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# OWNERSHIP, FINANCING AND LICENSING OF GEOTHERMAL PROJECTS IN THE PHILIPPINES

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## ABSTRACT

The Philippines has a total installed geothermal power capacity of 1,905 MW (13% of the country's total installed generating capacity) and now ranks second in the world next to the United States. An aggressive geothermal exploration and development program was formulated following the energy crisis of the 1970s and was carried out by Philippine Geothermal Inc. (PGI), a private company now with 756 MW of steam field capacity, and PNOC Energy Development Corporation, a government owned and controlled corporation now operating 1,149 MW. PNOC EDC implemented its geothermal activities with Official Development Assistance (ODA) loans from World Bank (WB) and the Japan Bank for International Cooperation (JBIC). The WB helped finance exploration drilling and delineation of several areas, through sector loans, to help the energy sector develop the country's geothermal resource potentials. After establishing technical and financial feasibility, subsequent WB project loans financed the development and commissioning of 777 MW of geothermal fields and power plants. The JBIC, also through project loans, helped finance 305 MW. National Power Corporation (NPC) traditionally was in charge of the power plant side of geothermal development, but an Executive Order, and later, a BOT law, allowed the private sector's participation in geothermal power generation through Build-Operate-Transfer (BOT) contracts on the power plants. ODA financing enhanced the viability of geothermal projects. This concessionary financing was made available pursuant to the government's energy sector goals and objectives. Project proposals undergo evaluation by the National Economic and Development Authority (NEDA) to ascertain economic and financial viability. Geothermal projects also require the Environmental Compliance Certificate (ECC) issued by the Department of Environment and Natural Resources (DENR). WB and JBIC appraisal of PNOC EDC's geothermal projects included due diligence by Bank consultants on the technical and financial feasibility, thorough consideration of environmental and social issues, and assessment of PNOC EDC's implementation capability.

## 1. INTRODUCTION

Pioneering work in geothermal energy reached a milestone in 1969 when the Philippine Institute of Volcanology (PIV) in the Tiwi geothermal area in the province of Albay in Southern Luzon successfully discharged a shallow geothermal well which was used to power a 2.5 kW non-condensing geothermal pilot plant. The successful feasibility study undertaken in Tiwi stimulated the move towards commercial exploitation of the country's geothermal resources. In 1970, the government declared 17,660 hectares of land in Tiwi, Albay as a geothermal reservation area and gave the National Power Corporation (NPC), the state-owned electric utility firm, the responsibility of administering the exploration and development of Tiwi.

In 1971, NPC entered into a service contract with Philippine Geothermal, Inc. (PGI), a subsidiary of Union Oil Company of California, (UNOCAL) to develop the Tiwi geothermal field and serve as steam supplier to the geothermal power plants to be set up by NPC. In 1973, an addendum to the service contract was signed between NPC and PGI to include the exploration and development of Makiling-Banahaw (Mak-ban) geothermal field in the province of Laguna wherein PGI shall also supply the steam to NPC's geothermal power plants.

The Philippines embarked on an accelerated program to develop and utilize geothermal energy following the energy crisis in 1973. From 1973 to 1976, the Philippine government entered into bilateral agreements with New Zealand, Italy and Japan for technical expertise in exploration, development and utilization of geothermal energy. With NPC as the implementing agency and assisted by consultants from New Zealand, temperature gradient wells were drilled in the geothermal areas of Tongonan in the island of Leyte and in Palinpinon in the southern part of the island of Negros. Both areas proved to be capable for full-scale production of power.

In 1976, the Philippine government, through the Philippine National Oil Company (PNOC), created the subsidiary company, PNOC Energy Development Corporation (PNOC EDC), to take over the exploration and development functions of NPC in the Tongonan and Palinpinon geothermal fields. NPC would still be responsible for the power generation side and would remain the buyer of geothermal steam.

Geothermal exploration, development and utilization activities in the Philippines are governed by Presidential Decree No. 1442, or the Geothermal Service Contract Law, promulgated in 1978. A developer or investor must enter into a Geothermal Service Contract with the Bureau of Energy Development of the Ministry of Energy (now the Department of Energy), the implementing arm of the government. Under the Geothermal Service Contract, the contractor will provide the necessary expertise, technology and financing to explore, develop and utilize the geothermal resource. The contractor will, in turn, receive a maximum of 40% of the net proceeds from the sale of the steam to the generating facility. Net proceeds are computed by deducting all necessary expenses incurred from the gross revenues. The Geothermal Service Contract also provides incentives such as exemption from the payment of customs and import duties for materials, machinery and equipment needed in geothermal operations.

## 2. ACCOMPLISHMENTS IN GEOTHERMAL RESOURCE DEVELOPMENT AND PRODUCTION

PGI and NPC completed and brought into commercial operation the first 110 MW geothermal power plant in Tiwi and the first 110 MW geothermal power plant in Mak-ban in 1979. By 1982, PGI and NPC were already producing 330 MW of geothermal power in Tiwi and 330 MW in Mak-ban. Additional power generating units were later constructed in Mak-ban to optimize the geothermal resource bringing the present installed capacity to 426 MW.

