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IMPLEMENTATION COMPLETION REPORT
(COFN-03440; COFN-03450; CPL-37460; SCL-3746A; CPL-37470)

ON A

LOAN

IN THE AMOUNT OF US\$227 MILLION

TO THE

NATIONAL POWER CORPORATION AND

THE PHILIPPINE NATIONAL OIL COMPANY

FOR THE

LEYTE-LUZON GEOTHERMAL PROJECT

OCTOBER 16, 2000

Energy and Mining Development Sector Unit
East Asia and Pacific Regional Office

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CURRENCY EQUIVALENTS

(Exchange Rate Effective as of October 6, 2000)

Currency Unit = Philippine Peso (P)

P1.00 = US\$ 0.022

US\$ 1.00 = P 46.4

Average Exchange Rates during Project Years

1993 US\$1= P27.12

1994 US\$1= P26.42

1995 US\$1= P25.71

1996 US\$1= P26.22

1997 US\$1= P29.47

1998 US\$1= P40.89

1999 US\$1= P39.12

FISCAL YEAR

January 1 to December 31

ABBREVIATIONS AND ACRONYMS

BITS	Swedish Agency for International Technical and Economic Cooperation
BOO	Build-Own-Operate
BOT	Build-Operate-Transfer
ECO	Expanded Cofinancing Operation
ESP	Energy Sector Plan
GET	Global Environment Trust Fund
IDC	Interest During Construction
IPP	Independent Power Producer
JEXIM	Export and Import Bank of Japan
NPC	National Power Corporation
PDP	Power Development Program
PNOC-EDC	Philippine National Oil Corporation- Energy Development Corporation
PPA	Power Purchase Agreement
PTRP	Power Transmission and Rehabilitation Project
ROW	Right-of-Way
TGRP	Transimission Grid Reinforcement Project

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<i>Project ID:</i> P004607	<i>Project Name:</i> LEYTE LUZON GEOTHERMAL
<i>Team Leader:</i> Selina Wai Sheung Shum	<i>TL Unit:</i> EASEG
<i>ICR Type:</i> Core ICR	<i>Report Date:</i> October 16, 2000

1. Project Data

Name: LEYTE LUZON GEOTHERMAL

L/C/TF Number: COFN-03440;
COFN-03450;
CPL-37460;
SCL-3746A;
CPL-37470

Country/Department: PHILIPPINES

Region: East Asia and Pacific
Region

Sector/subsector: PT - Thermal

KEY DATES

	<i>Original</i>	<i>Revised/Actual</i>
<i>PCD:</i> 10/16/89	<i>Effective:</i> 03/01/95	03/01/95
<i>Appraisal:</i> 06/05/93	<i>MTR:</i>	06/01/96
<i>Approval:</i> 06/07/94	<i>Closing:</i> 06/30/99	03/31/2000

Borrower/Implementing Agency: NPC AND PNOC/NPC AND PNOC-EDC

Other Partners: BOT Private Power Generation Contractors; Export and Import Bank of Japan (JEXIM); Global Environment Facility (GEF); Swedish Agency for International Technical and Economic Cooperation (BITS); Eurobond investors

STAFF	Current	At Appraisal
<i>Vice President:</i>	Jemal-ud-din Kassum	Gautam S. Kaji
<i>Country Manager:</i>	Vinay K. Bhargava	Callisto E. Madavo
<i>Sector Manager:</i>	Yoshihiko Sumi	Vineet Nayyar
<i>Team Leader at ICR:</i>	Selina Wai Sheung Shum	Claudio Fernandez
<i>ICR Primary Author:</i>	Selina Wai Sheung Shum; Mikio Matsumura	

2. Principal Performance Ratings

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HL=Highly Likely, L=Likely, UN=Unlikely, HUN=Highly Unlikely, HU=Highly Unsatisfactory, H=High, SU=Substantial, M=Modest, N=Negligible)

Outcome: U

Sustainability: UN

Institutional Development Impact: M

Bank Performance: S

Borrower Performance: S

	QAG (if available)	ICR
<i>Quality at Entry:</i>		U
<i>Project at Risk at Any Time:</i> Yes		

3. Assessment of Development Objective and Design, and of Quality at Entry

3.1 Original Objective:

The project objectives are to : (a) meet the rapidly increasing demand for power in Luzon using indigenous and environmentally superior geothermal energy; (b) strengthen the energy sector by implementing institutional, planning and financial improvements recommended by the Energy Sector Plan (ESP); (c) support the large ongoing private sector participation in power generation, and facilitate it by extending the national grid; (d) strengthen NPC's capabilities in environmental and social impact analyses; (e) introduce enhanced co-financing operation (ECO) in the Philippines; and (f) ensure the financial viability of NPC and PNOC for undertaking a long-overdue investment program.

The project objectives were consistent with the country's priorities and the Bank's Country Assistance Strategy (CAS) prevailing at the time of project preparation/loan approval (1989-94). Specifically, the CAS aimed at assisting the country to regain a sustainable high growth path led by the expansion of an internationally competitive private sector through such priority measures as improved policy and project implementation as well as reduction of infrastructure bottlenecks. The project design is directly relevant towards achieving the above objectives.

Overall Energy Sector Performance. In agreement with the Bank, an Energy Sector Plan (ESP) was developed by the government to lay out policies and define improvements in all areas of concern in the sector as well as their completion schedule. Implementation of the ESP was supported by a series of Bank operations in the sector, including this Project.

Environmentally Superior Indigenous Energy Supply. CO₂ emissions from geothermal power generation are only a fraction of those of an equivalent coal plant. Thus, the development of Leyte geothermal resources under this Project further the twin objectives of using an environmentally preferable energy and enhancing the security of energy supply by avoiding coal and oil imports.

Promotion of Private Sector Participation. In response to the power crisis and the consequent opportunity cost of economic losses in the early 1990s, the project objectives relating to the physical components were directed at ensuring the successful implementation of the Government's "fast track" Build-Operate-Transfer (BOT) private power program in an environmentally sustainable manner. In particular, they were essential to achieve the project objective of promoting private sector participation in geothermal power generation projects by transmission of the power generated and broadening the power market through the interconnection of the national power grid. In addition, this Project served as a vehicle to further leverage limited public sector resources with private sector financing by the introduction of ECO co-financing in the country.

Strengthening the Finances of NPC and PNOC-EDC. The ESP noted above included actions directed at strengthening the finances of sector institutions, including the National Power Corporation (NPC) and Philippine National Oil Corporation - Energy Development Corporation (PNOC-EDC). The planned measures included privatization of the two institutions as well as various other actions (e.g. tariff adjustment, equity infusion) to enable NPC to achieve financial viability. The minimum financial performance targets agreed with NPC and PNOC-EDC were incorporated in the financial covenants.

Strengthening NPC's Capabilities in Environmental and Social Impact Analyses. This objective was appropriate and the Project included a component for technical assistance and training to NPC for this purpose.

3.2 Revised Objective:

3.3 Original Components:

1. PNOC-EDC's Components comprised the following: (a) development of a 440 MW Geothermal energy field to expand Leyte geothermal capacity from 200 MW to 640 MW, including: (i) drilling about 65 additional producer and injector wells in Malitbog, Mahanagdong and Alto-Peak; (ii) contracting technical services for geothermal drilling; (iii) construction of steam gathering systems; (iv) constructing the related subtransmission systems in Leyte; (v) constructing a pilot reinjection plant for CO₂; and (vi) recruiting consultants to assist with project implementation; and (b) carrying out BOT Contracts between PNOC-EDC and private sector companies to construct and operate 440 MW geothermal power plants.
2. NPC's Components comprised the following: (i) construction of two high voltage DC (HVDC) monopole converter stations and related electrode stations at Ormoc and Naga, to be financed by a \$100 million Eurobond issue, partly guaranteed by an ECO of the Bank; (ii) installation of submarine cable (about 19 km at 350 kV, 440 MW) crossing the San Bernardino Strait and linking the Leyte Luzon lines; (iii) construction of a twin circuit HVDC overhead transmission line from Ormoc to Cabacungan cable terminal (about 176 km at 350 kV) and from Matnog to Naga (about 256 km at 350 kV); (iv) rehabilitation of the Naga-Tayabas transmission line (about 205 km at 500 kV); (v) recruiting two advisers for strengthening its environmental and social engineering departments; (vi) recruit consultants to design the Casecanan hydroelectric project and to support project implementation.

3.4 Revised Components:

The following components, which were added by PNOC-EDC in 1999, resulted in the extension of the loan closing date by 9 months (from June 30, 1999 to March 31, 2000).

- (a) Construction of a 7 km ***steamline interconnecting all of the power plant steam collection systems*** so that it could function as one integrated network equipped with operational and production flexibility. PNOC-EDC introduced this component after the initial results of commercial exploitation indicated that there would be temporary steam deficiencies in some sectors and surplus steam in other sectors and that an interconnection would be necessary to maximize the efficiency of the system.
- (b) ***Updated reservoir assessment*** of the Leyte Geothermal Project. This was a condition of the Bank in extending the loan closing date in order to confirm the soundness of PNOC-EDC's proposal to construct the steamline interconnection noted under item (a) above.

3.5 Quality at Entry:

Overall, quality at entry is rated as marginally unsatisfactory, with the PNOC-EDC components rated as satisfactory and NPC components rated as unsatisfactory. In hindsight, the project implementation schedule in the SAR proves to be overly optimistic in its critical assumption that NPC could successfully address the long standing implementation problems of tardy procurement and the right-of-way (ROW) issues.

- NPC's implementation delays. At the time of project appraisal, the risks of NPC's tardy procurement

procedures were considered to have been mitigated by the reorganization of NPC and all the key bids were underway. Further, NPC and PNOC-EDC had appointed high-level project directors to coordinate all project activities. The satisfactory implementation performance of PNOC-EDC's components confirmed their readiness for project implementation. By contrast, the substantial implementation delays encountered by NPC reflected, in part, its inadequate readiness for project implementation at the time of loan approval, particularly in regard to the resettlement action plan. Indeed, the project appraisal failed to identify the substantial risks related to ROW issues which had contributed to delays in the implementation of NPC's projects.

- **Risk Assessment.** In light of the substantial uncertainties of the operating environment, it is not clear if a sufficiently rigorous risk analysis had been performed to avoid overly optimistic expectations of the project outcome related to NPC's finances and its project components, paying particular attention to the following: (i) the risks related to fixed obligations under the "take-or-pay" provisions of the BOT contracts, taking into account potential implementation delays, market risks and mismatch in currencies between the revenues and liabilities of the project entities; (ii) the risks of delayed and lower power tariff adjustments; (iii) the impact of competition from new IPPs and self-generation by industrial users; and (iv) the impact of combination of adverse factors on the project economics and entities' finances.

4. Achievement of Objective and Outputs

4.1 Outcome/achievement of objective:

This Project is one in a series of recent operations through which the Bank supported the implementation of the aforementioned ESP and reduction of bottlenecks in power transmission to promote economic growth. In particular, the Bank loan for the Leyte Cebu Geothermal Project (LCGP) was approved four months prior to this Project and the Implementation Completion Report for the LCGP (dated March 31, 2000) set a precedent for evaluating the outcomes of this and subsequent projects in the series.

Despite the achievement of physical and environmental objectives, the overall project outcome is rated as marginally unsatisfactory mainly because (i) NPC has maintained its precarious financial situation and the objective of strengthening the financial viability of the project entities has not been achieved; and (ii) the high cost of meeting the Project's physical and environmental objectives was a contributing factor to this situation, and consequently a negative net present value (NPV) is currently estimated for the economics of the Project. NPC's financial viability was seen as critical for the improved performance of the power sector, since the Corporation's financial problems and consequent under-investment were considered to have been one of the key contributing factors leading to the power crisis. Hence, ensuring the sustainability of the Project's physical objective to eliminate the power crisis was also dependent on achieving the longer term financial objective.

Sectoral Improvement Objective. Although many of the actions in the ESP have been implemented (Annex 8), a major issue of concern is the protracted delays by Congress in the passage of (i) a power sector restructuring bill directed at improvements in the efficiency and sustainability of the sector; and (ii) a geothermal bill to increase financial incentives for investment in geothermal development. The current fiscal regime for geothermal development does not allow for a level playing field with competing imported fossil fuels (which are taxed at a much lower rate) and hinders private sector investment in the development of environmentally superior indigenous geothermal resources.

Financial Objective. The legal agreements under this Project included the following financial performance covenants: (a) for NPC, a minimum of 8% rate of return (ROR) on revalued net fixed assets and a minimum debt service coverage ratio of 1.3 times; and (b) for PNOC-EDC, a maximum debt/equity ratio of 70/30, a current ratio of not less than 1 time and a minimum debt service coverage ratio of 1.25 time.

BOT Obligations and Financial Ratios. At the time of project appraisal, BOT obligations were considered operating costs in the financial forecasts of both NPC and PNOC-EDC. On the other hand, the legal agreements did not make explicit reference to the treatment of BOT obligations in the definition of financial ratios, while the term "debt" was defined as "any indebtedness" of the Borrower maturing by its terms more than one year. Subsequently, the Commission on Audit (COA, state auditor in the Philippines) issued accounting guidelines on the BOT schemes which are considered capitalized lease and part of the liabilities of the project entities. In the case of a subsequent Bank-financed project for NPC, the Loan Agreement was amended to define "debt service" to include, inter alia, the BOT lease obligations, which was consistent with the approach of the co-financier, Asian Development Bank (ADB). However, in the case of PNOC-EDC, no such action was taken. Thus, notwithstanding the "take-or-pay" provisions in the BOT contracts and the above accounting treatment stipulated by COA, PNOC-EDC's calculation of the debt service coverage ratio has not taken into account the cash payment for BOT obligations, based on its interpretation that "the BOT arrangement is a mere provision of services whereby payment is contingent to the delivery of services". As such, this is a substantial deviation from the SAR approach (with internal cash generation net of BOT obligations) and that of the NPC (with debt service including BOT obligations). Similarly, the PNOC-EDC calculation of debt/equity ratio has excluded the liabilities for fixed BOT obligations. In hindsight, given the significant impact of the BOT obligations on the finances of the project entities, the legal agreements should have made explicit reference to the treatment of such obligations.

(a) NPC. Despite the valiant efforts made by the NPC, the Corporation had not complied fully with the financial covenants for some years even prior to the Asian financial crisis (Annex 9). The precarious finances of NPC are largely due to factors beyond its control, including its under-capitalization and inadequate tariff adjustments. To meet its liquidity needs, NPC has incurred huge liabilities which, in turn, expose the Corporation to expensive debt service and "take-or-pay" obligations under IPP contracts. Its financial difficulties have been exacerbated by the recent regional financial crisis, particularly the impact of local currency devaluation (54% by end-1997), lower energy demand and over-capacity in power generation.

Power sector restructuring, recapitalization and privatization of the NPC lie at the heart of the Corporation's recovery program. In particular, the government is aware that the Corporation's heavy reliance on foreign debt finance is unsustainable in the long run. In recent months, both the House and the Senate have passed their respective versions of the power sector restructuring bill. There are encouraging signs for this bill to be reconciled and passed by Congress in the near term, thus enabling measures to put NPC on the path to financial sustainability. In particular, the conversion of NPC's huge debt into equity would improve NPC's debt service coverage ratio significantly. However, at this point, there are substantial differences between the House and Senate versions of the Bill; thus, there are considerable uncertainties related to the scope and timing of NPC recapitalization. In the interest of partnership, ADB is taking the lead in power sector restructuring and privatization; the Bank will continue to coordinate closely with the ADB on this matter.

(b) PNOC-EDC. Until 1997, PNOC-EDC had consistently complied with all of the above financial performance covenants (Annex 10). However, it is ironic that the BOT scheme which helped in financing

the power plant has required PNOC-EDC to seek external financing in order to pay part of the BOT obligations, due to the mismatch between electricity revenues (25 years sales contract with NPC) and BOT payments (10 years contract). The liquidity squeeze at the Corporation has been exacerbated by the peso devaluation and related impact on foreign debt service. Consequently, even before the inclusion of BOT obligations as part of "debt", PNOC-EDC reported noncompliance with (a) the current ratio covenant in 1997 and 1998; and (b) the covenanted debt service coverage ratio in 1998. After the inclusion of BOT obligations as "debt", the Corporation fell short of all three financial targets in the last three years.

Over the medium term, PNOC-EDC's latest financial forecast indicated its expectation of improvement in profitability. However, even before the inclusion of BOT obligations, its debt service coverage ratio is projected to fall below 1 time in 2001, mainly due to the bullet repayment. After the inclusion of BOT obligations, the financial ratios would be weakened considerably. In response to the Bank's concern about the need for prudent financial management, PNOC-EDC is currently exploring various options to improve its finances, including the following : (a) to request PNOC Holding Company for an increase in PNOC-EDC's present capitalization; (b) to consider low cost concessional long-term financing, i.e. Miyazawa Initiative Phase 2 loan, to bridge the financial gap during the BOT cooperation period; (c) to pursue an increase in its sales volume to NPC, in line with the recent thrusts of the DOE and NPC to increase the utilization of indigenous energy for power uses; and (d) to pursue the development of financially viable indigenous energy projects.

Physical and Environmental Objectives. The Project substantially achieved the objective of meeting the increasing demand for power in Luzon using indigenous and environmentally superior geothermal energy resources. In 1999, geothermal power (with substantial share from this Project) accounted for about 27% of the total power generation in the country, including 80% and 15% of the power generation in the respective systems in Visayas and Luzon. Compared to the early 1990s, when the country was suffering from power shortages, consumers are unequivocally better served and the elimination of the power crisis contributed substantially to the country's economic growth (Annex 11). However, this achievement came at a high cost (in 1999, average production cost of NPC plants was P1.76/kWh, whereas the average cost for NPC's contracts with the IPPs was P 2.66/kWh, of which the geothermal plants cost P 2.8/kWh) and the current estimate of the NPV is negative for the economics of the Project.

Promotion of Private Sector Participation. This objective was substantially achieved by the Project, with some 51% of the total financing requirement funded by the private sector (Annex 2). PNOC-EDC entered into three BOT agreements with two private power companies for the construction and 10-year operation of three geothermal power plants. Separately, through the successful implementation of ECO under this Project, NPC tapped the international bond market for the first time, which paved the way for its subsequent long-term commercial borrowings from this market.

4.2 Outputs by components:

Physical Components

I. PNOC-EDC's components

Overall, implementation of PNOC-EDC's components was highly satisfactory, below budget and on schedule, except for delays in the implementation of the CO₂ reinjection plant.

- (a) ***Development of a 385 MW geothermal energy field.*** In total, 59 producer and injector wells

were drilled (9% lower than the appraisal estimate of 65 wells) and construction of steam gathering systems and the related subtransmission systems was completed on schedule in mid-1997. The capacity developed is lower than the appraisal estimate of 440 MW due to the abandonment of the Alto Peak sector which proved to be problematic to develop. Nevertheless, the combined system is able to surpass the required annual energy output specified under the power sales agreement with NPC, with the power plants operating within the plant factor commitment in the BOT contract. Overall, the output of this component is rated as highly satisfactory.

(b) **CO2 reinjection pilot program.** Due to the relatively novel and highly customized technology required, the procurement of CO2 compressor was not successful several times until October 1999. As a result, the pilot CO2 reinjection plant was not completed at the loan closing date (extended to March 31, 2000), although delivery of the compressor and electrical/instrumentation materials was completed before the loan closing date. Installation will be completed by August 2000 and test commissioning will begin in October 2000. Overall, the incompleteness of this component at ICR stage is rated as less than satisfactory.

(c) **Steamline Interconnection.** Since May 1998, the steam capacity of the Mahanagdong sector had continued to decline. Consequently, the output of the 120-MW Mahanagdong A plant declined to 72MW by February 1999. PNOC-EDC managed to increase the output through scale drillout, acidizing, drilling of additional wells and deposition inhibition techniques and the plant has been operated above 100MW since April 1999. In order to avoid similar problems in the future, PNOC-EDC started to interconnect the Mahanagdong sector with other sectors; this is expected to be completed in December 2000. Overall, this component is rated satisfactory.

In response to the Bank's recommendation, a **reservoir reassessment study** was recently completed by an independent consultant. The study basically confirmed the PNOC-EDC's assessment of the Leyte reservoir and found PNOC-EDC's measures to stabilize and optimize the steamfield to be well founded and practical. In addition, PNOC-EDC is in the process of following up various actions recommended by the consultant, particularly in progressing development of numerical simulation models of the Tongonan and Mahanagdong reservoirs in order that future trends in steam availability may be predicted and reservoir management strategies developed that optimize energy recovery from the entire Leyte Geothermal Project. Overall, the output of this component is satisfactory.

II. BOT Contracts. PNOC-EDC carried out three 10-year BOT contracts with private companies to construct and operate geothermal power plants (Malitbog Units 2 & 3, Mahanagdong, and the four optimization plants, totaling 385 MW). Overall, the output of this component is satisfactory.

