000[10].

2.5.3 Operation and Maintenance of the Transmission Facilities: Prevention of Further Pilferage

a) Regular maintenance

Actual operation of the power transmission facilities is executed by the System Operation Group of Luzon, under the command of the Luzon Grid Load Dispatch Center, according to the operation manual prepared by the supplier and following standardized procedure[*11] prepared by NPC. Maintenance of the power transmission facilities is executed by District 7 of Northern Luzon Transco (NLT) and Districts 2 and 3 of Southern Luzon Transco (SLT), with the help of the Power System Management Group.

Maintenance activities on transmission lines consist mainly of: (i) regular maintenance, including regular patrols, vegetation clearing and hot spot inspection, and (ii) restoration of damaged facilities. In order to prevent short circuits caused by contact with tree branches, vegetation is cleared as the need arises. A regular patrol, which looks for visible structural defects along the line in each section, is implemented every 6 months.

These maintenance activities are implemented on schedule, and there have been no particular difficulties with the maintenance activities themselves.

b) Measures to Prevent Further Pilferage

Although no facilities have been sabotaged since the beginning of the 1990s, the Project facilities still suffer from pilferage, especially where the transmission lines traverse mountainous area in Quezon and Camarines Norte Province and social conditions are unstable.

The motive for this theft is the money that can be made by selling the stolen materials to a dealer, who in turn sell the materials to others. In order to expose this illegal distribution channel, the Philippine Government enacted an Anti-Pilferage Law[*12] in July 1994. This law allows punishment not only of robbers, but also those who purchase stolen goods. NPC/Transco have strengthened security at the facilities with the help of the Philippine national police and army. Moreover, NPC/Transco has asked the Local Government Unit in areas the project facilities traverse, to assist in patrolling the area and to report pilferage and attempted sabotage. These measures have achieved some results, but pilferage still occurs. According to NPC/Transco, the power firm has incurred around P10 billion in losses from the thieves of transmission line equipment in last 15 years[13].

Under present laws, the pilferage of transmission lines is considered "simple theft." The Department of

[10] Transco staff nominally belongs to NPC until the Presidential Office approves full validation of Transco.
[11] Lines and substation Energizing/Shutdown Procedure
[12] Official title: An act penalizing the pilferage of electricity and theft of power transmission lines/materials, rationalizing system losses by phasing out pilferage losses as a component thereof, and for other purposes.
[13] *Manila Bulletin*, 24 January, 2002

Energy (DOE) is currently pushing for legislative measures that would treat such cases of thievery and pilfering as "heinous crimes" that would carry the heaviest penalty. Since the pilferage and stealing of transmission line equipment has serious socioeconomic implications, due to potential power shortages, DOE has been proposing that these acts be considered a form of economic sabotage.

2.5.4 Current EHV Development Plan in the Philippines

The Philippines needs to further develop its power generation and transmission lines in order to meet demand for power. NPC/Transco plans to install 2,500 km of transmission lines and 20,000 MVA transformer substations, including extra high voltage transmission lines and interconnection cables, in the main grids by the year 2005 (see the Figure-3).

According to the NPC's Development Program 2000, system demand in the Luzon grid for 2000-2010 was projected to grow at an average rate of 7.72%. To cope with this increasing demand, a 500 kV transmission line is being built from Dasmarinas to Tayabas (Central Luzon) with funding from the Asian Development Bank, and a 500 kV tie transmission line is being built from the Ilijan natural gas power station to the Dasmarinas–Tayabas line with Japan's ODA loan. The San Jose–Tayabas section is also expected to step up to 500 kV when these lines are commissioned.

Figure-3: Major Interconnection Projects and Unified Philippine Grid

Source: NPC/ Transco

Since the Tayabas–Naga section has a low load requirement, there is, at present, no plan to step it up to 500 kV. In addition, according to the NPC's Power Development Plan 2000, except for the Mambucal Geothermal Power Plant[14] (40 MW), there are no plans for construction of a large-scale geothermal power plant in the Southern Luzon and Visayas area. The construction of Tiwi 7-12 has been suspended.

3. Lessons Learned

It is necessary to keep close coordination between transmission network and power plant development both in planning and implementation stage of project. Also, in planning power transmission line construction project, validity of feasibility should be verified more thoroughly.

[14] The power station will be constructed at Bacolod, Negros Island, and completed in January 2009.

Comparison of Original and Actual Scope (Stage I)