Upon its creation in 1976, PNOC EDC became the government's arm in implementing the exploration and development of the Tongonan, Palinpinon and other geothermal fields in the country. Several other areas were explored and drilled with very satisfactory results which led to eventual development and production. These areas include the Bacon-Manito (Bacman) geothermal field in the provinces of Albay and Sorsogon in Luzon, the Mt. Apo geothermal field in the province of North Cotabato in Mindanao, and the Northern Negros geothermal field in the province of Negros Occidental in Negros Island. PNOC EDC's exploration drilling in several areas, however, yielded unsatisfactory results such that their further development had to be deferred. These areas include Daklan, Labo, Natib, Cagua and Pinatubo in Luzon, Biliran Island, Amacan in Davao del Norte in Mindanao.

NPC's deteriorating financial condition led to the issuance by the government of Executive Order 215 (E.O. 215) in 1990 which effectively removed NPC's monopoly in power generation and allowed the participation of the private sector in the construction, ownership and operation of power plants. E.O. 215, and later, the passage of the BOT Law in 1993, facilitated the entry of independent power producers (IPPs) with NPC as the buyer of the electricity produced by these IPPs. E.O. 215 and the BOT Law also facilitated the entry of PNOC EDC into geothermal power generation through Build-Operate-Transfer (BOT) contracts with private power companies.

The Philippines already has 1,905 MW of installed geothermal power capacity by mid-2005 (refer to Table 1), and already ranks second in the world next to the United States. Only two geothermal resource developers, PGI and PNOC EDC (refer to Figure 1 for the location of the geothermal power facilities) actively pursued the government's geothermal program, with private sector participation in the power plant side through BOT arrangements with PNOC EDC (refer to Table 2.)

TABLE 1: Installed Geothermal Power Capacity in the Philippines

| Geothermal Facility | Capacity (MW) | Power Plant Operator | Steamfield Operator |
|---|---|---|---|
| Luzon | | | |
| Mak-ban | 426 | NPC | PGI |
| Tiwi | 330 | NPC | PGI |
| Bacman | 150 | NPC | PNOC EDC |
| Leyte | | | |
| Tongonan I | 112.5 | NPC | PNOC EDC |
| Leyte-Luzon/Optimization | 386 | CalEnergy/Ormat* | PNOC EDC |
| Leyte-Cebu | 202 | CalEnergy* | PNOC EDC |
| Negros | | | |
| Palinpinon | 192.5 | NPC | PNOC EDC |
| Mindanao | | | |
| Mt. Apo | 106 | Marubeni* | PNOC EDC |
| Total Philippines | 1,905 | | |

Note: *Under Build-Operate-Transfer (BOT) contract with PNOC EDC.

TABLE 2: Capacity Ownership of Installed Geothermal Facilities in the Philippines (in MW)

| Location | Power Plant | | Steamfield | |
|---|---|---|---|---|
| | NPC | Other* | PGI | PNOC EDC |
| Luzon | 876 | | 756 | 150 |
| Leyte | 112.5 | 587 | | 700.5 |
| Negros | 192.5 | | | 192.5 |
| Mindanao | 106 | 106 | | 106 |
| Total | 1,285 | 691 | 756 | 1,149 |
| Grand Total | 1,905 | | 1,905 | |

Note: *Under various 10-year BOT contracts between PNOC EDC and CalEnergy, Ormat or Marubeni.

## 3. FINANCING THE GEOTHERMAL ENERGY UNDERTAKINGS

### 3.1 Development of the Tiwi and Mak-ban Fields by a Private Operator

PGI pioneered the large scale commercial development and use of geothermal resources in Tiwi and Mak-ban. The development and operation of the Tiwi and Mak-ban geothermal fields was an attractive business venture for the private investor, PGI, because its contract with NPC allowed the reimbursement of certain costs and the payment of service fees, thus, guaranteeing a certain return on its investment. The contractual arrangement between PGI and NPC actually preceded the promulgation of P.D. 1442, or the Geothermal Service Contract Law, which was later considered to be unattractive to private developers because of the 60%-to-government-40%-to-contractor sharing of net proceeds from geothermal operations. On the power generation side, NPC's power plants in Tiwi and Mak-ban were financed by Official Development Assistance (ODA) loans which had sovereign guaranty.

### 3.2 PNOC EDC as Geothermal Service Contractor

In accordance with P.D 1442, or the Geothermal Service Contract Law, PNOC EDC, as a geothermal resource developer, entered into Geothermal Service Contracts with the government over the areas where it operated. Financing the exploration, development and commissioning of the geothermal projects of PNOC EDC was a big challenge initially because of limited financial resources that could be used for exploration. With initial capitalization and advances from PNOC, the mother company, it was able to carry out its mandate of exploring, developing and putting into production the country's geothermal resources. The major advantage that the company enjoyed is that, similar to NPC, it was able to avail of ODA loans that were guaranteed by the government to finance its geothermal projects.