III. NPC's components

(a) **Construction of two high voltage DC (HVDC) converter stations at Ormoc and Naga and related electrode stations at Albura and Calabanga.** This component was completed in November 1997 and energized in March 1998, which was about eight months behind the appraisal schedule. Overall, the output is rated satisfactory.

(b) **Installation of submarine cables crossing the San Bernardino Strait between Cabacungan and Matnog.** This component was completed February 1997, but energized in March 1998 upon completion of the entire HVDC transmission system. Overall, the output is rated satisfactory.

(c) **Construction of (i) a twin circuit HVDC overhead transmission line from Ormoc to Cabacungan cable terminal and from Matnog cable terminal to Naga; and (b) electrode lines from Ormoc to Albura .**

This component was completed in January 1998 and energized in March 1998, representing an eight months delay from the effective date (July 1997) for its power purchase agreement (PPA) with PNOC-EDC. This was mainly attributable to Right-of-Way (ROW) problems. Overall, the output is rated satisfactory.

(d) *Rehabilitation of the Naga-Tayabas transmission line.* This component was completed in April 1998; this was behind the original schedule and the delays were due to frequently occurred pilferage of tower parts and line materials. Overall, the output is rated satisfactory.

Environmental/Resettlement Component

I. PNOC-EDC's component is rated as highly satisfactory.

PNOC-EDC prepared a detailed Environmental Impact Assessment (EIA) for the geothermal development. The Department of Environment and Natural Resources (DENR), based on its own evaluation, issued an Environmental Compliance Certificate approving the project implementation subject to protective measures during construction and operation. PNOC-EDC implemented the protective measures properly. A multi-sectoral task force composed of the DENR, NGOs, Local Government Units and PNOC regularly monitors compliance with relevant standards. PNOC-EDC has so far had no violations pertaining to air and water quality.

The Corporation designed and implemented a resettlement program for families affected by the geothermal development. The program included (a) protection of residents from potential health hazards; (b) relocation of the residents from the project area; (c) assistance for the relocated community in regaining their standard of living prior to relocation; and (d) facilitating the formation of community institution and self reliance. The total number of households affected by the Leyte Geothermal Project was 106 and the resettlement program was successfully implemented, with about half of the affected households transferred to the newly constructed relocation site.

II. NPC's component is rated as highly unsatisfactory.

There have been significant delays in compensation payments by NPC, particularly for land acquisition, which are partly beyond the control of NPC in such cases as missing or incomplete documentation of some landowners. In addition, inadequate ROW personnel has hampered NPC's efforts to speed up the land compensation negotiation process. To address this issue, NPC indicated its commitment to increase the number of ROW negotiators for the project. Separately, the ICR mission concluded that the original resettlement recovery action plan completion date (June 30, 2000) was overly optimistic. NPC then provided the Bank with a revised schedule which will realistically allow the completion of compensation for all cases who do not involve expropriation.

4.3 Net Present Value/Economic rate of return:

Economic Rate of Return (ERR). The current estimate of the ERR is lower than the appraisal estimate of 10.5 %, in part due to lower tariff than anticipated at the time of appraisal, cost overrun and delayed project completion by NPC. The overall project ERR is currently estimated at 7.5% (Annex 3), based on NPC's financial projection with the following assumptions: (a) graduated increase of its average revenues from the Luzon grid to P3.63/kWh (or US 7.8 cents in 1993 prices) by 2003; and (b) upon the completion of the Leyte-Mindanao interconnection project in 2004, shifting of power sales from Luzon to Mindanao at an average price of P 2.68/kWh (or US 5.8 cents in 1993 prices), reflecting the projected

surplus of power supply in Luzon grid which was not envisaged at the time of project appraisal. The results of sensitivity analysis indicated that the ERR would be increased to the appraisal estimate of 10.5% in the event the average price would remain at the aforementioned Luzon grid price in 2003 for the balance of the project life. On the other hand, if the average price were to be reduced from the currently projected levels by 10% from 2001 onwards, the ERR would be decreased to about 6%. As in the case of the appraisal estimates, the current estimates of ERR are conservative since the unit benefits assumption has not captured other benefits to the economy encompassed in the consumers' surplus and the positive environmental impacts associated with geothermal development. Further, as the Project is a major step for the overall interconnection of the grid, it would offer potential long-term benefits associated with the better use of the country's energy resources in power generation, as well as the opportunity to improve the operation of the power system, reduce reserve capacity and provide a more reliable service.

Global Environment Trust Fund (GET) Grant Justification The Project supported the development and use of an energy source which is environmentally preferable and indigenous based. Further, the project has a significant impact on mitigation of greenhouse gas emissions since an alternative coal-fired based plant would imply incremental CO₂ emissions of about 2.2 million tons per year. Although the GET grant of \$31.2 million equivalent appears small in the overall investment of \$1.3 billion, it has been critical for the investment decision and has influenced the government in preferring the geothermal over the coal alternative. Due to high transmission investment costs associated with the Leyte-Luzon, the Project is not a part of the system's least cost expansion program in the absence of the GET grant and the higher environmental impact of the coal alternative (Annex 3). Based on actual and latest cost estimates, the Project's total life cycle cost (in 1993 prices, at 10% discount rate) is higher than an alternative coal-fired based plant by \$280 million before the GET grant, and \$261 million after the GET grant. In terms of cost per kWh, the Project is about US 6.8 cents before GET grant and US 6.7 cents after GET grant, which is substantially higher than that of the alternative coal-fired plant of about US 4.7 cents. The above cost differentials (US 2 cents/kWh) are substantially higher than anticipated at the time of project appraisal (about US 1 cent/kWh), in part due to the lower price of coal (latest estimate at \$36.8/ton vs. \$45.5/ton at project appraisal) as well as delayed and lower power sales to Luzon grid than anticipated earlier. Thus, in relation to the additional economic cost incurred in choosing the Project instead of an alternative coal plant, the cost per ton of CO₂ reduced is currently estimated at about \$ 21.5, or 4 times higher than the appraisal estimate of \$4.05. On the other hand, the return of the GET grant is high, with the current estimated cost of \$1.6/ton of CO₂ emissions reduction which is the same as the appraisal estimate. This cost compares favorably with the reduction cost of other projects considered by GET.

4.4 Financial rate of return:

The SAR did not include the financial rate of return (FRR) for this Project; due to an apparent compilation error for the report, its annex included the FRR for PNOC-EDC under the first phase Leyte Cebu Geothermal Project.

Based on the latest available data for this Project, PNOC-EDC estimated that the FRR for its overall project components and the BOT power plants, with sunk costs incurred before 1994, are about 10.3% (in 1993 constant prices, Annex 10). Consistent with standard Bank practice for ERR/FRR calculations, the sunk costs should have been excluded from the calculation of the FRR, in which case the overall FRR would be increased to 13.5 % based on the current contracted power price to NPC.

However, it should be noted that under both the Senate and House versions of the power sector restructuring bill, NPC's privatization may entail a review of PNOC-EDC's contracts with NPC to

determine the avenues to effect possible reduction in electricity prices. Under this scenario, the adverse impact of power price reduction would be partially offset by reduction of PNOC-EDC's corporate income tax. The results of sensitivity analysis indicated that if the net cash flows of the Project were to be reduced by 10% from 2001 onwards, the FRR would be reduced to 8.7% with sunk costs, and 11.5% without sunk costs.

4.5 Institutional development impact:

I. PNOC-EDC's component

(a) ***CO2 Absorption and Sequestration Study.*** In recognition of the potential role of tropical forests in mitigating global warming, PNOC-EDC commissioned a GEF-financed study of CO2 sequestration in the Leyte Geothermal Reservation. PNOC-EDC's geothermal reserves in Leyte included a large forested watershed that was assumed to serve as a carbon sink to offset the carbon emissions of the geothermal plant. The study therefore aimed to estimate the absorption index and amount sequestered by the different vegetation species in the geothermal reservation.

Aside from improving the economics of the Leyte Geothermal Project (versus an imported coal-fired power plant project), the Grant, through this study, enabled PNOC-EDC, to prove that its activities in Leyte will not exacerbate global warming. The study concluded that while the study area cannot absorb all the annual CO2 emissions of the power plants, the amount of Carbon stored in the reservation as well as the Carbon to be sequestered for 25 years will more than offset the total Carbon that the power plants will emit in 25 years. The results of the study shall be used to estimate the Carbon stocks and rate of carbon sequestration of the entire Leyte geothermal reservation. The output of this component is rated as highly satisfactory.

(b) ***Technical Assistance for Project Implementation.*** PNOC-EDC hired consultants with extensive experience in the development and construction of geothermal fields and power plants. The contract was originally bid out for the Leyte Cebu geothermal project and was subsequently amended to include the work under the Leyte Luzon project. The same firm was also hired to provide consultancy services for other fields such as geoscientific, drilling and power engineering. In accordance with the Bank's requirements, PNOC-EDC also hired the services of an overall project manager with extensive experience in operations and project management. Overall, this component is rated as highly satisfactory.

II. NPC's component

The original consultancy component to strengthen NPC's departments for environmental management and social engineering was implemented under the first phase (Leyte Cebu) rather than this second phase of the Leyte Geothermal Project. On the other hand, the GET grant under this Project was reallocated to provide for NPC's training in project management (\$ 142,000). The institutional development impact of this component is rated as negligible in light of (a) NPC's delays in project implementation, most notably in land acquisition and ROW compensation; and (b) in the case of environmental management, the consultant report was completed satisfactorily, but there appeared to be inadequate follow up actions, including dissemination of the report to the relevant NPC staff. Separately, the original technical assistance component to design the Casecnan hydroelectric project was canceled as the Casecnan Project was decided to be led by National Irrigation Administration (NIA). Overall, this component is rated as marginally unsatisfactory.

5. Major Factors Affecting Implementation and Outcome

5.1 Factors outside the control of government or implementing agency:

- Asian financial crisis was a significant external factor beyond the control of the government and the implementing agencies. Consequent sharp devaluation of the peso and slowdown of power demand growth contributed to the unsatisfactory outcome of this Project, both in terms of project economics and the objective to ensure the financial viability of NPC and PNOC-EDC.
- There have been significant delays in compensation payments by NPC, particularly for land acquisition, which are partly beyond the control of NPC in such cases as missing or incomplete documentation of some landowners.

5.2 Factors generally subject to government control:

Pace and scope of energy sector reform

- In the wake of the power crisis, the Executive Order 215 in 1990 repealed the Marcos decree on NPC's monopoly on power generation and allowed for private sector development of power plants and infrastructure facilities. In addition, development and implementation of the Energy Sector Plan by the government also contributed positively to the realization of this Project.
- Ironically, introduction of competition from new IPPs contributed to NPC's loss of market share and exacerbated its financial difficulties.
- The protracted delays in the passage of the power sector restructuring bill by Congress have, in turn, hampered the implementation of financial recovery action plan by NPC. In addition, as noted above, the House and/or Senate versions of the power sector restructuring bill also have implications for PNOC-EDC.
- The delayed passage of the Geothermal Bill has, in turn, affected adversely the finances and sustainability of PNOC-EDC and their components under this Project.
- The levels and timeliness of power tariff adjustments fell short of the appraisal expectation, thus contributing to the unsatisfactory outcome in terms of the finances of NPC, project economics and sustainability.

5.3 Factors generally subject to implementing agency control:

Project Management, including among others, coordination among the relevant departments, procurement procedures and resettlement policies, has a significant impact on the performance of project implementation.

5.4 Costs and financing:

Overall, the total financing requirements (including interest during construction) amounted to \$1,317 million, which are slightly (1%) below the appraisal estimate of \$1,334 million (Annex 2). The substantial cost savings achieved by PNOC-EDC for its own components (18%) and by the BOT contracts with private power producers (7%) were largely offset by the 21% cost overrun by the NPC.

As indicated in the financing arrangements (Annex 2), this project is a good example of public-private partnership to leverage public sector financing with substantial private sector investments. Actual Bank funding for this project was sourced from the loans for this project, the earlier Energy Sector Loan and the subsequent Transmission Grid Reinforcement Project. Total Bank financing amounted to

\$177.3 million, which were 26% lower than the appraisal estimate. As explained below, this was mainly due to PNOC-EDC's under-utilization of Bank funding.

(a) PNOC-EDC's Components

PNOC-EDC's total financing requirements, including interest during construction (IDC) of \$ 9.8 million but excluding BOT power plants, are currently estimated at \$ 267.2 million, representing a 23% cost underrun against the appraisal estimate. The significant cost savings are mainly attributable to (a) discontinued development of the Alto Peak Sector; (b) considerably higher than expected use of PNOC-EDC's in-house equipment and services in both well drilling and civil/structural works in steamfield development; (c) lower actual cost than appraisal estimate as a result of competitive bidding; and (d) significantly lower IDC mainly as a result of substantial under-utilization of the original loan amount of both the Bank and the Export-Import Bank of Japan (JEXIM).

Of the original Bank loan (\$114 million) to PNOC-EDC, \$55.2 million were disbursed and \$58.8 million cancelled. Similarly, of the original JEXIM loan of \$114 million equivalent, disbursement amounted to \$53.3 million equivalent, and \$54.3 million equivalent were cancelled. Separately, an earlier Bank-financed Energy Sector Loan helped finance \$8.5 million of well drilling expenditures, as compared against the appraisal estimate of \$13.3 million. Under-utilization of the above loans was mainly attributable to (a) the cancellation of the development of the Alto Peak Sector due to the presence of acidic fluids; and (b) the aforementioned PNOC-EDC's use of in-house equipment and services for economic and efficiency considerations, but these expenditures were not eligible for reimbursement under the above loans. Separately, the Global Environment Trust Fund (GET) grant allocated to PNOC-EDC, totaling SDR 10.8 million (or \$15.7 million equivalent), were fully disbursed. The Bank loan and GET were closed on March 31, 2000 after a 9-month extension, and a grace period (up to July 31, 2000) was granted for loan/GET disbursement against eligible goods and services delivered before the loan closing date.

(b) NPC's Components

The total financing requirements of NPC's components amounted to \$470.4 million (including IDC of \$70.3 million), representing a 29% cost overrun against the appraisal estimate. This is mainly due to (a) greater than expected length of the submarine cable as well as the need for cable protection; (b) various ROW problems and re-routing of the lines due to unsuitable soil conditions; (c) substantially higher than expected engineering/administrative expenses and IDC.

Of the original Bank loan (Ln 3746 of US\$ 113 million), US\$ 99.2 million were disbursed. The loan was closed on schedule on June 30, 1999 and the undisbursed balance of US\$13.8 million were canceled. Due to appreciation of Japanese Yen against the US dollar during the early project implementation stage, contracts with significant Yen portion had exhausted the original loan allocation. To remedy this, \$14.4 million of the component for rehabilitation of the Naga-Tayabas transmission line was financed under the subsequent Transmission Grid Reinforcement Project. Separately, trust fund grants administered by the Bank included: (a) GET allocated to NPC, totaling SDR 10.8 million (or \$15.5 million equivalent), were fully disbursed; and (b) Swedish Agency for International Technical and Economic Cooperation (BITS) amounted to \$46 million equivalent, as compared against the appraisal estimate of \$39 million equivalent. In addition, actual drawdown of loan from JEXIM and Eurobond issue partly supported under an expanded cofinancing operation (ECO) amounted to \$53.7 million equivalent (which is close to the appraisal estimate of \$56 million) and \$100 million, respectively. Finally, internal cash generation from NPC amounted to \$143.7 million, representing a 243% increase against the appraisal estimate. This is, in part, attributable to one of the contracts for Naga-Tayabas transmission lines

rehabilitation deemed to be not eligible for Bank financing when NPC did not rebid upon the very high bids due to the urgency of this project component.

6. Sustainability

6.1 Rationale for sustainability rating:

Overall, the prospects for project sustainability are uncertain in light of the considerable uncertainties of the operating environment, including the protracted delays encountered in the passage of enabling legislation critical for the recapitalization and financial recovery of NPC. In recent months, the House and Senate passed their respective versions of the power sector restructuring bill. However, given the technical complexities as well as the difficulties and contentious nature of the issues involved, coupled with the politicization of the agenda, it remains uncertain as to the timing and scope of the reconciled version of the bill to be passed by Congress.

In terms of responding to the power crisis, the Project has contributed to making it unlikely that "power crisis" will happen again in the country in the foreseeable future. In fact, rather than suffering from undercapacity, NPC now experiences a high reserve margin. Moreover, subsequent projects, including Transmission Grid Reinforcement Project, continue to improve the robustness of NPC's transmission network.

However, meeting the Project's physical objectives came at a high cost, and has contributed to the perpetuation of NPC's already poor financial position and significant weakening of PNOC-EDC's liquidity position until the expiry of the BOT power purchase agreement (in 2006). Thus, one of the project objectives to strengthen the financial viability of NPC and PNOC-EDC have not been achieved.

Since the financial viability of NPC is critical to ensuring an effective and efficient power sector, this means that the Project's sustainability as a whole is uncertain, taking into account the following factors: (i) general sectoral uncertainty caused by the protracted delay in the passage of an enabling legislation for power sector restructuring and the Geothermal Bill which would reduce the high royalty imposed on the geothermal industry and level the playing field with nominally cheaper but more polluting fossil fuel; and (ii) the current overcapacity in power generation is expected to continue over the medium term, coupled with the fixed take-or-pay IPP obligations of NPC, has an adverse impact on the Corporation's finances.

6.2 Transition arrangement to regular operations:

(a) Transition Arrangements for the project's future operation

The steam supply system of PNOC-EDC as well as interconnection connecting the developed power plants to PNOC-EDC Central switching station are operated by PNOC-EDC Leyte Geothermal Production Field Office. The Field Office is in charge of operation and maintenance of PNOC-EDC facilities in Leyte geothermal area, including production plan and coordination with the BOT power plants. It includes adequate experts including geologists to operate the geothermal steam system. The BOT plants will be turned over to PNOC EDC in 2007. Meanwhile, PNOC-EDC has formed a Power Department in charge of monitoring the maintenance and operation of these plants and will be instituting in the next 2 years a formal training program for its personnel. The BOT contracts further provide for training of PNOC-EDC personnel 1 year prior to the formal turn-over.

Upon commissioning of the Leyte-Luzon HVDC interconnection system of NPC, the operation of these systems was transferred from the NPC Engineering Project Offices, which were in charge of the construction, to Regional Centers of NPC. Southern Luzon Regional Center is responsible for the operation and maintenance of Naga converter station, OHDC lines between Naga and Matnog and submarine cables. Visayas Regional Center is responsible for the operation and maintenance of Ormoc converter station and OHDC lines between Ormoc and Cabacungan. Adequate maintenance would be provided to the facilities based on NPC's guidelines for maintenance. Special tools, instruments and boats for patrol and maintenance of the submarine cables are equipped with in the cable terminal stations of the both sides.

(b) Performance indicators

The following indicators will be monitored annually through the existing data acquisition systems from the Leyte Geothermal Production Field Office of PNOC-EDC and the Southern Luzon and Visayas Regional Centers of NPC: (i) actual available energy and sales transferred to NPC Leyte-Luzon system from geothermal plants in Leyte; (ii) percentage of geothermal energy among energy sources for power generation in Luzon system; (iii) energy transferred from Leyte to Luzon through Leyte-Luzon HVDC interconnection; (iv) system reliability of the Luzon system; (v) system losses in Luzon system; and (vi) frequency deviation in the Luzon system.

(c) Follow-up by the Bank

The NPC transmission network has been expanded and reinforced under the Transmission Grid Reinforcement Project (TGRP, Loan 3996/3997-PH), including the installation of the Northwestern Luzon 500 kV transmission lines. TGRP also includes the establishment of a National Load Dispatch Center, which will allow for the operation of the interconnected transmission systems (Luzon, Visayas and Mindanao) in the country, once the planned Leyte-Mindanao interconnection is installed in the future. Under the TGRP, it was agreed with NPC that the Bank would monitor similar system performance indicators mentioned above for the three transmission systems.

7. Bank and Borrower Performance

Bank

7.1 Lending:

The overall Bank performance in project identification, preparation and appraisal is satisfactory, with substantial inputs having been provided by Bank staff on both the policy front and extensive project preparation. As cited by NPC's ICR (Annex 14), Bank support has also been critical in organizing the financial engineering required for this large and complex Project. However, selected aspects of the Bank's assessment had limitations, including (i) NPC's resettlement policy and action plan and the risks of right-of-way issues; and (ii) the interrelated aspects of project entities' finances, BOT contracts and risk analysis of the Project and entities. Moreover, the monitoring and evaluation indicators were oriented toward project output rather than outcome.

7.2 Supervision:

The overall Bank performance in supervision of this complex project, with two implementation agencies, is rated satisfactory.

- Supervision of the procurement activities was generally satisfactory. However, there were inadequate

follow up actions with NPC on resettlement issues during most of the project implementation period. Nevertheless, after the substantial completion of NPC's physical components, supervision efforts intensified on both the project level and country portfolio management level.

- Exceptionally frequent changes in task manager and team members hampered the continuity and effectiveness of the supervision efforts.

7.3 Overall Bank performance:

On balance, overall Bank performance is rated satisfactory. The above assessment of Bank performance is consistent with the comments by NPC and PNOC-EDC in their ICR (Annexes 13 and 14).