Item	Plan	Actual
(1) Project Scope		
1. Transmission Line		
a. Length	245km	241km
b. Voltage	500kV	As planned
c. Electric supply system	AC 3 phase 60HZ	As planned
d. Number of circuits	2	As planned
e. Support	500kV D/C, self-supporting galvanized steel angle tower	As planned
f. Number of towers	553	567
g. Conductor	ACSR 795 MCM "CONDOR" 4 bundle conductor, Length 6,060km	ACSR 795 MCM "CONDOR" 4 bundle conductor, Length 5,793.5km
h. Overhead ground wire	Aluminum clad steel wire 2 wire, Length 505km	Aluminum clad steel wire 2 wire, Length 482.772km
i. Insulator	Porcelain insulator	As planned
- Suspension string	30 units of 280mm	As planned
	Single string 328 towers	Single string 365 towers
	Double string 9 towers	Double string 16 towers
- Tension string	26 units of 320mm	As planned
	Double tension 216 towers	Double tension 186 towers
j. Line spacer	4 bundle, 28,728 pcs.	4 bundle, 29,646 pcs.
k. Damper	For ground wire, 2308 pcs.	As planned
2. Substation		
- Naga substation	230kV circuit breaker 3 units	230kV circuit breaker 7 units
	PLC Protection relay set	As Planned
	230kV disconnecting switch 6 units	As Planned
- Kalayaan substation	230kV circuit breaker 3 units	230kV circuit breaker, 7 units
	PLC Protection relay set	As Planned
	230kV disconnecting switch 6 units	As Planned
3. Consulting Services	11M/M	N.A.
(2) Implementation Schedule		
1. Transmission Line	Jul. 1982 – Dec. 1985	1982 – Apr. 1987
2. Substation	Mar. 1983 – Dec. 1985	N.A.
3. Date of Commissioning	December 1985	May 1987
(3) Project Cost		
Foreign currency	26,980 million yen	N.A million yen
Local currency	843,139 million peso	N.A million peso
Total	51,746 million yen	N.A million yen
ODA loan portion	32,420 million yen	25,490 million yen
Exchange Rate	US1$= 7.83 peso = 230 yen (In 1981)	

Comparison of Original and Actual Scope (Stage II)

Item	Plan	Actual
(1) Project Scope		
1. Transmission line		
- Length/ voltage	81km/ 500kV	As planned
- Number of circuits	2	As planned
- Support	500kV double circuit, self supporting galv. steel angle tower	As planned
- Number of towers	170	193
- Length of conductor	ACSR 795 MCM “CONDOR” 4 bundle conductor, Length 2,060 km	ACSR 795 MCM “CONDOR” 4 bundle conductor, Length 1,997 km
- Length of overhead ground wire	171 km	106 km
- Insulator	Porcelain insular	As planned
1) Suspension String	30units of 280mm single string 75 towers double string 5 towers	As planned single string 69 towers double string 14 towers
2) Tension String	26units of 320mm double tension 90towers	As planned double tension 110 towers
- Line spacer	for 4 bundle of “Condor” 10,212 pcs.	for 4 bundle of “Condor” 11,056 pcs.
- Damper	for ground wire 1,032 pcs.	for ground wire 808 pcs.
2. Substation		
- San Jose substation	230kV circuit breaker, 3 units PLC, Protection relay set	As Planned
- Kalayaan substation	230kV circuit breaker, 3 units PLC, Protection relay set	As Planned
(2) Implementation Schedule		
1. Transmission Line	Apr. 1984 – Nov. 1985	Jan. 1990 – July 1994
2. Substation	Feb. 1985 – Dec. 1985	Jun. 1988 – July 1989
3. Date of Commissioning	March 1986	July 1994
(3) Project Cost		
Foreign currency	9,900 million yen	6,437 million yen
Local currency	318,381 million peso	N.A. million peso
Total	19,451 million yen	N.A. million yen
ODA loan portion	9,900 million yen	6,510 million yen
Exchange Rate	US1$= 8.5peso= 255yen (In 1983)	

Independent Evaluator's Opinion on
Extra High Voltage Transmission Line Project Stage I, II

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The project's objective is to transmit power generated in Southern Luzon (by Tiwi Geothermal Power Plant and by Manito Geothermal Power Plant) and in Leyte (by Tongonan Geothermal Power Plant) to Metro Manila to meet increasing power demand in the Luzon Grid. Philippine Energy Plan: 2002-2011 provides for infrastructure development (generation facilities including the associated transmission, distribution and substation capacities) to ensure reliability and efficiency in the delivery of electricity services to end-users. Thus, this project is still consistent with the Philippine Energy Plan under its "Power Development Plan". However, the design of future transmission projects will have to be modified to take into consideration the changing mix of power plants (from steam-powered, oil-fired, and hydro power plants to coal-fired and natural gas-fired power plants) and changing locations (from Southern Luzon to Central and Northern Luzon).

The project can be considered efficient in a sense that the original scope was implemented as planned. However, the construction of connection lines and associated facilities in Stage II which were not planned at the time of appraisal drags down the efficiency level of the project and raises questions of the efficiency of the planning process. Factors that delay the project like sabotage of facilities are beyond the control of project management, but some factors can be blamed on Philippine government agencies such as: prolonged approval process for permission to cut trees in Quezon National Park, frequent pilferage of materials, and lack of local funds for the project. The long duration before the project was rehabilitated after it was sabotaged and pilfered makes the project ineffective, because it was useless to end-users before rehabilitation was completed. The adverse effect of non-use of the project facilities for more than 10 years after completion should be reflected in the recalculation of FIRR. The project has negligible adverse social and environmental impact.

The transfer of former NPC operation and maintenance people to TRANSCO will mean maintenance of technical capability and services. Moreover, maintenance is implemented on schedule. TRANSCO, however, must coordinate more intensely with Philippine National Police to minimize the occurrences of pilferage and stealing of transmission line equipment.