### 3.2 Tongonan I and Palinpinon I

The first major geothermal development project of PNOC EDC was the 112.5 MW Tongonan I Geothermal Power Project in the island of Leyte. Financing for the project was arranged in a package which included both the geothermal field development (for implementation by PNOC EDC) and the power plant construction (for implementation by NPC) under the Eighth Yen Credit Package of the Japan Bank for International Cooperation (JBIC), formerly known as the Overseas Economic Cooperation Fund (OECF) of Japan. PNOC EDC's portion of the loan for steam field development amounted to JPY5.8 billion. The loan was signed in 1980 and the project was successfully commissioned in March 1983. A year later, financing for the 112.5 MW Palinpinon I Geothermal Power Project under the Ninth Yen Credit Package of the JBIC was also signed. PNOC EDC's portion for steam field development amounted to JPY10.8 billion. Palinpinon I was successfully commissioned in June 1983.

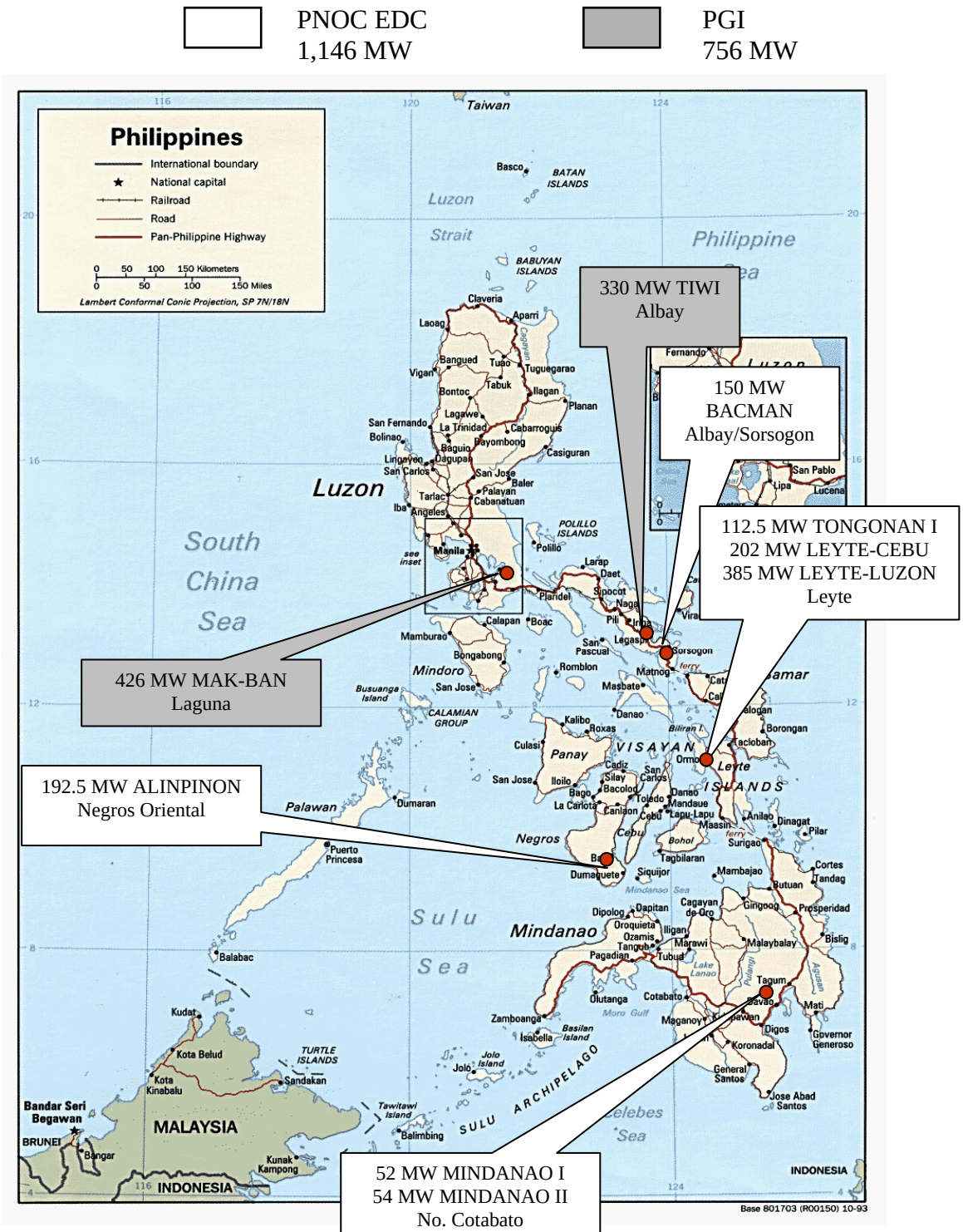
### 3.4 Bacman and Palinpinon Delineation and Evaluation

The involvement of the World Bank (WB) in the Philippine Energy Sector started with an identification mission in 1979 and followed by an energy assessment study in 1980 carried out jointly with the Asian Development Bank (ADB). In 1982, a US$36 million Geothermal Exploration Project (Loan 2203-PH) was approved which comprised a 25-well exploration program to be carried out by PNOC EDC in the highly prospective Bacman and Palinpinon areas in southern Luzon and southern Negros, respectively. The 110 MW Bacman I geothermal production field was delineated successfully under this Project. In the Palinpinon geothermal area, other sectors were further delineated for possible capacity expansion.