Borrower

7.4 Preparation:

Overall, the performance of both PNOC-EDC and NPC during extensive preparation for this complex project was rated satisfactory. Both corporations were committed to the Project and undertook the necessary upfront actions required by the Bank. However, as noted above, the protracted delays encountered by NPC in the implementation of the resettlement action plan reflected its inadequate preparation and is rated highly unsatisfactory for this component.

7.5 Government implementation performance:

Many of the actions in the ESP have been implemented and substantial progress has been made in reforming the energy sector (most notably in the full deregulation of the downstream oil industry). However, protracted delays in the passage of power sector restructuring bill and geothermal bill, as well as the levels and pace of power tariff adjustments, have significant adverse impact on the finances of the implementation agencies, project economic viability and sustainability. Nevertheless, it should be noted that the executive and legislative branches of the Philippine Government are independent of each other. While the executive branch can make several commitments to the Bank regarding policy (such as certifying a proposed bill), the passage of legislation is not within its sole control. Overall, the performance of the government is rated satisfactory.

7.6 Implementing Agency:

On balance, the overall performance of the implementation agencies was rated as satisfactory. Project implementation by both entities was marked by many contracts being completed satisfactorily and within budget for most of the components. PNOC-EDC is rated as highly satisfactory for implementing its overall project components on schedule and below budget. On the other hand, as noted above, NPC's procurement activities were tardy and its delayed implementation of the resettlement action plan is rated unsatisfactory. NPC's performance was hampered, in part, by changes in management and staff working on the Project. Separately, the financial objective of the Project was not achieved. However, as noted above (Sections 4 and 5), a number of the critical factors contributing to this result were outside the direct control of NPC and PNOC-EDC during the project implementation period.

7.7 Overall Borrower performance:

On balance, overall Borrower performance is rated satisfactory.

8. Lessons Learned

- While "fast-track" BOT projects have proved crucial in alleviating power shortages, the economic efficiency of individual private investments should be improved with due consideration for (a) a cohesive sectoral approach, with special attention to prudent investment planning and financial management as well as risk management; and (b) rationalization of prices and risk sharing arrangements within a competitive and transparent framework.
- It may not be realistic to expect power projects developed with private funds under the "fast-tracked" Independent Power Producer (IPP) Program to be least cost in the "traditional" sense; the additional cost over the hypothetical "least-cost" alternative is the price to pay for mobilizing resources that would otherwise not be available to the sector/country.
- The high cost of the IPP Program has been a contributing factor to the failure of the Project to meet its financial objective and has adversely affected the project economics. Such an outcome indicates the need for sufficient risk analysis/management in a highly uncertain operating environment, particularly in a sector undergoing major structural reform.
- Conventional economic rate of return analysis is poorly suited to an environment where higher-cost, sub-optimal investments are required to eliminate power shortages. In the case of NPC, the transmission investments to bring power from higher-cost plants are likely to be underutilized now that the power crisis is over. The main economic benefits were reaped in the first few years when power was scarce and the value of avoiding outages was very high. The quantification of benefits and the estimation of the economic rate of return is therefore critically dependent on the estimated value of unserved energy.
- The use of a "rate of return on assets" target for financial performance is inappropriate for a company/sector with a very large and lumpy investment program.
- In cases where such obligations as BOT contracts have significant impact on the entities' finances, the legal agreements should make explicit reference to the treatment of such obligations in the definition of financial covenants.
- Quality at entry is a critical success factor for project implementation. In particular, for the resettlement component, resolution of the right-of-way (ROW) issue and completion of compensation payment is one of the pre-conditions prior to project construction. Moreover, an adequate risk analysis is essential for realistic expectations of project outcome.
- In its ICR, NPC noted that as in the case of previous transmission line projects of the Corporation, the perennial ROW problem should be given top priority in terms of adequate policies and guidelines acceptable to affected landowners; adequate and qualified personnel to handle negotiations and expropriation cases; secure full support of other government agencies involved in the processing of ROW documents including speedy court decisions. These actions are vital in solving ROW problems of similar projects in the future.
- In its ICR, PNOC-EDC noted that although the BOT scheme ensured the availability of private capital, there is a need to plan for possible funding deficits resulting from imbalance between project revenues and project operating and financing costs.
- The complications associated with two implementation agencies (in different subsectors) under one project should be taken into account in the design of future projects. Indeed, in light of the diverse performance of the two project entities, the rating of project performance and outcome could be different if there had been two separate projects.
- There are no short cuts to a successful complex operation; above-average inputs of Bank resources and broad staff skill mix for project design, appraisal and supervision are required.
- Frequent changes of task manager and team members are not conducive to efficiency and effectiveness of the Bank's inputs. On the other hand, synergies may be achieved by a series of Bank interventions with the same project team.

9. Partner Comments

(a) Borrower/implementing agency:

Both NPC and PNOC-EDC provided data which have been incorporated in the ICR and no comments were received on the draft ICR provided to them.

(b) Cofinanciers:

Both JEXIM and BITS were provided with provided with the draft ICR and no comments were received from them.

(c) Other partners (NGOs/private sector):

10. Additional Information

Annex 1. Key Performance Indicators/Log Frame Matrix

Outcome / Impact Indicators:

Indicator/Matrix	Projected in last PSR ¹	Actual/Latest Estimate
I. Leyte-Luzon Geothermal Project		
- Energy transferred to NPC Luzon system from geothermal plants in Leyte	3,000 GWh per year (1997-1998) based on PPA	3,188 GWh (July 1998 -June 1999)
- NPC: Percentage of geothermal energy for power generation in Luzon system	- not available	19.9% in 1998 (compared with 17.6% in 1996) — to be replaced with 1999 data
- NPC: Energy transferred from Leyte to Luzon through the HVDC interconnection system	- not available	3,190 GWh in 1999
- NPC system reliability in Luzon system	- not available	99.89% in 1999
NPC to engage TA consultancies for Casecan hydro project		
PNOC-EDC to enter into BOT contract for 385MW power plant		
NPC to recruit two advisers for one year and five additional staff for its social and environmental departments		
Partly support financing of HVDC contract by an Expanded Cofinancing Operation (ECO) of the Bank		
PNOC-EDC to maintain current ratio higher than 1.0, maintain DSR above 1.25, and to not incur additional debt if debt-to-equity ratio greater than 70 to 30		
NPC to maintain DSR above 1.3 and RORB above 8%		
NPC to (ii) install 19km submarine cable linking Leyte to Luzon;		
NPC to (i) construct 36km HVAC line in Leyte, and 256km (Ormoc-Cabacunga) and 176km (Matnog-Naga) 230 kV HVDC lines		
(iii) rehabilitate 205km 500kV Naga-Tabayas line		

1/ SAR did not identify monitoring indicators for the Leyte Luzon Project per se; appraisal estimates for specific indicators for overall NPC operation and financial ratios are shown under the last PSR column.

Output Indicators:

Indicator/Matrix	Projected in last PSR ¹	Actual/Latest Estimate
- PNOC-EDC to develop 440 MW steamfield	- 385 MW steamfield developed	- 385 MW steamfield developed
- PNOC-EDC construct a pilot CO2 reinjection plant	- Delivery of equipment to be in March 2000, but installation will be beyond the loan closing date	- Delivery of equipment completed in March 2000. Test commissioning to be in October 2000. The final report to be in May 2001.

¹ End of project

Annex 2. Project Costs and Financing

A. Project Cost by Component (in US\$ Million equivalent)

	Appraisal Estimate US\$ million	Actual/Latest Estimate US\$ million	Percentage of Appraisal
A. PNOC Geothermal Development			
Goods and Equipment	167.0	117.77	71%
Works	116.9	71.68	61%
Technical Assistance & Others	31.6	67.94	215%
Subtotal	315.5	257.39	82%
B. BOT Power Plant	620.4	577.6	93%
C. NPC Transmission System			
Supply and Erection Contract	316.8	359.6	114%
Technical Assistance & Others	14.5	42.6	294%
Subtotal	331.3	402.2	121%
Total Project Costs	1,266.9	1,237.2	98%
Interest during construction	66.7	80.1	120%
Total Financing Required	1,333.6	1,317.3	99%

Project Costs by Procurement Arrangements (Appraisal Estimate, in US\$ Million)

Expenditures Category	ICB	LIB	LCB	Other	NBF	Total
1. Works - PNOC	82.2		10.0		24.5	116.7
	(36.8)		(4.0)			(40.8)
2. Goods - PNOC	153.1	12.0			1.8	166.9
	(65.1)	(6.0)				(71.1)
NPC	190.3				126.6	
	(106.4)					
3. Consultancies & Training - PNOC				4.3		4.3
				(2.1)		(2.1)
NPC				8.5		8.5
				(6.6)		(6.6)
4. Compensation & Administration - PNOC					27.3	27.3
NPC					5.9	5.9
5. BOT Power Station					620.4	620.4
TOTAL PROJECT COST	425.6	12.0	10.0	12.8	806.5	1,266.9
	(208.3)	(6.0)	(4.0)	(8.7)	(0.0)	(227.0)

Project Costs by Procurement Arrangements (Actual/Latest Estimate, in US\$ Million)

Expenditures Category	ICB	LIB	LCB	Other	NBF	Total
1. Works - PNOC	32.0	9.6	2.2		28.0	71.7
	(15.0)	(3.7)	(1.1)			(19.8)
2. Goods - PNOC	72.6	3.1	0.6	4.2	37.2	117.8
	(34.3)	(1.5)		(2.1)		(37.9)
NPC	327.7				32.0	359.7
	(110.7)					(110.7)
3. Consultancies & Training - PNOC		7.3		5.3	0.8	13.4
		(3.6)		(2.4)		(6.0)
NPC				3.1	0.5	3.6
				(2.9)		(2.9)
4. Compensation & Administration - PNOC					54.6	54.6
NPC					39.0	39.0
5. BOT Power Station					577.6	577.6
TOTAL PROJECT COST	432.3	12.7	2.8	12.6	769.7	1,230.0
	(160.0)	(8.9)	(1.1)	(7.4)	(0.0)	(177.3)

B. Project Financing (in US\$ Million equivalent)

Financing Plan (In US\$ Million)	Appraisal Estimate	Actual/Latest Estimate	Percentage of Appraisal
1. IBRD - PNOC	114.0	55.2	48%
NPC	113.0	99.2	88%
Subtotal	227.0	154.4	68%
2. IBRD Energy			
Sector Loan - PNOC	13.1	8.5	65%
3. IBRD Transmission			
Grid Project - NPC		14.4	
4. JEXIM - PNOC	114.0	55.7	49%
NPC	56.0	53.7	96%
Subtotal	170.0	109.4	64%
5. BOT Contract	620.4	577.6	93%
6. ECO-Bond - NPC	100.0	100.0	100%
7. BITS grant - NPC	39.0	46.0	118%
8. GET grant - PNOC	15.0	15.7	105%
NPC	15.0	15.5	103%
Subtotal	30.0	31.2	104%
9. Internal Cash Gen.			
PNOC	92.0	132.1	144%
NPC	41.9	143.7	343%
Total Financing	1333.6	1317.3	99%

Annex 3: Economic Costs and Benefits

Economic Rate of Return (in 1993 Constant Prices)

Year	Cost		Unit Benefit	Sales ^{/2}	Benefit	Net Benefit
	Investment (US\$million)	O & M ^{/1} (US\$million)	Total (US\$million)			
1993	69.15		69.15			(69.15)
1994	32.60		32.60			(32.60)
1995	59.48		59.48			(59.48)
1996	131.66		131.66			(131.66)
1997	151.14	66.69	217.83	7.6795	180.55	(203.96)
1998	164.79	112.38	277.17	5.5448	1,481.40	(195.03)
1999	86.92	114.16	201.07	7.4321	2,901.96	14.60
2000	8.98	97.47	106.45	7.1233	2,878.59	98.60
2001		92.72	92.72	6.8280	2,809.07	99.08
2002		90.35	90.35	6.9466	1,969.99	46.50
2003		87.85	87.85	7.3000	1,688.31	35.40
2004		85.65	85.65	5.2632	2,054.13	22.46
2005		84.24	84.24	5.1399	2,926.37	66.17
2006		81.82	81.82	5.0194	2,926.37	65.07
2007		82.28	82.28	4.9018	2,926.37	61.16
2008		29.78	29.78	4.7869	2,926.37	110.30
2009		30.70	30.70	4.6747	2,926.37	106.10
2010		30.32	30.32	4.5651	2,926.37	103.28
2011		31.00	31.00	4.4581	2,926.37	99.46
2012		30.93	30.93	4.3536	2,926.37	96.47
2013		31.11	31.11	4.2516	2,926.37	93.31
2014		31.00	31.00	4.1519	2,926.37	90.51
2015		31.72	31.72	4.0546	2,926.37	86.93
2016		30.15	30.15	3.9596	2,926.37	85.72
2017		30.32	30.32	3.8668	2,926.37	82.83
2018		30.65	30.65	3.7762	2,926.37	79.85
2019		30.69	30.69	3.6877	2,926.37	77.23
2020		31.03	31.03	3.6012	2,926.37	74.36
2021		31.07	31.07	3.5168	2,926.37	71.85
2022		31.42	31.42	3.4344	2,926.37	69.09
Internal Economic Rate of Return						7.5%
NPV @ 10%						-107
NPV @ 12%						-158

Notes:

^{/1} Estimated O & M cost for the interconnection at 1.5% of the investment cost

^{/2} Net of 2.5% transmission loss

Comparative Cost Analysis: Leyte-Luzon (Interconnection) vs. Without Leyte-Luzon Solution
(Isolated Grid)
(in US\$ Million 1993 Constant Prices)

Year	Interconnection				Isolated				Net Savings
	Inv	Fuel	O & M	Total	Inv	Fuel	O & M	Total	
1993	69			69					-69
1994	234	719	431	1,384	202	719	431	1,351	-33
1995	510	567	509	1,585	477	567	509	1,552	-33
1996	483	734	548	1,765	469	734	548	1,751	-14
1997	448	894	672	2,014	533	894	605	2,032	19
1998	295	687	853	1,835	233	687	741	1,661	-175
1999	84	713	1,170	1,967	-	745	1,070	1,815	-152
2000	173	284	1,470	1,927	164	323	1,475	1,962	35
2001	84	312	1,512	1,908	84	349	1,515	1,948	40
2002	115	505	1,663	2,283	115	524	1,615	2,254	-29
2003	368	540	1,729	2,637	368	565	1,664	2,597	-40
2004	492	527	1,778	2,797	492	609	1,738	2,839	42
2005	562	544	1,918	3,024	562	618	1,920	3,100	76
2006	404	562	1,955	2,921	404	645	1,960	3,009	88
2007	533	582	1,965	3,080	533	669	1,972	3,174	94
2008	491	614	1,920	3,025	491	705	1,978	3,174	149
2009	159	667	1,930	2,756	159	752	1,986	2,897	141
2010	-	715	1,956	2,671	-	800	2,013	2,813	142
2011	-	715	1,956	2,671	-	800	2,013	2,813	142
2012	-	715	1,956	2,671	-	800	2,013	2,813	142
2013	-	715	1,957	2,672	-	800	2,013	2,813	141
2014	-	715	1,956	2,671	-	800	2,013	2,813	142
2015	(2,433)	715	1,957	239	(2,613)	800	2,013	200	-39

Present Value

10%	2,167	5,471	10,755	16,918	2,192	5,764	10,612	18,569	(37)
12%	2,315	4,785	10,755	14,222	2,020	5,016	8,805	15,841	(79)
15%	2,312	4,008	11,400	11,222	1,786	4,172	6,815	12,773	(115)
18%	2,033	3,436	12,032	9,077	1,586	3,555	5,415	10,556	(131)

Impact of GET Grant on Comparative Costs of Geothermal Plant vs. Alternative Coal Plant (440 MW)

Year	Geothermal Plant			Coal Plant				Net Diff before GET	GET	Net Saving Less GET
	Invest-ment	O & M Cost	Total Cost	Invest-ment	O & M Cost	Fuel Cost	Total Cost			
1993	69	0	69	0	0	0	0	-69	0	-69
1994	33	0	33	30	0	0	30	-3	0	-3
1995	59	0	59	133	0	0	133	74	7	81
1996	132	0	132	245	0	0	245	114	14	128
1997	151	67	218	106	0	0	106	-112	3	-109
1998	165	112	277		14	19	33	-244	1	-243
1999	87	114	201		14	39	52	-149	4	-145
2000	9	97	106		14	39	52	-54	1	-53
2001		93	93		14	39	52	-40		-40
2002		90	90		14	39	52	-38		-38
2003		88	88		14	39	52	-36		-36
2004		86	86		14	39	52	-33		-33
2005		84	84		14	39	52	-32		-32
2006		82	82		14	39	52	-29		-29
2007		82	82		14	39	52	-30		-30
2008		30	30		14	39	52	23		23
2009		31	31		14	39	52	22		22
2010		30	30		14	39	52	22		22
2011		31	31		14	39	52	21		21
2012		31	31		14	39	52	21		21
2013		31	31		14	39	52	21		21
2014		31	31		14	39	52	21		21
2015		32	32		14	39	52	21		21
2016		30	30		14	39	52	22		22
2017		30	30		14	39	52	22		22
2018		31	31		14	39	52	22		22
2019		31	31		14	39	52	22		22
2020		31	31		14	39	52	21		21
2021		31	31		14	39	52	21		21
2022		31	31		14	39	52	21		21

Present Values at the Discount Rates Shown:												
Total cost (US\$ Million 1993 Prices)					Marginal cost (\$/kWh)					CO2 reduced	GET	Proj Savings
	Geo	Coal	Savings	Savings	Power Sales		Geothermal		Coal	(000 tons)	(\$/tons)	(\$/tons)
			ex GEF	inc GEF	Geo	Coal	ex GET	w/GET				
8%	1,061	752	-309	-288	17,157	17,490	0.062	0.061	0.043	15,737	1.3	-18.3
10%	923	642	-280	-261	13,475	13,687	0.068	0.067	0.047	12,152	1.6	-21.5
12%	811	558	-253	-235	10,760	10,882	0.075	0.074	0.051	9,550	1.9	-24.6
13%	763	523	-240	-222	9,670	9,755	0.079	0.077	0.054	8,517	2.0	-26.1
14%	719	491	-227	-211	8,720	8,773	0.082	0.080	0.056	7,623	2.2	-27.6
16%	642	438	-204	-189	7,159	7,160	0.090	0.087	0.061	6,169	2.5	-30.6

Annex 4. Bank Inputs

(a) Missions:

Stage of Project Cycle Month/Year	No. of Persons and Specialty (e.g. 2 Economists, 1 FMS, etc.)		Performance Rating	
	Count	Specialty	Implementation Progress	Development Objective
Identification/Preparation				
February 1992	6	1 FA, 2 PE, 1 EC, 2 ES		
November 1992	5	1 FA, 2 PE, 1 EA, 1 LW		
April 1993	4	1 PE, 1 EA, 1 EG, 1 FA, 1 EEC		
Appraisal/Negotiation				
June 1993	7	1 FA, 2 PE, 1 EC, 2 EEC, 1 ES, 1 LW, 1 DO		
Supervision				
June 1994	4	1 EC, 1 PE, 1 RS and 1 FA	S	S
November 1994	3	1 EA, 1 PE, 1 RS	S	S
February 1995	7	1 PE, 1 EC, 1 PA, 1 EV 1 RS, 1 CP, 1 FA	S	S
December 1995	2	1 PE, 1 ES	S	S
March 1996	2	1 ES, 1 RS	S	S
July 1996	2	1 ES, 1 FA	S	S
August 1997	3	2 ES, 1 PvA	S	S
February 1998	4	2 ES, 1 FA, 1 RT	S	S
December 1998	2	1 ES, 1 OP	S	S
November 1999	5	2 FA, 1 PE, 1 SI Spec, 1 OP	U	U
ICR				
May 2000	4	1 FA, 1 PE, 1 SI Spec., 1 OP	U	U

(b) Staff:

Stage of Project Cycle	Actual/Latest Estimate	
	No. Staff weeks	US\$ (.000)
Identification/Preparation	18.4	56.6
Appraisal/Negotiation	78.9	235.7
Supervision	131.6	406.9
ICR	*	*
Total	228.9	699.2

* ICR SWs and the corresponding US\$ amount are included in the quoted estimates under Supervision.