### 3.5 Bacman I Geothermal Power Project; Evaluation of Other Luzon Geothermal Areas

From 1984 until 1986, several WB missions, in conjunction with NPC, PNOC and PNOC EDC, reviewed the development of the power and geothermal sectors. At that time, no new generating plant was under construction in the Philippines, despite a projected increase in power demand and a decrease in capacity due to the mothballing of the 620 MW Philippine Nuclear Power Plant (PNPP) in 1986. An examination of NPC's least cost development program in 1987 indicated that the development of a 110 MW geothermal power plant in Bacman in southern Luzon should be NPC's next development priority. PNOC EDC had already incurred significant investments in the Bacman geothermal field using partly an earlier WB loan and has completed a feasibility study for a 110 MW steamfield development. In 1988, WB approved the Bacman I Geothermal Power Project (Loan 2969-PH) for an amount of US$41 million for PNOC EDC to finance the completion of the 110 MW Bacman I steamfield and also the delineation and appraisal of other prospective geothermal areas in Luzon. PNOC EDC completed the steamfield and was ready to supply steam to NPC's geothermal power plant in 1992; however, actual commissioning of NPC's power plant was delayed until 1993 because of NPC's late decision to switch to Italian financing and because of procurement problems. As of loan closing, under the delineation-cum-appraisal component of the loan, 12 wells were drilled in various prospect areas in Luzon, as follows: 3 wells Bacman area designated as Bacman II, 2 wells in Pinatubo, 2 wells in Natib, 2 wells in Cagua and 3 wells in Labo. Except for Bacman II and Mt. Labo, the other areas drilled yielded unsatisfactory evaluation results such that further activities in these areas were cancelled or deferred.

FIGURE 1: Philippine Geothermal Fields in Operation



### 3.6 Bacman II Geothermal Project; Delineation Drilling in Luzon and Visayas Prospects

In 1988, WB conducted a comprehensive Energy Sector Study in an effort to identify how the government and WB could jointly work together to address weaknesses in the Sector. In 1989, the Energy Sector Project was conceived with the objective of orienting the development strategy of the Philippine Energy Sector toward minimizing the cost of energy supply. There were various components of the Project and PNOC EDC's component involved: 1) completion of delineation drilling in prospective sites in Luzon and Visayas; 2) engineering, procurement, fabrication, installation and commissioning of fluid collection and disposal systems (FCDS) at various sites; 3) drilling of additional production and reinjection wells; and, 4) technical assistance for resource assessment and engineering. These activities are sequels to the earlier WB Loan 2203-PH and WB Loan 2969-PH. The Energy Sector Project was approved in 1990; PNOC EDC's portion was US$133 million and designated as WB Loan 3164-PH.

Due to the unfavorable geothermal resource assessment in the areas of Labo, Pinatubo, Natib and Cagua, the World Bank agreed to shift drilling program under the Energy Sector Project (WB Loan 3164-PH) to the more attractive Upper Mahiao and Malitbog sectors of the Tongonan geothermal area (also called Leyte A) in Leyte. Thus, out of 38 wells drilled under the Project, 28 wells were located in Leyte. Under this Project, the Bacman II steamfield, supplying steam to the 2 x 20 MW plants of NPC, was completed with the first unit synchronized to the Luzon grid in March 1994 and the second unit in May 1997.

### 3.7 Palinpinon II Geothermal Power Project

The JBIC became further involved in the geothermal sector in 1989 and 1993 with its financing of the 4 x 20 MW Palinpinon II Geothermal Power Project under the 15$^{th}$ and 18$^{th}$ Yen Credit Packages which allocated JPY4.0 billion and JPY77.4 million respectively to PNOC EDC to drill the required production and reinjection wells and to install the fluid collection and disposal system. This project was successfully carried out and the 4 x 20 units of NPC were put online successively from 1993 to 1995.

### 3.8 The Leyte-Cebu Geothermal Power Project

The Leyte-Cebu Geothermal Power Project was proposed to WB during the various supervision missions under the Energy Sector Project. Initial appraisal was done by WB in April 1993. The main objective of this project is to meet the rapidly increasing demand for electricity in the island of Cebu by transmitting the geothermal power abundantly available in the island of Leyte. Earlier resource studies had established up to 600 MW potential development in the area. The project has three main components: 1) development of about 200 MW of geothermal production capacity by PNOC EDC, including the FCDS; 2) construction of overhead transmission lines in Leyte and in Cebu and installation of submarine cables to interconnect the islands of Leyte and Cebu to be implemented by NPC; and, 3) the construction of about 200 MW of geothermal power plants to be implemented by a private power firm through BOT contract with PNOC EDC. (Please refer to Figure 2 for the map showing the interconnection line.) PNOC EDC's loan to implement its component of the project amounted to US$64 million. The loan was approved in February 1994 and designated as WB Loan 3702-PH.

In carrying out the project, PNOC EDC pursued the development of the Upper Mahiao and the Malitbog sectors of what is also called the Leyte A geothermal area. A total of 125 MW was developed in Upper Mahiao. Malitbog had the potential to produce 231 MW which was developed in modules of 77 MW plants; thus, the first 77 MW from Malitbog, in addition to the 125 MW Upper Mahiao, comprised the 202 MW for the Leyte-Cebu project.

For the power plant component of the project, PNOC EDC followed the BOT model which has come to be regarded as a typical private sector participation format. Under this BOT format, the power plant contractor designs, supplies, installs and commissions the plant for a pre-determined cooperation period of 10 years. During the cooperation period, PNOC EDC pays for the plant through an energy conversion tariff which provides for both capital recovery and operational costs. Plant ownership is transferred and handed over to PNOC EDC at the end of the cooperation period.

After the conduct of a bidding, a BOT contract was awarded to a winning U.S.-based BOT contractor in August 1993 to construct and operate the 125 MW Upper Mahiao Geothermal Power Plant. The plant was commissioned in July 1996. A second BOT contract for the construction and operation of the first unit of the 3 x 77 MW Malitbog Geothermal Power Plant was awarded to a U.S.-based contractor in September 1993. The unit was commissioned also in July 1996 to complete an aggregate capacity of 202 MW to be supplied to the island of Cebu.

The following tables show the project costs and financing plan for the entire project with all the components as appraised and as incurred.

TABLE 3: Leyte-Cebu Geothermal Power Project – Overall Cost Estimates

| Project Cost Component | Appraisal Estimate (in US$ million) | Actual Estimate (in US$ million) |
|---|---|---|
| A. PNOC EDC Geothermal Development | 74.80 | 88.00 |
| B. BOT Power Plants | 157.80 | 287.48 |
| C. NPC Transmission System | 155.40 | 210.00 |
| Total Baseline Cost | 388.00 | |
| Physical Contingencies | 24.60 | |
| Price Contingencies | 22.20 | |
| Total Project Costs | 434.80 | 585.48 |
| Interest During Construction | 24.10 | 27.50 |
| Total Financing Required | 458.90 | 612.98 |

TABLE 4: Leyte-Cebu Geothermal Power Project – Overall Financing Plan

| Project Cost Component | Appraisal Estimate (in US$ million) | Actual Estimate (in US$ million) |
|---|---|---|
| WB Loan to PNOC EDC | 64.00 | 53.03 |
| WB Loan to NPC | 147.00 | 140.08 |
| BOT Power Plants | 174.70 | 287.48 |
| PNOC EDC Internal Cash Generation | | |
| Geothermal Development | 19.70 | 34.98 |
| Interest During Construction | 7.50 | 4.03 |
| NPC Internal Cash Generation | | |
| Transmission System | 29.50 | 29.88 |
| Interest During Construction | 16.50 | 23.50 |
| Co-Financing of Transmission System | | 40.00 |
| Total Financing Required | 458.90 | 612.98 |

### 3.9 The Leyte-Luzon Geothermal Power Project

The WB sent an appraisal mission on the Leyte-Luzon Geothermal Power Project in June 1993 just after the appraisal of the Leyte-Cebu Geothermal Power Project. The project was approved in June 1994. The main objective of the project was to meet the rapidly increasing demand for power in Luzon using indigenous and environmentally superior geothermal energy which was abundant in the Leyte island. The project necessitated the coordinated implementation by NPC and PNOC EDC. The WB also brought in the Import Bank of Japan (JEXIM) to co-finance the project under the supervision and administration by WB. A grant from the Global Environmental Facility (GEF) was incorporated to make the project viable, considering the high investment costs of the Leyte-Luzon interconnection. The GEF grant was justified against the alternative of setting up a coal-burning power plant in Luzon. (Please refer to Figure 2 for the map showing the interconnection line.)

PNOC EDC's components originally comprised the following: a) development of 440 MW geothermal fields to expand the Leyte A geothermal capacity from 200 MW to 640 MW, including the drilling of 65 additional production and reinjection wells in Malitbog, Mahanagdong and Alto Peak sectors and the construction of the fluid collection and disposal systems; b) carrying out BOT contracts between PNOC EDC and private sector companies to construct and operate 440 MW power plants. The amount co-financed by WB and JEXIM for PNOC EDC was US$228 million under WB Loan 3747-PH. A grant of US$15 million was provided by the GEF.

NPC's components comprised the following: a) construction of two high voltage DC monopole converter stations and related electrode stations at Ormoc in Leyte and Naga in Luzon; b) installation of submarine cables crossing the San Bernardino Strait and linking the Leyte and Luzon lines; and, c) construction of the overhead HVDC lines from the submarine cable terminals to Ormoc and to Naga. WB and JEXIM allocated US$169 million for NPC. GETF provided a grant of US$15 million. NPC will also source US$100 million from a Eurobond issue guaranteed by an ECO of WB.

The overall cost estimates and financing plan for the Leyte-Luzon Geothermal Power Project are shown in the following tables.