Annex 5. Ratings for Achievement of Objectives/Outputs of Components

(H=High, SU=Substantial, M=Modest, N=Negligible, NA=Not Applicable)

	Rating				
☐ Macro policies	☐ H	☐ SU	☐ M	☐ N	☒ NA
☐ Sector Policies	☐ H	☒ SU	☐ M	☐ N	☐ NA
☐ Physical	☐ H	☒ SU	☐ M	☐ N	☐ NA
☐ Financial	☐ H	☐ SU	☐ M	☒ N	☐ NA
☐ Institutional Development	☐ H	☐ SU	☒ M	☐ N	☐ NA
☐ Environmental	☐ H	☒ SU	☐ M	☐ N	☐ NA
 <i>Social</i>					
☐ Poverty Reduction	☐ H	☐ SU	☐ M	☐ N	☒ NA
☐ Gender	☐ H	☐ SU	☐ M	☐ N	☒ NA
☐ Other (Please specify)	☐ H	☐ SU	☐ M	☒ N	☐ NA
☐ Private sector development	☐ H	☒ SU	☐ M	☐ N	☐ NA
☐ Public sector management	☐ H	☐ SU	☐ M	☒ N	☐ NA
☐ Other (Please specify)	☐ H	☐ SU	☐ M	☐ N	☐ NA

Annex 6. Ratings of Bank and Borrower Performance

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HU=Highly Unsatisfactory)

6.1 Bank performance

Rating

☐ Lending

☐ HS ☒ S ☐ U ☐ HU

☐ Supervision

☐ HS ☒ S ☐ U ☐ HU

☐ Overall

☐ HS ☒ S ☐ U ☐ HU

6.2 Borrower performance

Rating

☐ Preparation

☐ HS ☒ S ☐ U ☐ HU

☐ Government implementation performance

☐ HS ☒ S ☐ U ☐ HU

☐ Implementation agency performance

☐ HS ☒ S ☐ U ☐ HU

☐ Overall

☐ HS ☒ S ☐ U ☐ HU

Key Performance Indicators - Energy Sector Plan Implementation Status

Issues/Areas of Action	Required Action	Implementing Agency/Schedule	Status (by March 2000)
A. GENERAL/INSTITUTIONAL			
1) Energy Sector Coordination	Establish the Department of Energy (DOE)	President/Congress, December 1992.	Done.
	Formalize DOE organization.	DOE Secretary, March 1993.	Done.
2) Privatization	Propose clear congressional policy statement on private sector involvement in energy projects.	ECC/President	Done.
a) NPC/Power Sector	Complete OEA-commissioned study of privatization options	OEA-Price Waterhouse, November 1992.	Done.
	Submission of privatization plan.	DOE, NPC, September 1993.	Done.
	Approval of privatization plan.	Cabinet, March 1994.	
	Continue BOT approach for new projects; conduct bidding and come up with short list for the 900 MW and 200 MW BOT coal plants for Luzon and Mindanao, respectively.	NPC, June 1993.	1000 MW Sual Coal Fired Plant in Luzon - Energy Conversion Contract Signed in 1994; plant commissioning in 1999
			200 MW Mindanao Coal Fired Plant deferred -- commissioning in 2006
	Complete evaluation of bids.	October 1993.	10 contracts for 2300 MW already signed with the private sector. Other than the ABB BTO's (600 MW) all are BOT contracts.
	Awarding of contracts.	December 1993.	
3) Oil Industry Deregulation	Congressional policy statement on oil industry deregulation.	President/Congress, December 9, 1992.	Done (DOE Law).
	Complete ERB Energy Pricing Study.	ERB/IDP, June 1993.	Final study issued in March 1993.
	Complete industry cost structure study.	DOE/K&M, August 1993.	Draft report submitted March 1993.
	Recommend presidential endorsement of bill amending OPSF's law to effect automatic price adjustments.	DOE/ERB/OP, September 1993.	Done.

Key Performance Indicators for Project Operation - Energy Sector Plan Implementation Status (continued)

Issues/Areas of Action	Required Action	Implementing Agency/Schedule	Status (by March 2000)
	Set maximum oil industry rate of return.	ERB/Oil Companies, September 1993.	Done. ERB set a 10.6% average ROR for Oil Companies (April 16, 1993)
	Submit program for oil decontrol and other deregulation activities.	DOE, 1996.	Republic Act No. 8180, Oil Deregulation Law approved on March 29, 1996, but the law was declared unconstitutional by the Supreme Court on November 5, 1997, and is therefore invalid. Congress approved a new and more competitive deregulation law in February 1998.
	Approval of deregulation program.	Cabinet, 1996.	- do -
	Recommend presidential endorsement of ERB charter to allow decontrol of oil prices.	ERB/OP, 1996.	- do -
	Deregulate dealership activities (deregulation measures non-price related would be advanced whenever feasible).	DOE, 1996.	- do -
	Remove inter-fuel price subsidies.	DOE/ERB, 1996.	- do -
	Draft bill rationalizing the tariff tax component of petroleum product prices.	DOE/ERB/OP, 1996.	- do -
	Recommend presidential endorsement of draft bill.	DOE/OP, 1996.	- do -
	Submit petroleum import/export liberalization schedule.	DOE/ERB, 1996.	- do -
4) Single Price-Regulatory Body for Utilities	Legislation placing NPC and REC's under ERB price regulation.	Congress/President.	Done. DOE Law in operation.
5) More Efficient Approval System for Energy Projects	Presidential directive to DAR, DA, NEDA, DENR, November 1992.	ECC, DAR, NEDA, DENR, November 1992.	Done.
	Agreement between DENR and RDC regarding approval requirements and time limit for action.	DENR/RDC, June 1993.	Done. Latest guidelines for ECC processing issued in July 1994.
	Agree to approve power projects on a program basis instead per individual projects.	NPC/NEDA, June 1993.	Completed March 1993.
	NPC to develop standard BOT contracts for various power plant technologies.	NPC/NEDA, September 1993.	Model contracts for coal, diesel and gas turbines already developed.
	Approval of standard contracts.	NEDA-ICC. One month after completion of contract by NPC.	

Key Performance Indicators for Project Operation - Energy Sector Plan Implementation Status (continued)

Issues/Areas of Action	Required Action	Implementing Agency/Schedule	Status (March 2000)
B. POWER SECTOR			
1) Availability and Reliability of Supply	Ensure completion of fast track projects.	NPC/DOE, October 1993.	6 BOT contracts in operation.
	Ensure implementation of power development program.	NPC/DOE, ongoing.	PDP approved by ICC and presented to the Cabinet in May 1993.
	Submit plan to rehabilitate or retire/replace aging plants.	NPC, December 1993.	Done.
	Evaluate and approve NPC plan and allocate funding for technical assistance.	NEDA, January 1994.	Done. OPSF and PAGCOR grants approved.
	Adopt rehabilitation or retirement plan for old plants.		Rehabilitation of Sucat 2 & 3 completed.
2) NPC's Financial Viability	Conduct more effective public information program on the need for NPC rate increase.	NPC/Cabinet, Oct-Dec 1992.	Effective public information on price increase in place.
	Decision on acceptable rate of return base methodology.	ERB, September 1993.	Done. February 1993.
	Motion for early resolution by the Supreme Court of NPC fuel tax exemption cases.	NPC, May 1993.	Tax exemption cases of NPC were resolved by the Supreme Court favorably for NPC in the case of Maceda vs. Macaraig (197 SCRA 771).
	Approve automatic foreign exchange adjustment formula.	NPC, May 1993.	Formula applied once exchange rate exceeded P28/dollar.
	Implement rate adjustment to meet loan covenants. Develop annual projection of rate increase or decrease investment and overall financial requirement.	NPC, December 1992. NPC, end of each year.	NPC implemented tariff increase of P0.18/kWh from March 26, 1993, and additional P0.03/kWh from July 1993.
	Propose to DBM the level of government equity infusion to NPC. Submission of proposal for annual equity infusion to NPC.	NPC, March each year. DBM, June each year.	Approved for 1993. P3 billion from OPSF in 1993 approved by RA 7639, in addition to the P1 billion annually
	Executive support of bill proposing equity infusion to NPC.	DOE.	Done.
	Complete operational efficiency improvement study.	NPC/World Bank, December 1993.	First phase report completed in March 1993. Draft report for Second Phase completed end of June 1993.

Key Performance Indicators for Project Operation - Energy Sector Plan Implementation Status (continued)

Issues/Areas of Action	Required Action	Implementing Agency/Schedule	Status (March 2000)
3) Rate Restructuring (Demand charges and direct connections)	Complete nationwide consultation, especially in Bacolod, Cebu and Mindanao.	NPC, August 1993.	Ongoing.
	Implement rate restructuring down to distribution level.	NPC/Cabinet, NEA/RECs, ERB/PUs, December 1993.	Done.
4) Bataan Nuclear Power Plant (BNPP)	Complete negotiations with Westinghouse.	NPC-BNPP, December 1992.	Negotiations failed.
	Decision on BNPP operation.	Cabinet, March 1993.	Proposal for conversion of BNPP to 1500 MW gas fired plant (BOT) was approved but discontinued due to excess generation capacity
5) Improve Electricity Distribution Efficiency	Set limit to distribution loss that can be recovered through tariff.	NEA/ERB/ECC, ongoing.	ERB Resolution 91-22 has set to reduce losses permitted in tariffs from 14% to 10% in 5 years.
	Presidential endorsement of anti-pilferage bill.	ECC/OP, March 1993.	Done. (RA # 7832).
6) Energy Efficiency Standards	Finalize standards for power intensive appliances.	OEA/BPS-DTI, June 1994.	Building efficiency guidelines published March 1993.
C. DOWNSTREAM OPERATIONS			
1) Refinery Expansion	Decide price adjustment for non-crude increase	ERB, May 1993.	Done.
	Firm up PNOC expansion plans.	PNOC/DOE, January 1994.	Done.
2) Coal Import Liberalization	Implement financial/technical support program for local coal.	OEA, January 1994.	Initial program formulated.
	Reduce volume and tariff restriction.	DOE/ERB/NEDA, June 1994.	All coals in temporary exclusion list until June 1996. Anthracite and lignite having a 0% tariff and bituminous 10% tariff to 1999 and 5% thereafter.
3) Institutionalize Energy Conservation	Executive endorsement of DOE bill with provisions for continuation of energy conservation program.	President.	Done (DOE Law).
D. UPSTREAM OPERATIONS			
1) Geothermal Law to Encourage Private Sector Participation	Recommend presidential endorsement of pending legislation on geothermal royalties and development.	DOE/PNOC/OP, June 1993.	Senate hearings on SB 423 and 366 in April 1993. Still pending.
2) Improved Incentives for Oil and Gas Exploration	Recommend presidential endorsement of pending legislation on oil and gas development.	DOE/OP, June 1993.	

Key Performance Indicators for Project Operation - Energy Sector Plan Implementation Status (continued)

Issues/Areas of Action	Required Action	Implementing Agency/Schedule	Status (March 2000)
3) Continued Exploration Momentum Generated by Recent Oil Discoveries	Conduct aggressive campaign to attract more oil explorations.		Done.
4) Promote Development and Utilization of Renewable Energy Technologies	Intensify research and development of alternative/renewable energy technologies.	DOST-PCIERD/OEA/PNOC/NEA. Ongoing.	Ongoing.
	Promote utilization of cost-effective alternative energy systems.	OEA/NEA. Ongoing.	Ongoing.

Energy Sector Plan - Proposed Legislation

Issues/Areas of Action	Required Action	Implementing Agency/Schedule	Status (March 2000)
1) Energy Sector Coordination	Enact legislation creating the Department of Energy.	President/Congress (December 9, 1992)	Done. RA #7638, An act creating the Department of Energy.
2) Oil Industry Deregulation	Enact legislation amending the OPSF Law.	December 1993.	RA #8180, Oil Industry Deregulation Act was passed in 1996, but subsequently declared unconstitutional by the Supreme Court. in November 1997. Congress approved a new and more competitive deregulation law in February 1998.
3) Single Price-Regulatory Body for Utilities	Included in the DOE Law. Enact into law ERB charter amendment.	December 1992. June 1994.	Done. Done. RA #'s 7638, 8180, 7832 & 8184.
4) NPC Financial Viability	Approve annual equity infusion to NPC. Enactment of law authorizing OPSF equity infusion to NPC.	December each year.	Done. RA #7639, an Act providing payment in part of OPSF to NPC.
5) Improve Electricity Distribution Efficiency	Enact effective anti-power pilferage legislation. Enact law authorizing increase in NEA capitalization.	December 1993. March 1994.	Done. RA #7832, Anti-Pilferage of Electricity & Theft of Electric T/L Materials.
6) Rationalize Oil Prices	Enact law rationalizing the tariff and tax component of petroleum products.	1996.	Done. RA #8184, an Act Restructuring Excise Tax on Petroleum Products.
7) Energy Conservation	Refile and enact law institutionalizing energy conservation.	December 1993.	Done. EO #123, Institutionalizing the Committee on Power Conservation and Demand Management
8) Geothermal Law	Enact law to encourage private sector participation in geothermal development.	December 1993.	Pending (SB #726 and SB #888).

Key Monitoring Indicators: NPC Appraisal

Financial Year Ending 31- Dec.	1992	1993	1994	1995	1996	1997	1998
ACHIEVEMENT OF GOALS							
Total NPC Energy Sales (GWh)	23,835	24,897	29,592	32,344	34,788	36,499	39,894
Net NPC sales (Excl. Test-Run) - GWh	23,476	24,805	29,033	31,795	33,797	36,499	42,684
Power Sold/Total Pop. (kWh/person)	371	380	443	474	500	514	551
MANAGEMENT/EFFICIENCY							
# Days Accounts Receivable	39	38	38	38	38	38	38
% Receivables on Billing	10.8%	11.8%	10.3%	10.3%	10.3%	10.3%	10.3%
Total Number Employees	15,675	15,682	16,085	16,085	16,085	16,085	16,085
# of Operational Employees	12,761	12,583	12,979	12,979	12,979	12,979	12,979
Personnel Cost on Revenues	3.8%	4.0%	5.0%	4.6%	4.3%	4.3%	4.0%
Sales per Oper. Employees (MWh)	1,840	1,971	2,237	2,450	2,604	2,812	3,289
% Total Energy Losses and Plant Use	6.8%	6.5%	7.4%	7.0%	6.3%	6.4%	6.9%
FINANCIAL RATIOS:							
Operating Expenses/kWh	1.29	1.37	1.42	1.63	1.95	2.04	2.17
Average Tariff - P/kWh	1.6	1.7	1.9	2.1	2.4	2.5	2.7
Average Tariff Increase Centavos/kWh	20	11	15	19	35	13	12
Average Exchange Rate Pesos/US\$	25.1	27.1	27.9	29	30.4	31.7	33.1
Average Tariff - US\$/kWh	6.4	6.3	6.7	7.1	7.9	8.0	8.0
Working Ratio (1)	62.1%	59.6%	60.1%	64.1%	66.7%	65.7%	68%
Operating Ratio (2)	81.0%	80.2%	76.5%	79.9%	81.3%	80.4%	81.8%
Rate of Return-NPC's Charter (3)	6.9%	7.3%	9.0%	7.7%	7.6%	7.9%	7.9%
Rate of Return on Revalued Assets (4)	7.2%	7.5%	9.4%	8.0%	8.0%	8.3%	8.3%
Rate on Capital Employed (5)	2.0%	4.1%	7.3%	4.9%	6.0%	5.0%	5.6%
Net Profit on Equity	2.8%	4.1%	7.3%	4.9%	6.0%	5.0%	5.6%
Self-Financing Ratio (3-years Avg.) (6)	4%	23%	19%	17%	20%	27%	64%
Debt Service Coverage (7)	1.07	1.5	1.39	1.33	1.39	1.49	1.84
Interest Coverage (8)	1.38	1.5	1.83	1.59	1.85	1.94	2.41
Debt/Equity Ratio (9)	-3.4%	56.8%	54.9%	53.2%	49.5%	44.1%	38.6%
IN CONSTANT 1993 PRICES							
Average Tariff - P/kWh	1.72	1.71	1.69	1.75	1.94	1.95	1.95
Real Tariff Increase Centavos/kWh	9	-1	-2	6	19	1	-
Real Tariff Increase (Decrease)	5.6%	-0.5%	-0.9%	3.3%	11.2%	0.5%	-0.2%
Critical Financial Indicators Between 1993-1998							
Indicator	Min.	Average	Max.	Indicator	Min.	Average	Max.
Cash-Mill. Pesos	1,623	4,412	8,310	Debt Service Ratio	1.3	1.5	1.8
Average Tariff - P/kWh	1.69	1.88	1.95	Days Accounts Receiv.	38	38	43
Working Ratio	59.6%	64.0%	68.0%	Debt/Equity Ratio	38.6%	49.5%	56.8%
Rate of Return (Revalued)	7.5%	8.3%	9.4%				

- 1/ Operational expenses excluding depreciation / operational revenues
2/ Total operational expenses (including depreciation & prov. for d/a) divided by operational revenues
3/ Operating income on net average fixed assets plus one sixth of cash operating expenditures
4/ Operating income on net average revalued fixed assets in operation
5/ Profit before interest and taxes / total equity and reserves
6/ Cash available from operations / 3-year average capital expenditures
7/ Operating cash flow divided by debt service (principal plus operational interest)
8/ Profit before interest and taxes / total interest (operational and capitalized)
9/ Long-term debt / (long-term debt plus total equity)

Key Monitoring Indicators: NPC **Actual Operational & Audited Financial Results**

Financial Year Ending 31- Dec.	1992	1993	1994	1995	1996	1997	1998
<u>ACHIEVEMENT OF GOALS:</u>							
Total NPC Energy Sales (GWh)	23,958	24,805	28,745	31,031	33,381	36,442	37,321
Net NPC sales (Excl. Magellan & Test-Run)	23,875	24,712	28,520	30,356	32,549	36,442	36,429
Power Sold/Total Pop. (kWh/person)	395	409	474	452	487	496	508
<u>MANAGEMENT/EFFICIENCY:</u>							
# Days Accounts Receivable	38	39	36	38	37	38	44
% Receivables on Billing	10.70%	11.91%	10.33%	11.13%	11.22%	11.75%	13.93%
Total Number Employees	14,208	14,560	15,794	14,742	13,119	13,512	14,719
# of Operational Employees	11,185	13,142	12,448	12,164	11,024	11,583	11,875
Personnel Cost on Revenues	3.76%	3.85%	4.97%	6.41%	6.39%	6.21%	5.23%
Personnel Cost on Operational Costs							
Sales per Oper. Employees (MWh)	2,142	1,887	2,309	2,651	3,028	3,152	3,143
% Total Energy Losses & Plant Use	6.80%	6.80%	6.10%	6.80%	6.30%	5.90%	6.50%
<u>FINANCIAL RATIOS:</u>							
Average Tariff - P/kWh	1.58	1.64	1.77	1.73	1.96	2.12	2.38
Average Tariff Increase Centavos/kWh	18	6	13	-4	23	16	26
Average Tariff - US\$/kWh	6.3	5.9	7.3	6.6	7.4	5.3	6.1
Average Exchange Rate Pesos/US\$	26.7	27.1	26.4	25.7	26.2	29.5	40.9
Working Ratio/1	62.4%	60.3%	61.1%	56.9%	59.5%	64.1%	69.1%
Operating Ratio/2	81.2%	83.5%	76.1%	78.0%	79.1%	84.9%	92.0%
Rate of Return-NPC's Charter/3	6.8%	5.7%	8.0%	7.0%	7.9%	6.9%	3.10%
Rate of Return on Revalued Assets /4	7.1%	5.9%	8.3%	7.3%	8.2%	7.2%	3.20%
Rate on Capital Employed /5	11.4%	20.0%	18.8%	20.0%	22.2%	13.1%	14%
Net Profit - Million US\$	91	51	282	152	211	104	-88
Net Profit on Equity	6.10%	1.90%	7.20%	3.70%	5.60%	2.70%	-2.80%
Self-Financing Ratio (3-years Avg.)/6	7.2%	-11.4%	17.4%	-7.4%	-25.2%	-46.9%	-41.7%
Debt Service Coverage/7	1.14	1.51	1.15	0.98	1.12	0.96	1.18
Interest Coverage/8	1.32	2.36	2.37	2.39	2.75	1.43	1.32
Debt/Equity Ratio/9	49.8%	57.1%	49.9%	59.0%	75.1%	79.7%	77.4%
<u>IN CONSTANT 1993 PRICES:</u>							
Average Tariff - P/kWh	1.72	1.64	1.66	1.53	1.60	1.62	1.70
Real Tariff Increase Centavos/kWh	9	-8	2	-14	7	2	8
Real Tariff Increase (Decrease)	5.6%	-4.7%	1.3%	-8.2%	4.7%	1.6%	4.9%
Critical Financial Indicators Between 1993-1998							
Indicator	Min.	Average	Max.	Indicator	Min.	Average	Max.
Cash-Mill. Pesos				Debt Service Ratio	0.96	1.15	1.51
Average Tariff - P/kWh	1.64	1.93	2.38	Days Accounts Receiv.	36	39	44
Working Ratio	59.5%	61.8%	69.1%	Debt/Equity Ratio	49.9%	66.4%	79.7%
Rate of Return (Revalued)	3.2%	6.7%	8.3%				

1/ Operational expenses excluding depreciation / operational revenues

2/ Total operational expenses (including depreciation & prov. for d/a) / operational revenues

3/ Operating income on net average fixed assets plus one sixth of cash operating expenditures

4/ Operating income on net average revalued fixed assets in operation

5/ Profit before interest and taxes / total equity and reserves

6/ Cash available from operations / 3-year average capital expenditures

7/ Operating cash flow divided by debt service (principal plus operational interest)