TABLE 4: Leyte-Luzon Geothermal Power Project – Overall Cost Estimates

| Project Cost Component | Appraisal Estimate (in US$ million) | Actual Estimate (in US$ million) |
|---|---|---|
| A. PNOC EDC Geothermal Development | 315.5 | 257.4 |
| B. BOT Power Plants | 620.4 | 577.6 |
| C. NPC Transmission System | 331.3 | 402.2 |
| | | |
| Total Project Costs | 1,266.9 | 1,237.2 |
| Interest During Construction | 66.7 | 80.1 |
| Total Financing Required | 1,333.6 | 1,317.3 |

TABLE 5: Leyte-Luzon Geothermal Power Project – Overall Financing Plan

| Project Cost Component | Appraisal Estimate (in US$ million) | Actual Estimate (in US$ million) |
|---|---|---|
| WB Loan to PNOC EDC | 114.0 | 55.2 |
| JEXIM Loan to PNOC EDC | 114.0 | 55.7 |
| WB Loan to NPC | 113.0 | 99.2 |
| JEXIM Loan to NPC | 56.0 | 53.7 |
| WB Energy Sector Loan to PNOC EDC | 13.1 | |
| WB Transmission Grid Project Loan to NPC | | 14.4 |
| BOT Power Plants | 620.4 | 577.6 |
| ECO Bond - NPC | 100.0 | 100.0 |
| BITS Grant - NPC | 39.0 | 46.0 |
| GEF Grant to PNOC EDC | 15.0 | 15.7 |
| GEF Grant to NPC | 15.0 | 15.5 |
| PNOC EDC Internal Cash Generation | 92.0 | 132.1 |
| NPC Internal Cash Generation | 41.9 | 143.7 |
| Total Financing Required | 1,333.6 | 1,317.3 |

FIGURE 2: The Leyte-Cebu and Leyte-Luzon Power Grid Interconnections

Out of the total projected 440 MW to be developed from the Leyte-Luzon Project, PNOC EDC was able to produce 385 MW from the sectors of Malitbog and Mahanagdong. These sectors were contracted out to private BOT power plants operators. Drilling and resource evaluation of the Alto Peak sector indicated that the resource is dominated by acidic fluids and contain high levels of non-condensable gases which made the sector unsuitable for further development.

Bidding for the power plant packages resulted in the following:

- Malitbog Power Plant (2 x 77 MW). A 10-year BOT contract was awarded in September 1993 to construct and operate a 3 x 77 MW power plant. The first unit intended for the Leyte-Cebu Geothermal Power Project was commissioned in July 1996, while the second and third units, intended for the Leyte-Luzon Geothermal Power Project, were commissioned in July 1997.
- Mahanagdong Power Plants (3 x 60 MW). A 10-year BOT contract was awarded in July 1994 to construct and operate a 3 x 60 MW generation facility located at two sites. Commercial operation was July 1997.
- Optimization Plants. A further 52 MW to be obtained from topping and bottoming plants (Tongonan I Topping, Mahanagdong Topping and Malitbog Bottoming Plants) was also awarded under a 10-year BOT contract.in August 1995. The plants were commissioned in September 1997.

### 3.10 The Mindanao I and II Geothermal Power Projects

One remarkable geothermal area that PNOC EDC was able to develop using only its internally generated funds is the Mt. Apo geothermal area located in the province of No. Cotabato in the island of Mindanao. The geothermal area is located in the environmentally sensitive Mt. Apo National Park and home to several indigenous tribes. The Mindanao power grid is basically hydro-based; geothermal power from Mt. Apo would be critical in alleviating power shortages in times of drought and low water levels. The furor generated by non-governmental organizations and other oppositionists to the geothermal project kept away international financing organizations including WB and JBIC but PNOC EDC went on to obtain government and local support for the project. In due time, the first 52 MW steamfield was commissioned in 1997. The corresponding geothermal power plant was set up through a BOT contract between PNOC EDC and Marubeni Corporation, a Japanese private company. A second phase involving 54 MW geothermal development was commissioned in 1999; again, the power plant was awarded through another BOT contract with Marubeni Corporation. The Mt. Apo Geothermal Power Project has become a showcase of PNOC EDC on how environmentally acceptable geothermal development can be and how local tribes and inhabitants can benefit from the project.

### 3.11 No. Negros Geothermal Power Project

The latest of the projects implemented by PNOC EDC, the No. Negros Geothermal Project, is located in Negros Occidental and is currently being constructed through a loan from JBIC (21$^{st}$ Yen Credit) amounting to JPY14.5 billion. The loan is used to finance the steam field development and the power plant construction, with PNOC EDC undertaking both components. The project will augment the already critical power requirements of the Cebu-Negros-Panay interconnected island grids and will come on line in February 2007.

### 3.11 Summary of Loans Availed by PNOC EDC

Being a wholly government owned and controlled corporation, PNOC EDC's experience in the financing of geothermal exploration and development projects involved mostly the utilization of ODA funds from the World Bank and the Japan Bank for International Cooperation. From its inception in 1976, PNOC-EDC has availed of the following loans to fund geothermal projects earlier discussed in the preceding paragraphs:

TABLE 6: PNOC-EDC's Loans from World Bank and JBIC

| Lender/Project | Loan Amount | Maturities | Interest Rate |
|---|---|---|---|
| WB-IBRD | | | |
| 2203 PH Geothermal Exploration Project | US$ 36 million | 1988 to 2002 | CQB + 0.5% |
| 2969 PH Bac-Man I Geothermal Project | US$ 41 million | 1994 to 2008 | CQB + 0.5% |
| 3164 PH Energy Sector Loan | US$ 118 million | 1995 to 2010 | CQB + 0.5% |
| 3702 PH Leyte-Cebu Geothermal Power Project | US$ 64 million | 1999 to 2013 | CQB + 0.5% |
| 3747 PH Leyte-Luzon Geothermal Power Project | US$ 128 million | 1999 to 2014 | CQB + 0.5% |
| JBIC | | | |
| 8th Yen Tongonan I Geothermal Project | JPY 5.8 billion | 1990 to2010 | 3% |
| 9th Yen Palinpinon I Geothermal Project | JPY 10.8 billion | 1991 to 2011 | 3.2% |
| 15th Yen Palinpinon II Geothermal Project | JPY 4.0 billion | 1999 to 2019 | 5.7% |
| 18th Yen Palinpinon II Geothermal Project | JPY 77.4 million | 2003 to 2023 | 3% |
| 21st Yen No. Negros Geothermal Power Project | JPY14.5 billion | 2007 to 2027 | 2.3% |

Note: CQB – Cost of Qualified Borrowings of WB's Currency Pool Loans

### 3.12 ODA Loans Compared with Available Commercial Financing

ODA loans enhance the financial viability of geothermal projects because of the low interest rates and long grace periods before the start of loan repayments. WB loans normally are at 5% to 7.5% per annum and offer 5 years grace period and 10 years repayment. Regular JBIC loans offer 3% p.a. interest rate, 10 years grace period and 20 years repayment. On the other hand, commercial loans available from Export-Import banks are normally at interest rates of 2% to 4% above LIBOR and have short maturities, with repayment over a period of 5 years. Commercial loans to the private sector are used to finance turnkey power projects and other arrangements such as BOT projects.

### 3.13 Private Sector Participation Through BOT Contracts

The participation of the private sector in the power plant side was necessary to complete the geothermal development program at the time when the National Power Corporation was already experiencing financial difficulties such that it no longer had the capacity to incur more loans for new generation facilities. Private investment in BOT projects was encouraged by the support of WB in the geothermal sector, particularly in the Leyte-Cebu and Leyte-Luzon projects. The success of the BOT arrangements in Leyte was followed by similar BOT contracts in the Mt. Apo geothermal project in Mindanao. Under these BOT contracts, capital recovery period for the private company was only for ten years. Commercial funding for the private BOT contractors did not pose much problems because the significant risks on the geothermal resource as well as the risks in the power market are clearly borne by either PNOC EDC or NPC. Furthermore, payments to the BOT contractor are backed by a government undertaking in case of default by PNOC EDC or NPC.

## 4. CONSIDERATIONS IN THE AVAILMENT OF OFFICIAL DEVELOPMENT ASSISTANCE (ODA FUNDING)

### 4.1 Implementing the National Energy Sector Objectives

ODA borrowings are basically government loans because they bear the guarantee of the government. PNOC EDC's loans from WB and JBIC have this guarantee. PNOC EDC's projects and work programs are aligned with the national objectives. Organizationally, PNOC EDC is an attached agency of the Department of Energy (DOE) and it is instrumental in the formulation and development of the energy sector's plans, programs and strategies, especially in the development and utilization of the country's indigenous geothermal resources. PNOC EDC, basically, has been the sole implementer of the country's geothermal development program incorporated in the Philippine government's Medium Term Public Development Plan (MTPDP) and the Medium Term Public Investment Plan (MTPIP).

WB's lending activities are guided by its Country Assistance Strategy (CAS). In the Philippines, WB's pre-appraisal missions in the early 1980s identified the problems and needs of the Philippine energy sector. Consistent with national goals and objectives and in line its CAS, the WB set the following energy sector objectives for the Philippines: a) develop a sector-wide capability to increase energy resources and coordinate policy implementation; b) adopt a least-cost strategy for energy development; c) strengthen regulatory activities for rational consumer energy pricing and improved product and service standards; d) encourage private sector privatization through joint ventures and other schemes; e) improve environmental standards and monitoring in areas of high energy use or resource development; and, f) enhance the technical capabilities of sector institutions. These objectives were the bases for the series of WB loans which financed the country's geothermal development program implemented by PNOC EDC.

### 4.2 The Project Proposal and Evaluation Process

PNOC EDC's planned geothermal projects, being part of the the government's MTPDP and MTPIP, are eligible candidates for the government's bilateral aid programs. The National Economic Development Authority (NEDA) undertakes the screening of candidate projects proposed for ODA financing. Before a project is endorsed by NEDA, it must ensure that: a) it is consistent with the national goals and objectives, especially in the energy sector; b) it has been technically evaluated as a viable geothermal resource for long term production; c) it is financially and economically feasible to undertake; d) it has been granted an Environmental Compliance Certificate (ECC) and has the endorsement of the local inhabitants and authorities; and, d) PNOC EDC has the available counterpart financing and the organizational capability to implement the project. A project is financially feasible if its financial internal rate of return (FIRR) is greater than the weighted average cost of capital. From country economics viewpoint, a project's economic internal rate of return (EIRR) should not be lower than 15%.

The WB and the JBIC employ Consultants during project appraisal to validate the resource assessment and development strategy prepared in-house by PNOC EDC. Over the years, PNOC EDC has developed its expertise in exploration and resource evaluation techniques through actual experience and training in other geothermal producing countries like New Zealand, Japan, Iceland and Italy. This has helped build WB's confidence in PNOC EDC's technical capability.

The following factors influence the financial and economic viability of the geothermal projects pursued by PNOC EDC: a) project costs; b) energy pricing; and, c) market and demand projections. In the case of the Leyte-Cebu and Leyte-Luzon projects, WB appraised the viability of the integrated and interdependent components. To ensure that steam from PNOC-EDC's geothermal production fields in Upper Mahiao, Malitbog and Mahanagdong are converted into electricity, the power plant BOT contracts had to be established. NPC, as the offtaker of the generated electricity, had to implement the Leyte-Cebu and the Leyte-Luzon transmission interconnection in order to bring the

electricity to the demand centers or power markets in Cebu and in Luzon, respectively. WB appraisal also included a review of the contractual arrangements among the implementers of the project components.

The Leyte-Luzon Geothermal Power Project was not part of the country's least cost expansion program because of the associated high transmission system interconnection costs which made the project much more expensive than an alternative coal-fired power plant in Luzon. However, during appraisal, the project merited a GEF grant of US$31.2 million to enhance its economic acceptability. The project supported the use of an energy source which is environmentally preferred and indigenous compared to the coal-burning alternative. It has a significant impact on mitigation of greenhouse gas emissions (GHG) since an alternative coal-fired power plant would generate incremental CO2 emissions of about 2.2 million tons per year.

Both WB and JBIC impose strict compliance to the environmental requisites for geothermal projects. The project ECC issued by the Department of Environment and Natural Resources (DENR) normally contain conditionalities such as protective measures during construction, air and water quality monitoring and mitigation plans, among others. For the Leyte-Cebu and Leyte-Luzon projects, WB required a resettlement program for families affected by the geothermal development. The program included: a) protection of residents from potential health hazards; b) relocation for 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.

## 5. CONCLUSIONS AND RECOMMENDATIONS

Financing a geothermal program of exploration and delineation is a capital intensive undertaking which involves a high degree of risk. In the Philippines, under the regime of P.D. 1442, or the Geothermal Service Contract Law, private sector developers have not been attracted to risk their funds in geothermal exploration and development considering the expected low financial returns that will result from the 40:60-contractor: government sharing of net proceeds. PNOC EDC has been the only geothermal service contractor under P.D. 1442, and because it is a government owned and controlled corporation, its financial viability has been enhanced by concessionary ODA loans from WB and JBIC which were guaranteed by the government. Since 1988, however, proposals have been made for Congress to pass a more private investor-oriented geothermal law to attract private sector participation in the geothermal industry.

The development and utilization of indigenous and environmentally superior geothermal resources in order to displace imported fuels such as petroleum and coal was pursued as a policy of the Philippine government. Assisted by lending agencies like WB and JBIC, the energy sector was strengthened in this direction. PNOC EDC, as the government's implementing agency, exerted efforts to acquire the necessary expertise and technology in exploration, resource assessment, well drilling, reservoir management and steam production, as well as the expertise in environmental management, impact assessment and risk mitigation from more advanced countries like the United States, Italy, Japan, New Zealand and Iceland. The sector loans provided by WB for the exploration and delineation of prospective geothermal areas gave the necessary boost for the government's geothermal development program.

The subsequent project loans from JBIC and WB were designed to support the funding requirements of both PNOC EDC as the geothermal field developer and NPC as the power plant owner and buyer of steam for conversion to electricity. This arrangement ensured the market for geothermal energy because NPC was also the operator of the power grid and transmission system. In the case of the Leyte-Cebu and the Leyte-Luzon projects, the WB loans ensured that the abundant geothermal power from Leyte can be transmitted to the load centers in Cebu and Luzon. The environmental benefits of

avoiding greenhouse gases was translated into a US$31.2 million GEF grant to make the Leyte-Luzon project more economically attractive for the country.

Aside from being backstopped by a government undertaking, private sector participation in the power plant BOT contracts in Leyte and Mindanao do not involve any geothermal resource risks or market risks on the part of the contractor. Under these contracts, it is PNOC EDC's risk and obligation to produce and supply the geothermal steam. It is also the risk and obligation of PNOC EDC to sell the generated electricity to an offtaker. These are notably the risks that have to be mitigated in order for the private sector to participate in geothermal field development and operation.

The expected financial return from a geothermal project would depend on: a) the certainty and ability of producing the resource which would dictate the investment and operating costs; b) the regulatory environment which would set taxes, fees and royalties that affect the contractor's expected cash flows; c) energy selling price, which is often a social and political issue, and offtake arrangements on the steam or the generated electricity; and, d) environmental compliance requirements which could involve local government and tribal concerns.

If the major private investor concerns cannot be readily addressed, government must formulate strategies using its own corporate agencies to advance its geothermal development objectives. ODA loans would still be the best financing option if the government would have to undertake the development of the country's geothermal resources through a designated implementing agency. It would be imperative to develop the agency's technical and professional expertise and capability to undertake the geothermal program. Commercial funds and private sector participation would remain very limited to specific undertakings where the risks have significantly been reduced such as in the BOT contract arrangements of PNOC EDC.

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