8/ Profit before interest and taxes / total interest (operational and capitalized)

9/ Long-term debt / (long-term debt plus total equity); long term debt included BOT lease obligation

PNOC Energy Development Corporation
Financial Indicators
Appraisal

	1991	1992	1993	1994	1995	1996	1997	1998
Revenues (peso:million)	1,367	1,499	2,373	3,463	4,504	5,679	11,032	18,533
Net Earnings	395	421	1,031	1,770	1,837	2,170	3,209	3,700
Net Working Capital	434	-110	3,250	3,979	3,601	3,498	3,715	6,616
Capital Assets	11,484	13,238	16,145	20,071	25,622	30,918	32,791	32,643
Long-Term Debt (Foreign)	4,859	5,056	9,032	10,820	14,340	17,579	16,782	16,206
PNOC Advances	3,231	1,774	0	0	0	0	0	0
Stockholders' Equity	4,009	6,576	10,504	13,597	15,250	17,203	20,091	23,421
Total Assets	12,978	14,764	20,650	25,477	30,871	36,230	40,946	43,461
Current Ratio	1.6	0.9	6.3	6.4	5.3	4.7	4.5	3.9
% LT Debt/(Debt+Equity)	67.2	51.6	46.8	44.3	48.5	50.5	45.5	40.9
Debt Service Times	48.9	2.4	2.2	3.5	2.8	2.1	2.8	1.7
Capital Expenditure	1,408	2,196	2,301	4,138	5,415	4,705	1,513	714

PNOC Energy Development Corporation
Financial Indicators
Actual

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Revenues (peso:million)	1,367	1,499	1,970	2,285	2,286	2,920	3,958	12,014	15,417
Net Earnings	394	422	607	1,207	730	797	-140	535	638
Net Working Capital /1	-207	474	-341	-743	-118	1,147	-1,290	4,749	2,125
Capital Assets	11,484	12,496	15,927	18,324	22,721	25,128	69,582	68,762	72,643
Long-Term Debt (Foreign)	4,859	4,911	9,286	9,972	12,068	15,973	19,843	20,099	25,592
PNOC Advances	3,231	2,078	0	0	0	0	0	0	0
Stockholders' Equity	4,009	6,389	10,386	13,631	14,075	14,667	14,369	15,252	15,814
Total Assets	12,981	14,372	21,136	25,272	28,431	34,986	80,880	78,767	82,202
Current Ratio /1	1.6	1.0	2.9	4.2	1.8	2.2	0.9	0.7	1.2
Current Ratio /2	1.6	1.3	3.4	9.1	3.0	3.0	0.7	0.6	0.7
% LT Debt/(Debt+Equity) /1	67	53	48	43	47	53	58	57	64
% LT Debt/(Debt+Equity) /2	67	53	48	45	48	55	79	77	78
Debt Service Times /1	2.8	2.7	2.5	3.7	1.3	1.8	2.1	1.0	2.2
Debt Service Times /2	8.3	3.7	2.2	4.4	3.2	3.6	0.3	0.9	0.9
Capital Expenditure	616	1,128	1,047	679	1,325	1,257	1,165	773	392

Notes: 1) excludes the BOT lease obligations
2) includes the BOT lease obligations
3) 1991-1999: audited

PNOC-EDC
FINANCIAL RATE OF RETURN ON PROJECT COMPONENTS:
STREAMFIELD OPERATIONS
(In Million Pesos Constant 1993 Price Terms)

Year	GWh Sales	Revenues 0.33/kWh	Investment Cost*	O & M Cost	Depre- ciation	Cum. Recov. Cost	Cost Recovery	Net Proceeds	Govt Share	PNOC EDC Share	PNOC EDC Cashflow
1993			2,028			1,217					(2,028)
1994			804			1,699					(804)
1995			1,376			2,525					(1,376)
1996			1,463			3,403					(1,463)
1997	3,000	626	785	154	193	4,221	564	63	38	25	(351)
1998	3,000	626	379	428	217	4,530	564	63	38	25	(218)
1999	3,060	639	17	395	218	4,589	575	64	38	26	189
2000	3,085	644	432	262	218	4,754	580	64	39	26	(89)
2001	3,000	626		606	218	4,999	564	63	38	25	(18)
2002	3,000	626		627	218	5,280	564	63	38	25	(38)
2003	3,000	626		636	218	5,571	564	63	38	25	(47)
2004	3,000	626		572	218	5,797	564	63	38	25	16
2005	3,000	626		567	218	6,019	564	63	38	25	22
2006	3,000	626		544	218	6,217	564	63	38	25	45
2007	3,000	626		578	25	6,256	564	63	38	25	11
2008	3,000	626		560	1	6,254	564	63	38	25	29
2009	3,000	626		597		6,287	564	63	38	25	(9)
2010	3,000	626		574		6,298	564	63	38	25	15
2011	3,000	626		600		6,334	564	63	38	25	(11)
2012	3,000	626		591		6,361	564	63	38	25	(3)
2013	3,000	626		594		6,392	564	63	38	25	(5)
2014	3,000	626		583		6,411	564	63	38	25	6
2015	3,000	626		610		6,458	564	63	38	25	(22)
2016	3,000	626		532		6,426	564	63	38	25	57
2017	3,000	626		534		6,396	564	63	38	25	55
2018	3,000	626		543		6,375	564	63	38	25	45
2019	3,000	626		539		6,351	564	63	38	25	50
2020	3,000	626		548		6,335	564	63	38	25	40
2021	3,000	626		544		6,316	564	63	38	25	45
2022	3,000	626		554		6,306	564	63	38	25	35

PNOC-EDC
FINANCIAL RATE OF RETURN FOR INTEGRATED COMPONENTS
(In Million Pesos Constant 1993 Price Terms)

Year	GWh Sales	Gross Revenue	ECA / O & M	Royalty Fee	Steam Cost	Gross Margin	Depreciation	Income Tax	Net Income	Net Cashflow	Add: Steam-Field CF	Total Cashflow
1993										-	(2,028)	(2,028)
1994										-	(804)	(791)
1995										-	(1,376)	(1,279)
1996										-	(1,463)	(1,340)
1997	3,000	1,849	1,848	6.21	626	-625		0	-625	-625	-351	-937
1998	3,000	4,798	4,584	19.18	626	-413		0	-413	-413	-218	-632
1999	3,060	4,979	3,776	18.22	639	565		186	378	378	189	577
2000	3,085	4,673	3,776	18.22	644	254		81	173	173	-89	84
2001	3,000	4,545	3,400	18.22	626	519		166	353	353	-18	329
2002	3,000	4,545	3,279	18.22	626	639		205	435	435	-38	380
2003	3,000	4,545	3,164	18.22	626	754		241	513	513	-47	436
2004	3,000	4,545	3,134	18.22	626	784		251	533	533	16	502
2005	3,000	4,545	3,075	18.22	626	844		270	574	574	22	531
2006	3,000	4,545	2,985	18.22	626	934		299	635	635	45	592
2007	3,000	4,545	2,972	18.22	626	946		303	644	644	11	556
2008	3,000	4,545	549	18.22	626	3370	424	943	2003	2427	29	2040
2009	3,000	4,545	554	18.22	626	3364	367	959	2038	2405	-9	2397
2010	3,000	4,545	560	18.22	626	3359	318	973	2068	2386	15	2401
2011	3,000	4,545	565	18.22	626	3353	276	985	2093	2368	-11	2357
2012	3,000	4,545	571	18.22	626	3347	239	995	2114	2353	-3	2350
2013	3,000	4,545	577	18.22	626	3342	207	1003	2132	2339	-5	2333
2014	3,000	4,545	583	18.22	626	3336	180	1010	2146	2326	6	2332
2015	3,000	4,545	588	18.22	626	3330	156	1016	2159	2314	-22	2292
2016	3,000	4,545	594	18.22	626	3324	135	1021	2169	2304	57	2361
2017	3,000	4,545	600	18.22	626	3318	117	1024	2177	2294	55	2349
2018	3,000	4,545	606	18.22	626	3312	101	1028	2184	2285	45	2330
2019	3,000	4,545	612	18.22	626	3306	88	1030	2188	2276	50	2326
2020	3,000	4,545	618	18.22	626	3300	76	1032	2192	2268	40	2309
2021	3,000	4,545	625	18.22	626	3294	66	1033	2195	2261	45	2305
2022	3,000	4,545	631	18.22	626	3288	57	1034	2197	2254	35	2288

FRR with sunk cost **10.3%**

FRR without sunk cost **13.7%**

Economic Value of Installed IPP Capacities¹

I. Background

The decision of the Aquino administration to mothball the 620 MW Bataan Nuclear Power Plant in 1986 and the inability to install replacement capacities contributed to the power crisis which started to be felt in the early nineties and the consequent decline in the economic growth of the country. Data regarding GDP at 1985 prices, Electric Sales and IPP installed capacities from 1986 to 1997 are shown in Chart 1.

II. Economic Values of Installed IPP

1. Impact of Electricity Supply on Economic Growth

Prior to the power crisis, the country was experiencing an average GDP growth rate at constant 1985 prices of about 6.5% per annum and electricity demand growth rate of about 10%. In 1990, the GDP growth rate started to decline to 3% and went further down to negative 0.5% in 1991 and 0.3% in 1992. During this period, electricity consumption was almost flat due to the lack of power capacities.

With the entry of power plant capacities by Independent Power Producers starting 1992, its impact on the country's economic growth rate started to be felt, with the GDP growing by 3.8% in 1993 to about 8.7% in 1997 before the impact of the Asian currency crisis was felt by the country. During this period a total of 4,652 MW power plant capacities were installed with electricity sales registering an average increase of about 11.5% per annum.

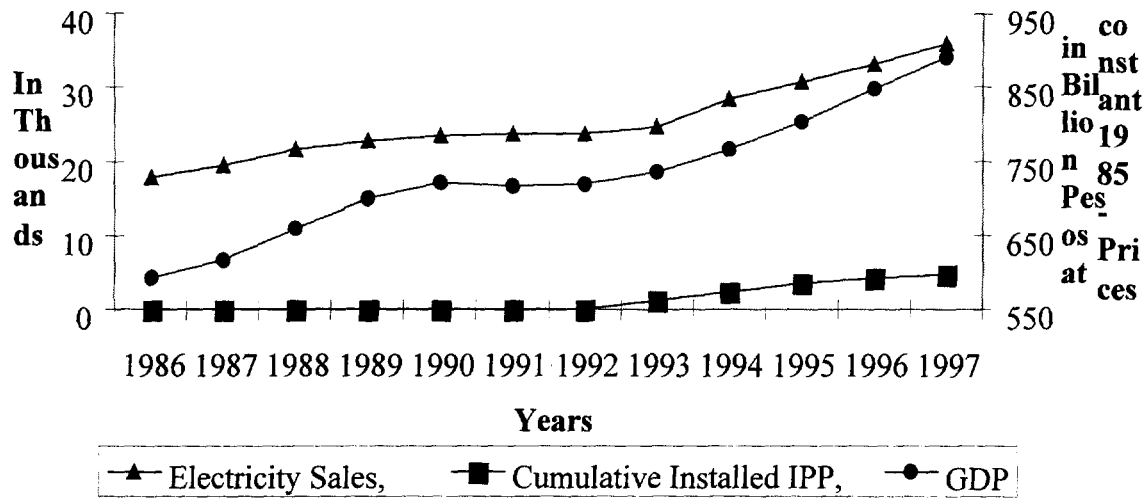
It could be seen from this analysis the importance of electricity supply to economic growth.

2. Economic Value of Installed IPP Capacities

Starting 1993, the economic growth experienced by the country can be mainly attributed to the availability of power supply. From 1993 to 1997, the total value of the incremental GDP growth was about P157 billion pesos or about \$8.44 billion dollars. For the same period, the additional electricity supplied by IPPs was about 11,323 gigawatt hours. This translates to an economic value of P13.8/kwh or \$0.745/kwh. In terms of investment, the estimated cost of about \$4.8 billion for the power plant installed by the IPP has been more than compensated by the increased gross domestic product realized by the country.

¹ Source: PNOC-EDC

Electricity Sales vs. GDP



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Electricity Sales, GWH	17.85	19.431	21.573	22.731	23.323	23.625	23.769	24.692	28.449	30.791	33.112	36.015
Cumulative Installed IPP, MW	0	0	0	0	0	0	0.072	1.278	2.472	3.605	4.305	4.652
GDP	591.423	616.923	658.581	699.448	720.69	716.522	718.941	734.156	766.368	802.866	848.451	891.53

PHILIPPINES

Leyte-Luzon Geothermal Project (Ln. 3746 / 3747 – PH)

AIDE MEMOIRE

1. A World Bank mission, comprising Ms. Selina Shum (Task Team Leader) and Mr. Mikio Matsumura (Power Engineer) met with the relevant officials from the NPC and PNOC-EDC at various times during the period May 15 to 31, 2000 for the preparation of an Implementation Completion Report (ICR) for the Leyte-Luzon Geothermal Project. The mission was assisted by Mr. Lanfranco Blanchetti-Revelli (Social Impact Specialist) and Ms. May Olalia (Operations Officer) in the review of resettlement aspects. The mission would like to express its appreciation to NPC and PNOC-EDC for their cooperation and hospitality. The findings and recommendations of the mission are summarized below.

Project Implementation

A. PNOC-EDC's Project Components

2. **Physical Components.** Overall, PNOC-EDC implemented its components satisfactorily and on schedule, except for delays in the implementation of the CO₂ reinjection plant.

- (a) ***Development of a 385 MW geothermal energy field.*** In total, 59 producer and injector wells were drilled (9% lower than the appraisal estimate of 65 wells) and construction of steam gathering systems and the related subtransmission systems was completed on schedule in mid-1997. The capacity developed is lower than the appraisal estimate of 440 MW due to the abandonment of the Alto Peak sector which proved to be problematic to develop. Nevertheless, the combined system is able to surpass the required annual energy output specified under the power sales agreement with NPC, with the power plants operating within the plant factor commitment in the BOT contract.
- (b) ***CO₂ reinjection pilot program.*** Due to the relatively novel and highly customized technology required, the procurement of CO₂ compressor was not successful several times until October 1999. As a result, the pilot CO₂ reinjection plant was not completed at the loan closing date (extended to March 31, 2000), although delivery of the compressor and electrical/instrumentation materials was completed before the loan closing date. Installation will be completed by August 2000 and test commissioning will begin in October 2000.
- (c) ***Steamline Interconnection.*** Since May 1998, the steam capacity of the Mahanagdong sector had continued to decline. Consequently, the output of the 120-MW Mahanagdong A plant declined to 72MW by February 1999. PNOC-EDC managed to increase the output through scale drillout, acidizing, drilling of additional wells and deposition inhibition techniques and the plant has been operated above 100MW since April 1999. In order to avoid similar problems in the future, PNOC-EDC started to interconnect the Mahanagdong sector with other sectors; this is expected to be completed in December 2000.

3. In response to the Bank's recommendation, a ***reservoir reassessment study*** was recently completed by an independent consultant. The study basically confirmed the PNOC-EDC's assessment of the Leyte reservoir and found PNOC-EDC's measures to stabilize and optimize the steamfield to be well founded and practical. In addition, it is understood that PNOC-EDC is in the

process of following up various actions recommended by the consultant, particularly in progressing development of numerical simulation models of the Tongonan and Mahanagdong reservoirs in order that future trends in steam availability may be predicted and reservoir management strategies developed that optimize energy recovery from the entire Leyte Geothermal Project.

4. **BOT Contracts.** PNOC-EDC carried out three BOT contracts with private companies to construct and operate geothermal power plants (Malitbog Units 2 & 3, Mahanagdong, and the four optimization plants, totaling 385 MW).

5. **Environmental Management.** PNOC-EDC prepared a detailed Environmental Impact Assessment (EIA) for the geothermal development. The Department of Environment and Natural Resources (DENR), based on its own evaluation, issued an Environmental Compliance Certificate approving the project implementation subject to protective measures during construction and operation. PNOC-EDC implemented the protective measures properly. A multi-sectoral task force composed of the DENR, NGOs, Local Government Units and PNOC regularly monitors compliance with relevant standards. PNOC-EDC has so far had no violations pertaining to air and water quality.

6. **CO₂ Absorption and Sequestration Study.** As part of the CO₂ abatement project component financed under the Global Environment Trust Fund (GET) grant, the main objective of the study is to estimate the carbon sequestration rate and to quantify the carbon sequestered by the different vegetation types in the watershed area within the Leyte geothermal reservation. This study was completed satisfactorily. Overall, the study provided one of the first primary data on the absorption capacity of tropical vegetation for CO₂. It documented the effects and measures adopted by the geothermal sector to minimize the contribution to global warming. In addition, it provided a protocol for the regular monitoring by PNOC of its CO₂ loading to the atmosphere.

7. **Resettlement Program.** The Corporation designed and implemented a resettlement program for families affected by the geothermal development. The program included (a) protection of residents from potential health hazards; (b) relocation of the residents from the project area; (c) assistance for the relocated community in regaining their standard of living prior to relocation; and (d) facilitating the formation of community institution and self reliance. The total number of households affected by the Leyte Geothermal Project was 106 and the resettlement program was successfully implemented, with about half of the affected households transferred to the newly constructed relocation site.

8. **Project Component Cost and Financing.** PNOC-EDC's total financing requirements, including interest during construction (IDC) of \$ 9.8 million but excluding BOT power plants, are currently estimated at \$ 267.2 million, representing a 23% cost underrun against the appraisal estimate of \$348.2 million (including IDC of \$33.1 million). The significant cost savings are mainly attributable to (a) discontinued development of the Alto Peak Sector; (b) considerably higher than expected use of PNOC-EDC's in-house equipment and services in both well drilling and civil/structural works in steamfield development; (c) lower actual cost than appraisal estimate as a result of competitive bidding; and (d) significantly lower IDC mainly as a result of substantial under-utilization of the original loan amount of both the Bank and the Export-Import Bank of Japan (JEXIM).

9. As of July 19, 2000, of the original Bank loan (\$114 million) to PNOC-EDC, \$55.2 million were disbursed and \$57.7 million cancelled. Similarly, of the original JEXIM loan of \$114 million equivalent, disbursement amounted to \$53.3 million equivalent, and \$54.3 million equivalent were cancelled. Separately, an earlier Bank-financed Energy Sector Loan helped finance \$8.5 million of well drilling expenditures, as compared against the appraisal estimate of \$13.3 million. Under-utilization of the above loans was mainly attributable to (a) the cancellation of the development of the Alto Peak Sector due to the presence of acidic fluids; and (b) the aforementioned PNOC-EDC's

use of in-house equipment and services for economic and efficiency considerations, but these expenditures were not eligible for reimbursement under the above loans. Separately, of the Global Environment Trust Fund (GET) grant allocated to PNOC-EDC, totaling SDR 10.8 million, SDR 10 million were disbursed as of July 19, 2000. The Bank loan and GET were closed on March 31, 2000 after a 9-month extension, and a grace period (up to July 31, 2000) was granted for loan/GET disbursement against eligible goods and services delivered before the loan closing date.

10. **BOT Power Plants.** The total cost of the three contracts with private power producers amount to \$577.6 million, representing 7% lower than the appraisal estimate of \$620.4 million.

11. **Monitoring Project Operation and Performance.** The steam supply system of PNOC-EDC as well as interconnection connecting the developed power plants to PNOC-EDC Central switching station are operated by PNOC-EDC Leyte Geothermal Production Field Office. The Field Office is in charge of operation and maintenance of PNOC-EDC facilities in Leyte geothermal area, including production plan and coordination with the BOT power plants. It includes adequate experts including geologists to operate the geothermal steam system. PNOC-EDC has formed a Power Department in the Field Office to monitor the maintenance and operation of these BOT plants and will institute training program for PNOC-EDC staff. The BOT plants will be transferred to PNOC-EDC in the year 2007 under the current contracts. The BOT contracts further provide PNOC-EDC personnel with training one year prior to the formal turn-over of the plants. The mission discussed with PNOC-EDC the performance indicators to be used to monitor future operation and development impact. In order to evaluate the project objectives and impact as well as performance of geothermal generation, the following performance indicators would be monitored: actual available energy and sales from geothermal plants in Leyte to NPC Leyte-Luzon system

B. NPC's Project Components

12. Physical Components.

- (a) *Construction of two high voltage DC (HVDC) converter stations at Ormoc and Naga and related electrode stations at Albuera and Calabanga.* This component was completed in November 1997 and energized in March 1998, which was about eight months behind the appraisal schedule.
- (b) *Installation of submarine cables crossing the San Bernardino Strait between Cabacungan and Matnog.* This component was completed February 1997, but energized in March 1998 upon completion of the entire HVDC transmission system.
- (c) *Construction of (i) a twin circuit HVDC overhead transmission line from Ormoc to Cabacungan cable terminal and from Matnog cable terminal to Naga; and (b) electrode lines from Ormoc to Albuera.* This component was completed in January 1998 and energized in March 1998, representing an eight months delay from the effective date (July 1997) for its power purchase agreement (PPA) with PNOC-EDC. This was mainly attributable to Right-of-Way (ROW) problems.
- (d) *Rehabilitation of the Naga-Tayabas transmission line.* This component was completed in April 1998; this was behind the original schedule and the delays were due to frequently occurred pilferage of tower parts and line materials.

13. **Resettlement and Land Acquisition.** Under the Leyte Cebu and Luzon Geothermal Projects, there have been significant delays in compensation payments by NPC, particularly for land acquisition, which are partly beyond the control of NPC in such cases as missing or incomplete documentation of some landowners. The mission's discussions with NPC focused on the following

issues: (a) lack of personnel; (b) status of the recovery Action Plan; and (c) extension of the recovery action plan.

- (a) ***Lack of personnel*** has hampered NPC's efforts to speed up the land compensation negotiation process and to reconstruct the available data base. Particularly urgent is the situation in the Leyte-Samar side. NPC indicated its commitment to increase the number of ROW negotiators for the project. For the Leyte Luzon project, ideally the increase in personnel should include two new teams, each composed of 4 persons. One of the teams will be operating on the Luzon side of the transmission line and the other on the Leyte-Samar side. For the Leyte Cebu project, two additional ROW negotiators will be required.
- (b) ***Extension of the Recovery Action Plan.*** It was concluded that under both projects, the original resettlement recovery action plan completion date (June 30, 2000) was overly optimistic. As agreed with the mission, NPC provided the Bank with a revised schedule which will realistically allow the completion of compensation for all cases which do not need to be expropriated (Attachment 1).
- (c) ***Recovery Action Plan Reporting.*** In light of the large quantity of data involved, NPC requested, and the mission agreed, that the formerly monthly progress report be changed to every 1 1/2 months, starting from July 2000.

14. ***Slow Disposition of Expropriation Cases.*** The mission met with provincial judges at Malolos, Bulacan in order to understand details in the court procedure that may cause delays in the implementation of the Recovery Action Plan. It is understood that the once-a-month settings of expropriation cases is beyond the control of NPC, especially so when landowners are also represented by counsel who are contributory to the delay in the disposition of the case. Further, NPC Legal informed the mission that setting up or creating a special expropriation court is a matter within the jurisdiction of the judiciary and representations, if any, should be done with the Supreme Court through the Court administrator.

15. ***Other Follow Up Actions.*** Following the meeting with the provincial judges, the mission contacted the Flagship office at the Office of the President in order to seek assistance in accelerating the implementation of the recovery action plans. Two issues in the implementation of the plans were discussed: (i) the necessity of accelerating expropriation, and (ii) the necessity of simplifying the registration of the Deeds of Sale. According to the flagship office, expropriation procedures may be accelerated by establishing special expropriation hearings for the project. It was agreed that NPC will contact the Flagship office in the next few weeks to study the possibility of holding project-specific expropriation hearings and explore possible actions to streamline Deeds of Sale registration.

16. ***Project Component Cost and Financing.*** The total financing requirements of NPC's components amounted to \$470.4 million (including IDC of \$70.3 million), representing a 29% cost overrun against the appraisal estimate of \$365 million (including IDC of \$33.6 million). This is mainly due to (a) greater than expected length of the submarine cable as well as the need for cable protection; (b) various ROW problems and re-routing of the lines due to unsuitable soil conditions; (c) substantially higher than expected engineering/administrative expenses and IDC.

17. Of the original Bank loan (Ln 3746 of US\$ 113 million, US\$ 99.2 million were disbursed. The loan was closed on schedule on June 30, 1999 and the undisbursed balance of US\$13.8 million were canceled. Due to appreciation of Japanese Yen against the US dollar during the early project implementation stage, contracts with significant Yen portion had exhausted the original loan allocation. To remedy this, \$14.4 million of the component for rehabilitation of the Naga-Tayabas transmission line was financed under the subsequent Transmission Grid Reinforcement Project (Ln 3996/3997). Separately, trust fund grants administered by the Bank included: (a) GET allocated to

NPC, totaling SDR 10.8 million (or US\$15.5 million equivalent), were fully disbursed; and (b) Swedish Agency for International Technical and Economic Cooperation (BITS) amounted to \$46 million equivalent, as compared against the appraisal estimate of \$39 million equivalent. In addition, actual drawdown of loan from JEXIM and Eurobond issue partly supported under an expanded cofinancing operation (ECO) amounted to \$53.7 million equivalent (which is close to the appraisal estimate of \$56 million) and \$100 million, respectively. Finally, internal cash generation from NPC amounted to \$141.6 million, representing a 279% increase against the appraisal estimate of \$41.9 million. This is, in part, attributable to one of the contracts for Naga-Tayabas transmission lines rehabilitation deemed to be not eligible for Bank financing when NPC did not rebid upon the very high bids due to the urgency of this project component.

18. **Monitoring of Project Operation and Performance.** Upon commissioning of the Leyte-Luzon HVDC interconnection system of NPC, the operation of these systems was transferred from the NPC Engineering Project Offices (which were in charge of the construction) to Regional Centers of NPC. Southern Luzon Regional Center is responsible for the operation and maintenance of Naga converter station, OHDC lines between Naga and Matnog and submarine cables. Visayas Regional Center is responsible for the operation and maintenance of Ormoc converter station and OHDC lines between Ormoc and Cabacungan. Adequate maintenance would be provided to the facilities based on NPC's guidelines for maintenance. Special tools, instruments and boats for patrol and maintenance of the submarine cables are equipped with in the cable terminal stations of the both sides.

19. The mission discussed with NPC the performance indicators to be used to monitor future operation and development impact. In order to evaluate the project objectives and impact as well as system performance, it was agreed that the following performance indicators would be monitored: (a) percentage of geothermal energy among energy sources for power generation in Luzon system; (b) energy transferred from Leyte to Luzon through Leyte-Luzon HVDC interconnection; (c) system reliability of the Luzon system; (d) system losses in Luzon system; and (e) frequency deviation in the Luzon system.

C. NPC Finances

20. **Recent Finances.** NPC's precarious finances are mainly attributable to factors beyond the control of the Corporation, most notably its under-capitalization and inadequate tariff adjustments. To meet its liquidity needs, NPC has incurred huge liabilities which, in turn, expose the Corporation to expensive debt service obligations. Its financial difficulties have been exacerbated by the recent regional financial crisis, particularly the impact of local currency devaluation, lower energy demand and over-capacity in power generation (including "take-or-pay" obligations under IPP contracts). Consequently, its net loss amounted to P 3.6 billion in 1998 and increased to P 5.9 billion in 1999. Despite valiant efforts by NPC in cost cutting and other measures, financial turnaround of the Corporation (as envisaged in its budget for 1999) did not materialize. Further deterioration of NPC's finances was mainly due to lower than expected power sales and delayed implementation of the proposed tariff adjustments (actual average tariff was 21% lower than the budgeted level). Indeed, NPC has been in noncompliance with the financial performance covenants under the Bank-financed projects since 1997; its return on rate base (RORB) was estimated at only 3.4% (far below the covenanted minimum rate of 8%) and its debt service coverage ratio also fell short of the covenanted minimum ratio of 1 time for 1999.

21. **Future Finances.** The survival strategy of NPC includes, among others, seeking timely approval for tariff adjustment applications, proactive marketing of power sales, continued cost cutting measures and rationalization of IPP contracts (including shelving of projects not yet contracted and, if possible, deferral of contracted projects through mutual agreement with the

concerned project sponsors).

22. However, as demonstrated by its recent financial results, cost cutting and other measures within the control of the NPC are far from adequate in restoring the financial health of the Corporation; ***power sector restructuring, recapitalization and privatization of the NPC lie at the heart of the Corporation's recovery program.*** In particular, the government is aware that the Corporation's heavy reliance on foreign debt finance is unsustainable in the long run. The current expectation for the passage of the Electricity Industry Reform Bill in the near term would enable various measures to put NPC on the path to financial sustainability, most notably the conversion of NPC's huge debt into equity would improve NPC's debt service coverage ratio significantly. However, there are considerable uncertainties related to the scope and timing of NPC recapitalization. In the absence of adequate remedial measures, NPC's finances will deteriorate further in the year 2000, mainly due to MERALCO renegeing on its power purchase agreement and the recent commissioning of the Sual power plant, both of which exacerbate the problem of excess generation capacity. Indeed, in order to avoid the loss of market share, the magnitude of NPC's tariff adjustments is constrained by competition with the IPPs and self generation by the industrial users.

23. ***Follow Up Actions.*** In the interest of partnership, ADB is taking the lead in power sector restructuring and privatization; the mission will continue to coordinate closely with the ADB on this matter. In addition, to facilitate monitoring of NPC's precarious finances, it was agreed that ***NPC would regularly update the Bank on its financial condition***, including, inter alia, the status of tariff increase application with the ERB and the Electricity Industry Reform Bill, and furnish the Bank with its unaudited quarterly financial statements.

D. PNOC-EDC Finances

24. PNOC-EDC's actual financial results fell short of the appraisal projections (for the period 1993-98) in terms of profitability, liquidity and capital structure indicators. This is, in part, attributable to (i) delayed implementation of selected projects (brought about by the unexpected change in the energy development policy of the Ramos administration, i.e., the displacement of geothermal energy plants as a priority in energy development with coal-fired plants); (ii) non-passage of the long delayed Geothermal Bill which would have reduced the royalty/tax payment of the geothermal industry and level the playing field with nominally cheaper but more polluting fossil fuel; (iii) foreign exchange loss (resulting from devaluation of the pesos); and (iv) write-offs of unsuccessful exploratory costs.

25. Under the provisions of the Project Agreement, PNOC-EDC is covenanted to maintain a maximum debt/equity ratio of 70/30, a current ratio of not less than 1 time and a minimum debt service coverage ratio of 1.25 time. Until 1997, PNOC-EDC had consistently complied with all of the above financial performance covenants. However, it is ironic that the BOT scheme which helped in financing the power plant has required PNOC-EDC to seek external financing in order to pay part of the BOT obligations, due to the mismatch between electricity revenues (25 years sales contract with NPC) and BOT payments (10 years contract). The liquidity squeeze at the Corporation has been exacerbated by the peso devaluation and related impact on foreign debt service. Consequently, even before the inclusion of BOT obligations as part of "debt", PNOC-EDC reported noncompliance with (a) the current ratio covenant in 1997 and 1998; and (b) the covenanted debt service coverage ratio in 1998. After the inclusion of BOT obligations as "debt", the Corporation fell short of all three financial targets in 1997 and 1998.

26. Based on PNOC-EDC's audited financial statements in 1999, prior to the inclusion of the BOT lease obligations, its debt service coverage ratio was 2.2 times, current ratio at 1.2 times and

debt/equity ratio at 64/37. On the other hand, after the inclusion of BOT lease obligations, its debt service coverage ratio was only 0.87 time, current ratio at 0.68 time and debt/equity ratio at 78/22.

27. Over the medium term, PNOC-EDC's latest financial forecast indicated its expectation of improvement in profitability. However, even before the inclusion of BOT obligations, its debt service coverage ratio is projected to fall below 1 time in 2001, mainly due to the bullet repayment. After the inclusion of BOT obligations, the financial ratios would be weakened considerably. In response to the Bank's concern about the need for prudent financial management, PNOC-EDC is currently exploring various options to improve its finances, including the following: (a) request PNOC Holding Company for an increase in PNOC-EDC's present capitalization; (b) consider low cost concessional long-term financing, i.e. Miyazawa Initiative Phase 2 loan, to bridge the financial gap during the BOT cooperation period; (c) pursue an increase in its sales volume to NPC, in line with the recent thrusts of the DOE and NPC to increase the utilization of indigenous energy for power uses; and (d) pursue the development of financially viable indigenous energy projects.

E. Next Steps

July 31, 2000	NPC and PNOC-EDC to send to the Bank their own ICR and all the necessary data [including, inter alia, (a) latest project cost/financing/procurement arrangements as well as financial rate of return for PNOC-EDC components; and (b) inputs for economic analyses (least cost system development and economic rate of return) and GET grant justification for both PNOC-EDC and NPC components]
August 25, 2000	The Bank to send its draft final ICR to NPC/PNOC-EDC for comments
September 15, 2000	NPC/PNOC-EDC to forward their comments on the draft ICR to the Bank.
September 30, 2000	The ICR will be finalized by the Bank; copies will be forwarded to NPC/PNOC-EDC and the relevant GOP agencies.

LEYTE LUZON GEOTHERMAL PROJECT
REVISED RESETTLEMENT ISSUES RECOVERY ACTION PLAN
As of May 31, 2000

ITEM	ACTION PLAN	TARGET DEADLINE	STATUS/REMARKS
1.0	SUBMISSION OF RESETTLEMENT ISSUES RECOVERY ACTION PLAN		Submitted
2.0	UPDATED COMPENSATION STATUS BASELINE INFORMATION		
	• Status Report (All Compensation Categories)	November 22, 1999	Submitted
	• Summary of Payment for Land Acquisition	November 22, 1999	Submitted
	• Status of Land Acquisition (Summary & Masterlist)	November 22, 1999	Submitted
	• Status of Land Acquisition Under Expropriation (Summary & Masterlist)	November 22, 1999	Submitted
3.0	ESCROW ACCOUNT		
	• Table summarizing escrow accounts for all compensation categories	November 30, 1999	Completed
	• Establish Escrow Account for all outstanding compensations except for cases under expropriation	December 31, 1999	Escrow account has already been established.
	• Earned interest from Escrow Account shall be given to all landowners on the total amount to be compensated reckoned from the date of opening the escrow account to the date of payment and computed based on the prevailing bank interest rate.		
4.0	PARCELLARY SURVEY		
	• Without Problems		100% Completed
	• With Problems		
	Completion of Field Survey	October 31, 2000	
	Submission of Lot Sketch Plan	December 31, 2000	
5.0	DEEDS OF SALE PROCESSING		
	• Without Problems	September 30, 2000	
	• With Problems	February 28, 2001	
6.0	LAND COMPENSATION		
	• Without Problems	December 31, 2000	
	• With Problems	June 30, 2001	
7.0	PAYMENT OF IMPROVEMENTS		
	• 100% Compensation (w/o problems)	December 31, 2000	
	• 100% Compensation (w/ problems)	June 30, 2001	

ITEM	ACTION PLAN	TARGET DEADLINE	STATUS/REMARKS
8.0	EASEMENT AND TOWER OCCUPANCY FEES • Notify landowners by registered mail if they are willing to accept or waive payment • 100% compensation	August 31, 2000 June 30, 2001	
9.0	PROGRESS REPORT • Status of payment for all compensation categories • Status of expropriation cases	Every 1-1/2 month after submission of end of May 2000 report -do-	

LLTP Res Issues Rec Act Plan.xls/bgs

NOTE: NPC understands that this plan forms part of the Resettlement Action Plan and is committed to the completion of all the compensations under the said plan by June 2001 except for cases wherein NPC has no control and cannot expedite payment due to incomplete documentation by affected landowners. NPC, however, will exert all effort to assist the landowners in completing the documentary requirements.

LEYTE-CEBU INTERCONNECTION PROJECT (IBRD 3700 PH)
REVISED RESETTLEMENT ISSUES RECOVERY ACTION PLAN
As of May 31, 2000

ITEM	ACTION PLAN	TARGET DEADLINE	STATUS/REMARKS
1.0	SUBMISSION OF RESETTLEMENT ISSUES RECOVERY ACTION PLAN		Submitted
2.0	UPDATED COMPENSATION STATUS BASELINE INFORMATION		
	Status Report (All Compensation Categories)	October 31, 1999	Submitted
	Summary of Payment for Land Acquisition	October 31, 1999	Submitted
	Status of Land Acquisition (Summary & Masterlist)	October 31, 1999	Submitted
	Status of Land Acquisition Under Expropriation (Summary & Masterlist)	October 31, 1999	Submitted
3.0	ESCROW ACCOUNT		
	Table summarizing escrow accounts for all compensation categories	October 31, 1999	Completed
	Establish Escrow Account for all outstanding compensations except for cases under expropriation	November 30, 1999	Escrow account has already been established.
	Earned interest from Escrow Account shall be given to all landowners on the total amount to be compensated reckoned from the date of opening the escrow account to the date of payment and computed based on the prevailing bank interest rate.		
4.0	DEEDS OF SALE PROCESSING		
	Without Problems	September 30, 2000	
	With Problems	February 28, 2001	
5.0	LAND COMPENSATION		
	Without Problems	December 31, 2000	
	With Problems	June 30, 2001	
6.0	EASEMENT		
	Notify landowners by registered mail if they are willing to accept or waive payment	August 31, 2000	
	100% compensation	June 30, 2001	
7.0	PROGRESS REPORT		
	Status of payment for all compensation categories	Every 1-1/2 month after submission of end of May 2000 report	
	Status of expropriation cases	-do-	

LCIP Res Issues Rec Act Plan.xls/bgs

NOTE: NPC understands that this plan forms part of the Resettlement Action Plan and is committed to the completion of all the compensations under the said plan by June 2001 except for cases wherein NPC has no control and cannot expedite payment due to incomplete documentation by affected landowners. NPC, however, will exert all effort to assist the landowners in completing the documentary requirements.

**LEYTE LUZON GEOTHERMAL PROJECT
BORROWER'S IMPLEMENTATION COMPLETION REPORT
PNOC-ENERGY DEVELOPMENT CORPORATION**

Original Objectives.

The objectives of the proposed Leyte Luzon Geothermal Project are to:

- (a) meet the rapidly increasing demand for power in Luzon using indigenous and environmentally superior geothermal energy;
- (b) strengthen the energy sector by implementing institutional, planning and financial improvements recommended by the ESP;
- (c) support the large ongoing private sector participation in power generation, and facilitate it by extending the national grid;
- (d) strengthen NPC's capacity to evaluate environmental and social impacts;
- (e) introduce an Expanded Co-financing Operation in the Philippines; and
- (f) ensure the financial viability of NPC and PNOC-EDC for undertaking a long-overdue investment program.

Revised Objectives.

The project's original objectives of the project were not revised during project implementation.

Original Components.

PNOC's original components of the project are as follows:

- (a) Development of a 440 MW geothermal energy field to expand Leyte geothermal capacity from 200 MW to 640 MW, including
 - i. drilling of about 65 additional producer and injector wells in Malitbog, Mahanagdong and Alto Peak;
 - ii. contracting technical services for geothermal drilling;
 - iii. constructing steam gathering systems;
 - iv. constructing the related subtransmission systems in Leyte;
 - v. constructing a pilot reinjection plant for CO₂
 - vi. recruiting consultants to assist with project implementation;
- (b) enter into BOT contracts with private sector companies to construct and operate 440 MW geothermal power plants.

Revised Components. The following components were added to the original project components in 1999 and resulted in the extension of the loan closing date by 9 months or from June 30, 1999 to March 31, 2000.

- (a) Construction of a 7 km steamline interconnecting all of the power plant steam collection systems so that it could function as one integrated network equipped with operational and production flexibility. PNOC-EDC introduced this component in 1999 after the initial effects of commercial exploitation indicated that there would be temporary steam deficiencies in some sectors and surplus steam in other sectors and that an interconnection would be necessary to maximize the efficiency of the system.
- (b) Updated reservoir assessment of the Leyte Geothermal Project to confirm the viability of the steamline interconnection project. The World Bank required that this component be

carried out in order to confirm PNOC-EDC's reservoir assessment and to confirm the soundness of its proposal to construct a steam highway.

A. Achievement of Objectives and Outputs

Outcome/Achievement of Objectives. The outcome and achievement of the objectives of the project to the extent of PNOC/PNOC-EDC'S participation are as follows:

- (a) meet the rapidly increasing demand for power in Luzon using indigenous and environmentally superior geothermal energy;

Achievement of the objective is satisfactory. The project contributed an additional 383 MW to the Luzon grid using the indigenous and environmentally superior geothermal energy.

The commissioning of the project and its eventual full dispatch in 1998 increased geothermal's share in indigenous energy mix from 12% in 1996 to 16% in 1998, while in terms of total energy mix, the project enabled geothermal energy to climb from 5.07% to 6.4%.

- (b) support the large ongoing private sector participation in power generation, and facilitate it by extending the national grid;

Achievement of the objective is satisfactory. PNOC-EDC entered into three (3) BOT agreements with two (2) private power companies for the construction and 10-year operation of three (3) geothermal power plants. The project paved the way for the interconnection of the Leyte and Luzon grids.

- (c) ensure the financial viability of PNOC-EDC for undertaking a long-overdue investment program.

PNOC-EDC's financial viability in the long term was ensured by the following factors emanating from project completion:

1. Increased revenue due to increase in electricity generation;
2. Increase in PNOC-EDC assets;
3. Decreased dependence on NPC for utilization of geothermal steam by transforming into an independent power producer;

Although PNOC-EDC is currently experiencing short term cash problems due to the mismatch between its 10-year BOT contract obligations and its revenue receipts from NPC, this has not reduced its ability to secure concessional financing to finance the shortfall. The company expects to start reporting a comfortable cash surplus in 2006 after completion of the BOT contracts.

OUTPUT BY COMPONENTS

Development of a 440 MW geothermal energy field to expand Leyte geothermal capacity from 200 MW to 640 MW, including

- i. **Drilling about 65 additional producer and injector wells in Malitbog, Mahanagdong and Alto Peak.** The outcome of this component is highly

satisfactory. PNOC-EDC was able to drill 59 (48 funded by Loan 3747 and 11 funded by Loan 3164) out of the 65 programmed wells. The balance of wells were not drilled due to the discontinuance of the development of the Alto Peak Sector and sufficient production and reinjection capacity had already been obtained from the wells already drilled. The bulk of the well drilling was completed by 1997.

Abandonment of Alto Peak Sector Development. In January 1997, PNOC-EDC informed the World Bank that it would indefinitely discontinue the development of the Alto Peak Sector based on the following considerations:

- After the drilling of several wells in the sector, data indicated that the Alto Peak resource consists of a high permeability central core of limited size (1 sq. km only) surrounded by cooler rocks which are poorly permeable. The core region and immediate surrounds are the only areas where commercial geothermal production can be obtained.
- Geothermal chemistries in the core are dominated by acid magmatic fluids and high NCG (Non-Condensable Gas) levels.
- There is some localized occurrence of neutral fluids within the central core region as demonstrated by one well. It is believed however, that with the general dominance of acid fluids in the core, the neutral fluids in the well would become acidic after some production time.
- A re-assessment of geothermal reserves indicates that the total resource at Alto Peak has a development potential of 52 MW. However, when resource blocks dominated by acidic fluids are removed from this, there is at best only 27 MW of resource available and at worst, 10 MW, if the neutral fluid in the well discussed previously turns acidic and the undrilled resource to the North proves to be too cool to utilize.
- Economic analysis indicates that a minimum of 60 MW of neutral resource is required to justify development.

Prior to the decision to abandon Alto Peak, PNOC-EDC also examined possible technological solutions in the development of Alto Peak as follows:

- The use of exotic materials such as high chromium and/or titanium for well casings and steamfield piping and vessels. With the cost of these materials being substantially greater than standard carbon steel (up to 30 times), the economics of development at Alto Peak was clearly unfavorable
- The use of reboilers to reduce the high NCG levels. Although untested in the geothermal industry at a commercial level of steam production, the use of reboilers remains a viable option for reducing gas levels and could be implemented provided the problem with acid fluids can first be resolved.

- ii. **Contracting technical services for geothermal drilling.** Outcome of this component is **highly satisfactory**. Throughout the project implementation, PNOC-EDC was able to contract out technical drilling services contracts with internationally known companies for directional drilling, well cementing, hardbanding, inspection, fishing, acidizing, mud and corrosion control services. In addition, PNOC-EDC entered into 2 contracts for the rental of three rigs from the United States and India which were used to drill approximately 50% of the programmed wells for the Leyte Luzon Geothermal Project.
- iii. **Constructing steam gathering systems.** Outcome of this component is **highly satisfactory**. PNOC-EDC constructed fluid collection and disposal systems (FCDS) in Mahanagdong and South Sambaloran capable of providing the requirements of an aggregate power plant installation of 383 MW.

The South Sambaloran FCDS was completed on June 14, 1997 while the Mahanagdong A and B FCDS was completed on April 30, 1997. For the optimization project, the FCDS of Tongonan I and Mahanagdong A were completed on June 22, 1997 and the FCDS for the Mahanagdong B Topping Plant and the Malitbog Bottoming Plant were completed in August 1997 and on November 30, 1997, respectively. All systems were completed on schedule and well within budget.

- iv. **Constructing the related subtransmission systems in Leyte.** Outcome of this component is **highly satisfactory**. The subtransmission system for the main plants was completed on January 21, 1997 while the subtransmission system for the optimization plants was completed on September 16, 1997 (Switchyards) and on August 24, 1997 (Transmission Lines). The systems were completed on schedule and well within budget.
- v. **Constructing a pilot reinjection plant for CO₂.** Outcome/achievement of the project is **less than satisfactory**. As early as 1995, PNOC-EDC firmed up its commitment to install and operate a pilot CO₂ injection project in Tongonan, Leyte, by creating a program defining the detailed design of the gas injection scheme. Along with this program, a Memorandum of Agreement with NPC whose Tongonan I Power Plant turbine would be the source of the non-condensable gases to be used for the testing, was executed on November 29, 1995. However, due to the highly specialized nature of the equipment required for the injection process, problems in the procurement developed and several re-bids were undertaken. The considerable delay in the procurement of the gas compressor therefore, made it impossible for PNOC-EDC to conduct the testing of the project and to subsequently present the results to the Bank before the Grant closing date. Despite the delay, PNOC-EDC confirms that it shall pursue the CO₂ injection project and submitted to the Bank a comprehensive operating plan for the gas injection trials. The gas compressor was delivered last March 2000 and installation is currently ongoing. Testing is expected to commence in September 2000 and will be completed by November 2000. Results obtained will be made available to the Bank.
- vi. **CO₂ Absorption and Sequestration in the Leyte Geothermal Reservation.** Outcome/ achievement of the project, one of the components of the GEF grant, is **highly satisfactory**. In 1997, in recognition of the potential role of tropical forests in mitigating global warming, PNOC-EDC commissioned the University of the Philippines Los Banos Foundation, Inc. to conduct a study of CO₂ sequestration in the PNOC-EDC Geothermal Reservation in Leyte. PNOC-EDC's geothermal reserves in Leyte included a large forested watershed that was assumed to serve as a carbon sink to offset the carbon emissions of the geothermal plant. The study therefore aimed to estimate the absorption index and amount sequestered by the different vegetation species in the geothermal reservation.

Aside from improving the economics of the Leyte Geothermal Project (versus an imported coal-fired power plant project), the Grant, through this study, enabled PNOC-EDC, to prove that its activities in Leyte will not exacerbate global warming. The study concluded that while the study area cannot absorb all the annual CO₂ emissions of the power plants, the amount of Carbon stored in the reservation as well as the Carbon to be sequestered for 25 years will more than offset the total Carbon that the power plants will emit in 25 years. The results of the study shall be used to estimate the Carbon stocks and rate of carbon sequestration of the entire Leyte geothermal reservation.

- vii. **Recruiting consultants to assist with project implementation.** The outcome/achievement of the component was **highly satisfactory**. For its technical assistance requirements, PNOC-EDC hired consultants with extensive experience in the development and construction of geothermal fields and power plants. The contract was originally bid out for the Leyte Cebu geothermal project and was subsequently amended to include the work under the Leyte Luzon project. The same firm was also hired to provide consultancy services for other fields such as geoscientific, drilling and power engineering.

In accordance with World Bank requirements, PNOC-EDC also hired the services of an overall project manager with extensive experience in operations and project management

- viii. **Construction of a 7 km steamline interconnecting all of the power plant steam collection systems so that it could function as one integrated network equipped with invaluable operational and production flexibility. (Additional Component).** Outcome/achievement of this component is **satisfactory**. Phase I, which connects Upper Mahiao to Mahanagdong was completed in June 2000. The entire interconnection project is expected to be completed by December 31, 2000.
- ix. **Updated reservoir assessment of the Leyte Geothermal Project to confirm the viability of the steamline interconnection project. (Additional Component).** Outcome/achievement of this component is **satisfactory**. The study was completed on December 31, 1999 and confirmed PNOC-EDC's strategy in the exploitation of the Leyte Geothermal Reservoir.

Execution of BOT contracts with private sector companies to construct and operate 440 MW geothermal power plants.

The outcome/achievement of this component was **satisfactory**.

PNOC-EDC entered into the following BOT agreements to provide 383 MW capacity for export to Luzon via the Leyte-Luzon link constructed by NPC:

Malitbog Power Plant – 2 x 77 MW, at one station. A 10 year BOT contract was awarded in September 1993 to construct and operate a 3 x 77 MW plant. The first unit intended for the Leyte Cebu geothermal project was commissioned on July 25, 1996, while the 2nd and 3rd units, intended to serve the Leyte Luzon Geothermal Project, were commissioned on July 25, 1997. Construction and installation of the 2 units was on schedule.

Mahanagdong A and B Power Plants – 3 x 60 MW, at two stations. A 10 year BOT contract was awarded in July 1994 to construct and operate a 3 x 60 MW generation facility split over two sites. Construction and installation were on schedule and the BOT contractor had little difficulty in meeting the deadline for commercial operation on July 25, 1997.

Optimization Plants, 49 MW, at 3 stations. A further 49 MW of geothermal power is being obtained from topping and bottoming plants resulting from field optimization studies. This 49 MW consists of:

- A single 17.3 MW non-condensing HP turbine upstream of the existing Tongonan I power plant (Tongonan I Topping Cycle);
- 3 x 6.4 MW non-condensing steam turbines upstream of each of the Mahanagdong A and B power plants (Mahanagdong A and B Topping Cycles); and

- a 14.6 MW low pressure condensing steam turbine downstream of the Malitbog Power Plant (Malitbog Bottoming Cycle).

All of the optimization power plants were bid out as a single BOT package. Construction work was on schedule and the plants were progressively commissioned in late 1997 and early 1998.

Reduction in Capacity. The reduced installed capacity of 383 MW brought about by the cancellation of the Alto Peak sector development turned out to be sufficient to meet and even exceed NPC's annual contracted requirements of 3,000 GwH due to the higher power plant efficiencies of BOT power plants (compared with existing NPC power plant efficiencies). Conversely, the reduction in installed capacity served to improve the financial viability of the project.

Project Cost and Financing. The total cost of the project amounted to US\$844.83 Million including interest during construction and was financed by (a) World Bank Loan 3747 for US\$55.69 Million (6.6% of total); (b) internal cash generation of US\$122.53 Million equivalent (14.5% of total); (c) Jexim cofinancing loan of US\$55.69 equivalent (6.6% of total); (d) a grant from the Global Environment Facility through the Global Environmental Trust Fund (GET) for US\$15 Million equivalent (1.8% of total); (e) 3 BOT contracts for the generating plants totaling US\$577.6 Million (68% of total); and (f) World Bank Loan 3164 or the Energy Sector Loan for US\$8.48 Million (1% of total).

The project's overall financing requirement inclusive of interest during construction was 13% lower than appraisal estimates mainly due to the reduced actual cost of steamfield development by 18% and the BOT power plants by 7%.

PNOC-EDC Geothermal Development. The cost of PNOC-EDC's geothermal development amounted to US\$257.4 Million, 18% less than appraisal estimates of US\$315.5 Million, despite the additional component of a steamline interconnecting the different power plant reservoirs. The reduction in cost was mainly due to the cancellation of the development of the Alto Peak Sector, the reduction of wells drilled from the programmed 65 to 59, and lower actual costs obtained as a result of competitive bidding. Savings in loan drawdown on the other hand were due to the undertaking by administration of civil and structural works and in-house drilling of approximately 50% of the programmed wells.

Significant cost overruns were incurred in the costs of pipes and fittings due to changes in design; the cost of engineering and supervision due to the cost of the project director's contract and technical services consultancy contract, both of which were not accounted for in the SAR estimates; and the cost of engineering and management which, as in the Leyte Cebu Project, was underestimated.

BOT Power Plants. The total cost of the 3 contracts with private power producers amount to US\$577.6 Million which was 7% lower than the appraisal estimate of US\$620.4 Million.

Of the \$114 Million World Bank Loan, only \$55.69 was disbursed. \$49.67 Million was cancelled from the loan on April 20, 1999 because of the (a) discontinued development of the 80 MW Alto Peak Sector; (b) use of PNOC-EDC owned rigs to drill some of the wells thus making corresponding expenses ineligible for funding under the loan; and (c) undertaking of civil and structural works in-house by PNOC-EDC in order to complete the project on schedule. An additional \$8 Million was cancelled from the remaining loan amount on June 26, 2000 after the Bank denied PNOC-EDC request to reimburse its in-house rig costs from the loan.

Similar cancellations of JPY5,195.4 Million (US\$49.67 equivalent) and JPY500 (US\$4.67 Million equivalent) were cancelled from the Jeximbank Loan on July 30, 1999 and June 26, 2000, respectively.

The SDR 10.8 Million GEF Grant, on the other hand, was fully utilized by March 31, 2000 and fully disbursed by July 31, 2000.

Financial Rate of Return. It was noted that the Project Financial Rate of Return (Annex 15, page 5) tables in the SAR for the Leyte Luzon Geothermal Project are identical to those presented in the SAR of the Leyte Cebu Geothermal Project and that there has obviously been some error in the compilation of the Leyte Luzon SAR.

Nevertheless, the re-evaluated Financial Rate of Return is 9.1% under the following major assumptions:

1. Levelized cash flow computations were based on 1999 cost levels
2. Electricity sales revenues based on Leyte PPA Nominated Energy of 3,000 GwH (Yr. 1997-first 7 mos. Of 1999 and last 5 months of Yr. 2000 and beyond) and 3,145 GwH (last 5 months of 1999 – first 7 months of Yr. 2000)
3. Electricity selling price based on Leyte Luzon PPA BER of P1.55 per Kwh (N. E. of 3,000 GwH) and unified Leyte A PPA BER of P1.581 (N. E. of 3,145 Gwh)
4. Electricity Sales revenues based on Leyte A PPA Contracted Energy of 3,000 GwH
5. ECA fees based on actual Nominated Capacities for Malitbog (2 units), Mahanagdong and Optimization Power Plants with VAT in 1997 and 1998.
6. Royalty and income tax on steam operations based on a steam price of P0.33 per Kwh.
7. PD 1442 still in effect with no amendatory legislation for additional fiscal incentives for geothermal
8. Power plant depreciation after takeover using double declining method.
8. Corporate income tax rates: 1997 = 35%; 1998 = 34%; 1999 = 33%; 2000 and beyond = 32%.

B. Major Factors Affecting Implementation and Outcome

a. Factors Outside the Control of Government or Implementing Agency

Delay in completion of NPC Component. NPC's component of the Leyte Luzon geothermal project was completed only on August 2, 1998, (13 months after the completion of Leyte Luzon's main plants) due to difficulties encountered in land purchases and acquisition of right of ways.

Asian Financial Crisis. The Asian Financial Crisis, as stated in the Leyte Cebu ICR was a significant external factor beyond the control of the government and the implementing agency. The sharp devaluation of the Philippine Peso and its consequent downward effect on the Philippine economy and therefore power demand has had a significant impact on PNOC-EDC's financial status.

b. Factors Generally Subject to Government Control

Passage of Omnibus Power Sector Reform Bill. The Omnibus Power Sector Reform Bill involves the restructuring of the Power sector and the privatization of the National Power Corporation, aimed at creating competitive electricity markets to drive down electricity prices, shifting market risks to the private sector and relieving government of the heavy burden of financing the sector.

The versions in the lower house (namely, HB 8457- Electricity Industry Reform Act) and 4 bills in the Upper House (namely, SB 1712 – Creation of the National Transmission Company; SB 1621 – Amending the DOE Law; SB 1943 – Amending EO 172 Creating the Energy Regulatory Board); and SB 2000 (Electric Power Industry Policy Act) have been separately approved by the House of Representatives and Senate and are currently being taken up jointly by a Bicameral Conference Committee. The bicameral sessions have since been suspended due to the failure of the House and Senate panels to reconcile several contentious issues including the legal entanglements arising from the Senate’s decision to tackle the privatization and restructuring in 4 separate bills. The passage of the reconciled versions of the bill is expected to be achieved not earlier than September 2000.

Impact of Omnibus Power Sector Reform Bill on PNOC-EDC. Under HB 8457, NPC shall be spun off into 6 generation companies (GenCos) wherein NPC shall allocate responsibilities for its liabilities, in form of equity, loans or contracts to spin-off companies. NPC shall also divest its transmission and subtransmission assets to NTC (National Transmission Company). SB 2000 provides for a joint legislative and executive committee to determine the privatization of NPC. In both cases, NPC’s privatization may entail a review of PNOC-EDC’s contracts with NPC to determine the avenues to effect possible reduction in electricity prices.

SB 2000 also provides for the parity of tax treatment between indigenous and non-indigenous sources of energy which is a favorable aspect for PNOC-EDC as it results in a material reduction in geothermal steam prices making it more competitive with other sources of energy. Lastly, SB 2000 also specifies that the privatization of hydro and geothermal generating systems shall be deferred until the privatization of all other generating systems has been completed.

c. Factors Generally Subject to Implementing Agency Control

Competence and Professionalism of BOT Contractors. BOT contractors engaged were of high professional caliber and the construction of the power plants were carried out in a highly efficient and competent manner resulting in their timely completion.

Extensive Experience of PNOC-EDC in Steamfield Development. PNOC-EDC’s extensive experience and competence in steamfield development allowed for timely and cost-efficient completion of the project.

A. Sustainability

The project’s sustainability during its project life is likely with prudent management of the geothermal reservoir. An independent resource re-assessment conducted 6 months after the commencement of commercial exploitation of the Leyte reservoir advised that the following actions be undertaken to ensure sustainability of the reservoir:

1. The design and construction of the steamline interconnection assume top priority so that the existing excess in available steam within the Tongonan production sectors can be utilized in Mahanagdong or in other fields which may henceforth show capacity decline.
2. The current shortfall in steam supply to the Mahanagdong plants should continue to be made up by drilling new wells from existing production well pads in the Mahanagdong steamfield and by the workover of existing wells that show signs of chemical scaling
3. Numerical simulation models of the Tongonan and Mahanagdong reservoirs should be completed so that future trends in steam availability may be predicted and

reservoir management strategies can be developed to optimize energy recovery from the entire Leyte geothermal project.

Initial simulation studies conducted in the early 1990s indicated that maintenance and replacement wells would be immediately required within the first few years of commercial production of the greater Tongonan field. Based on the simulation results, as many as 12 make-up and replacement wells would be required within the first year of production, 6 of which would be in Mahanagdong. However, based on actual operations of the field, only 2 wells were drilled in Mahanagdong since commissioning in 1997, and no additional drilling has been required in the other sectors. Furthermore, except in Mahanagdong, the capacities of the plant have been maintained without well workovers. Drillout of blockages caused by mineral deposition were undertaken in Mahanagdong wells to sustain the individual well capacities. Results therefore indicate that the simulation study provided a more conservative figure in terms of the number of well requirement and cost of M&R drilling.

The updated simulation study currently being carried out for Tongonan and Mahanagdong is ongoing as of report's writing. Although preliminary matches were already obtained between actual data and simulation model, there is still a need to come up with a more accurate representation of the field in order to provide a more reliable prediction of the field performance over the life of the plants. The modeling study is further complicated by the intense dynamism of the reservoir wherein significant changes in reservoir behavior are still occurring since the commencement of commercial exploitation in 1996. It therefore appears that the field has still not stabilized since commercial operation commenced. Nevertheless, the simulation study is proceeding smoothly and PNOC-EDC expects to complete the matching within the year.

Difficulty in completing the earlier simulation study by PNOC-EDC is also due to the lack of pre- and post-graphics processors of the simulation software which will aid in the evaluation of the simulation runs. The graphics processors will provide visual representation of the simulation runs during modeling and will speed up the run analyses. This was partly addressed with the acquisition in April 1999 of a pre-processor through the GEF fund. PNOC-EDC is currently sourcing out and evaluating possible post-processors which PNOC-EDC can use to further accelerate the simulation study completion.

Transitional Arrangements for Future Operations. The BOT plants will be turned over to PNOC EDC in 2007. PNOC-EDC in the meantime has formed a Power Department in charge of monitoring the maintenance and operation of these plants and will be instituting in the next 2 years a formal training program for its personnel in the maintenance and operations of these plants. The BOT contracts further provide for training of PNOC-EDC personnel 1 year prior to the formal turn-over.

Performance Indicators. Indicator of the performance of the project is annual nominated energy or annual available energy.

D. Bank and Borrower's Performance

Bank. Bank's performance was satisfactory.

Borrower. The borrower's performance was **satisfactory**. All project components and obligations were carried out and completed either on or ahead of schedule. Procurement and disbursement was carried out satisfactorily with a few exceptions since the borrower was familiar with the Bank's procurement and disbursement guidelines.

E. Lessons Learned

1. The BOT financing mode versus other financing modes that could have been made available by the World Bank to PNOC-EDC is expensive. In addition, the resultant shorter term BOT contracts (10 years) and the longer term electricity sales contract (25 years) result in a financing gap which has to be managed by sourcing out bridge financing and implementation of prudent financial management.
2. For BOT projects and all other projects with innovative financing modes, the treatment of the components that make up financial covenants agreed upon should be clearly defined in the loan agreement to prevent future ambiguities and possible default by borrower.

**LEYTE LUZON GEOTHERMAL PROJECT
BORROWER'S DRAFT IMPLEMENTATION COMPLETION REPORT
NATIONAL POWER CORPORATION**

A. STATEMENT OF OBJECTIVES

Project Background

The five indigenous energy sources that could be developed potentially during the conceptual stage of the project were coal, hydropower, geothermal, oil, and natural gas with the following general considerations:

- Geothermal reserves are not yet fully evaluated but its power potential is expected to exceed 6,000 MW. About 1,000 MW are already produced and another 640 MW can be immediately developed to support the Leyte-Luzon and Leyte-Cebu interconnections.
- Proven oil reserves amount to only 4 million tons and have been declining.
- Discovery of natural gas offshore of Palawan which is expected to provide 8 trillion cubic feet; but requires substantial exploration to confirm the size of the deposit and its economic viability.
- Total coal reserves are estimated at about 1,500 million tons but most of this coal is low grade and expensive to mine.
- Hydro resources are quite substantial, with a theoretical power potential in excess of 10,000 MW but the better sites are not readily accessible requiring longer tie lines. In addition, their development has become uncertain given environmental concerns; higher initial capital investment and long development period; and, resistance of affected residents and guerilla activities in the remote areas. As a result, no single project has been completed in the last decade. There are various proposed run-of-river small hydro projects but those feasible could not add more than 300 MW to the system.

Consequently, the most promising and sustainable indigenous source, considered during the project conceptual stage, came out to be the geothermal energy.

The projected increase in the growth of Gross Domestic Product (GDP) from 3.5% per annum between 1990 to 1995 to 5.5% per annum between 1995 to 2000 is expected to result in the rise of energy consumption by 6.4% per annum. This expectation would prove the need and would warrant the development and implementation of a generation expansion program.

Because of the above considerations, the selection of the geothermal fields in Tongonan, Leyte to be the indigenous source for power generation became most appropriate. The geothermal field is found to be capable of supporting the steam requirement of geothermal power plants with a total combined capacity of 640 MW. With this available capacity, the interconnection of the island of Leyte to the Cebu-Negros-Panay grid and to the Luzon grid is required to warrant the full utilization of the energy that will be produced. Thus, the power development scheme consisting of the Leyte-Luzon and the Leyte-Cebu Interconnection Projects by the National Power Corporation (NPC or the Borrower); and, the Leyte Geothermal Plants by both the Philippine National Oil Company (PNOC) and its subsidiary, the Energy Development Corporation (EDC) was realized.

Project Objectives

The main objectives of the Leyte-Luzon Interconnection Project under IBRD Loan No. 3746-PH of the World Bank (WB or the Bank) are as follows:

1. Meet the rapidly increasing demand for Luzon using indigenous and environmentally superior geothermal energy;
2. Strengthen the energy sector by implementing institutional, planning and financial improvements recommended by the Energy Sector Plan (ESP);
3. Support the large ongoing private sector participation in the power generation, and facilitate it by extending the national grid;
4. Strengthen the Borrower's capabilities in environmental and social impact analysis;
5. Introduce expanded co-financing operation (ECO) financing in the Philippines; and
6. Ensure the viability of NPC and PNOC for undertaking a long overdue investment program.

PNOC will be responsible both for the development of the steamfield resource and for electricity generation on the basis of Build, Own and Transfer (BOT) contracts with private sector companies to construct 440 MW geothermal power plants. On the other hand, NPC will be responsible for the transmission of power from the Leyte Geothermal fields of PNOC to the Luzon Grid using High Voltage Direct Current (HVDC).

The very serious power crisis experienced by the country from 1991 to 1992 made the funding of the Leyte-Luzon Geothermal Project by the Bank very timely and most welcome. The Project's objectives are consistent with the Government's highest priority, i.e., to reform and improve the energy sector.

Project Components

There are two major and distinct projects covered by the loan, namely:

1. The Leyte-Luzon Interconnection Project - this involves the interconnection of Leyte and Luzon islands to transmit 440 MW at 350 kV monopolar facility to the Luzon Grid through a HVDC transmission network, consisting of (a) Submarine Cables; (b) Converter, Electrode & Cable Terminal Stations; and (c) Overhead Transmission Lines & Electrode Lines. This project covers a distance of nearly 500 km. Since the HVDC power transmission is a new technology in the country, the services of consultants were tapped to assist in the implementation.
2. The Naga-Tayabas Rehabilitation Project – this involves the rehabilitation of the 205 km. extra high voltage (EHV or 500 kV) overhead transmission lines between Naga and Tayabas Substations in Luzon Island. The original line was completed in 1987 but extensive damages due to typhoons and pilferage were incurred afterwards, thus needing such rehabilitation. This project will reinforce the transfer capability in the Bicol Region (Southern Luzon) and to transmit power from Bicol to the Luzon Grid. This line is therefore is a vital link of the Leyte-Luzon HVDC Power Transmission Line. The Naga-Tayabas section is actually the 2nd phase of the Naga-Kalayaan 500 kV Rehabilitation Project, after having completed rehabilitation of the Kalayaan-Tayabas section (1st phase) which was energized in February 1996.

B. ACHIEVEMENT OF PROJECT OBJECTIVES

Physical Objectives

The Leyte-Luzon Interconnection Project successfully achieved its objectives by completing the following:

- (a) Construction of two (2) converter stations (one in Ormoc, Leyte Island and the other in Naga, Luzon Island) and related remote electrode stations; construction of two (2) cable terminal stations (also one in Cabacungan, Leyte Island and the other in Matnog, Luzon Island). These were completed on November 5, 1997 and were energized on March 17, 1998.
- (b) Installation of about 23 km. submarine cables linking the cable terminal stations in Leyte and Luzon Islands. The installation of submarine cables was completed two (2) months ahead of schedule. As early as February 28, 1997, the installation of the cables was already completed. This was energized much later on March 17, 1998 upon the completion of the overhead transmission lines and electrode lines.
- (c) Construction of 468 km (187 km in Luzon & 281 km in Visayas) of HVDC overhead transmission lines from the two converter stations to their respective cable terminal stations, and construction of electrode lines linking the two converter stations to the electrode stations. Completion was delayed mainly due to ROW problems.

As a whole, this interconnection project commenced on June 15, 1994. The original target completion of the project was on June 30, 1997, to meet the target operation date of July 25, 1997 based on the signed agreement between NPC and PNOC. Because of the several factors causing the delays, NPC and PNOC eventually moved the target completion to November 29, 1997.

Physical completion of the entire project was achieved in November 1997 and switch-on ceremonies were held on December 13, 1997. The actual energization was accomplished later on March 17, 1998 and actually delivered power to the Luzon grid in limited capacity as its test and commissioning phase started. The system tests were also delayed due to various reasons, foremost of which, was the systems limitations of the existing system of NPC that prevented the full testing and commissioning. Consequently, all tests were declared completed on August 10, 1998 and commercial operation officially commenced on August 11, 1998.

Likewise, the Naga-Tayabas Rehabilitation Project successfully achieved its objectives. The rehabilitation works between Naga and Tayabas in Luzon Island started in April 1997 and completed in April 1998. With this, the reinforcement of power transfer capability in the Southern Luzon has been realized, with the line now serving as a vital link of the Leyte-Luzon HVDC Transmission Line.

During the early implementation of the Leyte-Luzon Interconnection Project, the Japanese Yen greatly appreciated against the US Dollar, affecting the contracts denominated in Yen, exhausting the amount originally allocated. As a result, the Bank could not issue its commitment to support portion for the rehabilitation of the Naga-Tayabas Transmission Line under the Leyte-Luzon loan. As the Bank itself recommended, the project was eventually lined-up for funding under the Transmission Grid Reinforcement Loan (TGRL), WB Loan No. IBRD 3996-PH. Hence, the contracts for the supply of power conductors, overhead groundwires and optical groundwires were excluded from the Leyte-Luzon loan and included in the TGRL. The rehabilitation works proper, was maintained under the Leyte-Luzon loan.

It should be noted that the preparation of designs for a hydroelectric power project at Casecnan in Luzon Island was cancelled and the preparation of Feasibility Study became the responsibility of NIA as lead agency for the Casecnan Project.

Financial Objectives

The original project cost, based on the Bank's allocation, was US\$ 365 Million. Funds were sourced out from the WB, Japan-Eximbank, Swedish Board for Investment and Technical Support (BITS) Grant, Global Environment Trust (GET) Grant and ECO-financing loan. However, due to various variation orders to meet existing field conditions and increase in the payment of ROW claims incurred during construction, the actual project cost increased to US\$ 473 Million (nearly 30% more than the appraisal estimate).

The submarine cables, overhead transmission lines and consultancy services were funded by WB, Japan-EximBank and GET Grant. The converter and electrode stations were funded under the ECO-Loan and BITS Grant

On June 6, 1995, the Bank agreed to NPC's request for reallocation of loan, increasing the available fund for contracts for the installation of submarine cables, overhead transmission lines and consultancy services for the Leyte-Luzon Interconnection Project. Cost changes were due to the following:

- Increase in actual length of the submarine cables as well as the need for cable protection.
- Various ROW problems and re-routing of the lines due to unsuitable soil conditions.
- Increase in the administrative and engineering costs provided in the Power Crisis Act of 1993
- Variation Orders due to field changes to meet existing conditions

Perhaps, one the more notable feats was that the loan did not require extension beyond the original closing date of June 30, 1999. The project, on the average, was physically completed around 1-1/2 year before closing date, giving ample time to process remaining disbursements from the loan. While the loan agreement noted that the project was expected to be completed by June 30, 1998, the project was physically completed by the end of 1997.

C. MAJOR FACTORS AFFECTING THE PROJECT

The major problems encountered during the implementation of the Project were as follows:

1. Delay in the effectivity of loan and contracts:
 - (a) Due to delays in complying with the loan pre-conditionalities, the contract effectiveness of all major project components were affected. From contract signing, it took 303 cal. days for the submarine cables contract to become effective (168 cal. days for the overhead lines contract, and 127 cal days for the stations contract). This resulted to the movement of the project target completion date, based on the NPC-PNOC Power Purchase Agreement (PPA) and the Loan Agreement, from July 25, 1997 to November 29, 1997.
 - (b) Postponement of bidding schedules in order to: i) incorporate additional provisions/contract specifications required by the Bank, ii) accommodate complaints and clamor of bidders aired through the Bank, and iii) conduct re-bidding because of substantial variations between the Borrower and Bank estimates.

- (c) Prolonged effectivity of the contracts following the Bank's strong stand not to issue the special commitment which is required to establish the Letter of Credit, without the Borrower's compliance on the power rate restructuring for Visayas and Mindanao.
 - (d) Re-allocation of funds for some contracts having Japanese Yen currency contract denominations due to the appreciation of the Japanese Yen against the US Dollar. With this re-allocation, financing of some projects had to be withdrawn from the loan, such as the Feasibility Study of Casecnan Hydroelectric Project and the supply contracts for the rehabilitation of the Naga-Tayabas EHV Transmission Line.
2. Delay during project construction and test/commissioning:
- (a) The foremost problem during construction was ROW. There was minimal lead-time allocated for ROW acquisitions, and inconsistent policies on ROW valuation/acquisition of land and land rights, among others.
 - (b) Problems that are direct offshoots of some deficiencies in the specifications.
 - (c) Suspension of the test and commissioning from May 4 to 17, 1998, in compliance with the directive of the "Task Force *Halalan* (Election)" of the System Operations, to maintain the grid security and stability during the critical phase of the Presidential election in the country.
 - (d) Deferment of the schedule of testing for reasons of national security, to likewise maintain systems stability and security during the turnover of the reigns of the government from the previous to the present administration.
 - (e) Deferment of the energization of Line 1 of the Naga-Tayabas EHV T/L Project. This line is needed for the full power test and over-load test.
 - (f) Limitation on time for the testing of the HVDC system due to systems limitations. For instance, testing had to be scheduled on very early mornings, with limited time of only one hour and only on specific days of the week - even while test actually required from 2 to 4 hours.
 - (g) Replacement of defective thyristor valve resistors and converter transformer

D. PROJECT SUSTAINABILITY

The Leyte-Luzon HVDC Transmission Line project has been in commercial operation since August 11, 1998. Presently, Luzon is benefited with up to 440 MW power supply from the Leyte Geothermal fields of PNOC. The completed project also assures Luzon of continuous and reliable power supply using an environmentally preferable indigenous source.

The project is ensured of continued support by the government to maintain the achievements done, considering that the project is in line with the government thrust as follows:

- Sustained power development - there is enough steam economically and financial viable to sustain energy production during the economic life of the geothermal plants.
- Promotion of private sector participation in energy projects – the generation facilities were contracted by private power utilities. Potential private players will have a bigger market with the expansion of the national grid.

- Utilization of indigenous resources and reduction of dependency on oil fired plants – the Philippines is rich in geothermal steam and with its full development, the country could save its dollar reserves which would have been allocated for importation of oil.
- Favors use of environmentally superior power facilities – the submarine cable is non-pollutant as compared to a thermal plant (if one such plant must have to be installed instead of a submarine cable to serve the target area). The use of geothermal steam for power generation, followed by re-injection of the effluent liquid and gases into the ground, is environmentally superior to other fossil fuels because it produces much lower emission of carbon dioxide, sulfite and nitrogen oxide.

E. BANK PERFORMANCE

The performance of the Bank in this project is satisfactory. The Bank exerted diligent efforts in assisting to reform NPC, and the energy sector, in general. The Bank, through the completed project, helped to alleviate the power crisis, expand base load power capacity and assist the Borrower in expanding and reinforcing the required transmission system. With Bank's support, the Government has already implemented far-reaching reforms in the power sector, as it has adopted policies and strategies and made institutional improvements which conform to Bank policies.

Bank's intervention in the sector has been critical in helping define the improved policies and actions in the Energy Sector Action Plan, establishing and strengthening the Borrower's finances and institutional arrangements, improving its efficiency and promoting private sector generation of power, to ensure a robust implementation of its power program. Bank's support has also been critical in organizing the financial engineering required for the Leyte-Luzon Interconnection Project. By completing the sector study "Toward Improvement Management of Environmental Impacts", the Bank has also supported a balance between the country's energy development and sound environmental practices.

F. BORROWER PERFORMANCE

The performance of the Borrower was generally satisfactory. During project preparations, most requirements were readily submitted by the Borrower to the Bank which in turn readily gave its No-Objections to the project implementation. Exception is made on the pre-condition requiring NPC and Meralco to have a signed Power Purchase Agreement, which was delayed for eight months. With the signing of the NPC-Meralco PPA in March 1995, the Borrower satisfactorily complied the Bank's requirements for loan effectivity.

There were instances of postponement of bidding schedules in order to incorporate additional provisions/contract specifications required by the Bank, thus causing delays in implementation. Further, pre-qualification procedures of the Borrower were not effective enough to disqualify contractors and suppliers which are financially unstable.

During project implementation, the Borrower experienced difficulties with perennial ROW problems. The Borrower was not able to ensure timely acquisition of lands and ROW, causing delays in erection/construction works. There were disagreements with landowners on the price of the affected properties forcing the Borrower to file expropriation cases which took time to resolve in the courts. Variation orders were implemented and affected financial performance. Some delays were also attributed to other government agencies and even local government officials who intervened in the process and aggravated the ROW acquisition.

G. ASSESSMENT OF OUTCOME

The overall outcome of the project was satisfactory. The project has achieved most of its major objectives and is likely to maintain satisfactory results, with only a few minor shortcomings. The project proved instrumental in fostering the development of geothermal resources in the Philippines. It also served as an important catalyst in improving the sustainability of the overall power sector through its efforts in effecting the financial recovery of the Borrower. More so, it must be emphasized that such recovery is genuine in that it included electricity tariff increases with automatic adjustment mechanisms, rather than relying on significant and distorting subsidies or direct budgetary transfers from the government.

The main objective was achieved, i.e., to supply the Luzon grid with an initial power of 440 MW by harnessing the geothermal reserves of Leyte, representing a big step towards the ultimate goal of interconnecting the different island grid into a single national grid to be known as the Philippine National Grid. The project components as per SAR are successfully completed and energized, to wit: (a) Submarine Cables, (b) Converter, Electrode & Cable Terminal Stations; and (c) Overhead Transmission Lines & Electrode Lines.

Considering that the project commenced in June 1994, it was physically completed after around 3-1/2 years in November 1997 and was in commercial operation after more than four (4) years in August 1998. This shows the substantial period between physical completion, energization, testing and commercial operation. But, overall, the delay was mainly due to extensive period incurred for contract effectivity and ROW problems for the overhead transmission line contracts. It should be noted that while the other major components such as the converter stations, cable terminals stations and submarine cables were completed much earlier than the overhead transmission lines, the test of the whole system test required the completion of the overhead lines.

The other objective of rehabilitating the Naga-Tayabas line, which is part of the backbone transmitting energy from Southern Luzon to Manila was physically achieved. But financially, this project showed how the currency fluctuations affect the appraisal estimates, requiring additional funds outside the original loan to make possible the allocation of funds for the contracts under the interconnection project, which is the primary loan component. Overall, the successful completion of both projects indicated the flexibility of both Borrower and the Bank during difficult times.

H. FUTURE OPERATIONS

Damage to the transmission line and power interruption can be caused by explosion, fire, typhoon or sabotage. These problems will be dealt with by regular inspection by a transmission line monitoring group, and by an emergency response program. An effective and timely response to such emergencies will require adequate manpower and transportation equipment. Regular clearing of the transmission line route using labor will be required.

An alarming frequency of pilferage and sabotage of NPC transmission line facilities by lawless elements threatens the continuous delivery of generated power. Much of the transmission line route is far from military camps and detachments. A comprehensive and integrated program has been formulated by the Borrower to encounter the problem of pilferage and acts of sabotage against transmission lines and facilities. Part of the program generates public awareness, cooperation and support in protecting NPC's transmission line facilities. It also grants monetary payments to communities for overseeing the lines and for helping in the recovery of pilfered transmission line materials or the apprehension and prosecution of pilferers/saboteurs.

A land management group will develop a land utilization or rehabilitation program along the transmission line route, ensuring control of erosion in areas affected by the transmission line.

Under the Borrower's restructured organization, there are two main groups, namely Core Businesses and Non-core Businesses. The operation is classified under Core Businesses with 2 main groups, namely Generation Company (GENCO) and Transmission Line Company (TRANSCO). The Leyte-Luzon HVDC Transmission Line is presently handled by TRANSCO, and is responsible for its adequate staffing, training, management, operation and maintenance. Presently, the maintenance of the submarine cables is handled mainly by operations personnel based in the Luzon side, specifically in Naga, Bicol Region.

In order to monitor future operation and development impact of the project, the following performance indicators in the Luzon Grid are proposed to be monitored; a) Per Cent System losses (energy output/energy input) b) Per Cent System Reliability (energy supplied to distribution system/energy to be supplied to distribution system; and c) Frequency deviation (number of days per year which recorded more than 40 times of system frequency beyond control target of 60+/- 0.3 Hz).

In the 1990 Long-Range Power Transmission Study submitted by NPC Consultants, the Leyte-Luzon HVDC Transmission Line will be uprated from 440 MW to 880 MW in the near future.

I. KEY LESSONS LEARNED

To avoid, or at least minimize, recurrence of the problems experienced during the implementation of the project, the following measures are recommended:

1. During Tendering and Award of Contract:

- (a) Design and pre-construction activities must be well planned and coordinated to assure completed and accuracy of inputs to technical specifications.
- (b) Cost estimates must be thoroughly reviewed and evaluated before conduct of bidding.
- (c) Borrower and the Bank should mutually work out solutions to speed up approval of bid evaluation results and issuance of disbursement clearances.
- (d) The preparation of technical specifications must undergo a thorough study, investigation and evaluation .
- (e) The scope of work for each contract pay item must be clearly defined to avoid variation orders.
- (f) For projects containing complex technical component, available references and studies should be ascertained if these are suitable for project appraisal.

2. During Project Construction

- (a) The solution to ROW problem should be prioritized in terms of policies and guidelines acceptable to affected landowners.
- (b) ROW activities should be given appropriate lead time depending on the size of the project and the expected magnitude of ROW efforts (from 2 to 4 years or more if needed), thus providing a modicum of assurance that the ROW is acquired prior to the start of construction activities.

- (c) A common schedule of values for all affected improvements and the different classification of land usage for each project should be adopted, as a matter of policy, to expedite ROW claims.
 - (d) A system of instructions and procedures delineating all the required steps and documentation for all types of claims should be developed and implemented.
 - (e) Inter-office or inter-agency coordination should be standardized to facilitate processing of problematic ROW claims, i.e. expropriation cases, legal action, appraisal, registration of deed, registration of title/untitled lands, etc.
 - (f) Full support of other government agencies involved in the processing of ROW documents should be secured, particularly for the speedy court decisions on expropriation cases.
 - (g) There must be adequate and qualified personnel to handle negotiations and expropriation cases.
 - (h) When procurement contracts contain materials that experiences sudden, unexpected increase in price on world markets, Bank and Borrower should mutually exert efforts to minimize the time of bid processing and evaluation to be able to award the contract promptly.
3. For the Borrower to maintain sufficient cash flows to service satisfactorily future borrowing, it must continue to insure that tariff levels are broadly in line with the Long-Run Marginal Cost (LRMC) of generation and transmission and that all user groups are charged a tariff that matches the average LRMC of generation and transmission.
4. The Borrower must continue to design power projects where the financial and economic benefits are transparent and where subsidies from the Government are not required for any development works.