No. 15

REPUBLIC OF THE PHILIPPINES

FEASIBILITY STUDY REPORT ON INFRASTRUCTURE SURVEY FOR RIO TUBA NICKEL MINE (CANDAWAGA HYDROPOWER DEVELOPMENT)

AUGUST 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

The Japan International Cooperation Agency (JICA) has conducted a feasibility study on Candawaga River hydropower development in the west coast of Palawan Island as an Infrastructure Survey for the Rio Tuba Nickel Mine located in Bataraza, Palawan Province of the Philippines.

The said study was made as a follow up to the Infrastructure Survey for the Rio Tuba Mine (Tamlang River hydropower development) conducted in 1984. JICA sent a 8-member survey team headed by Mr. Minoru Sayama to the Candawaga River Area from March 19 to May 7, 1985.

The team with the cooperation of the officials concerned of the Government of the Philippines and other related personnel, conducted a field survey on Palawan Island. After the return of the team to Japan, further studies were made and the present report has been prepared.

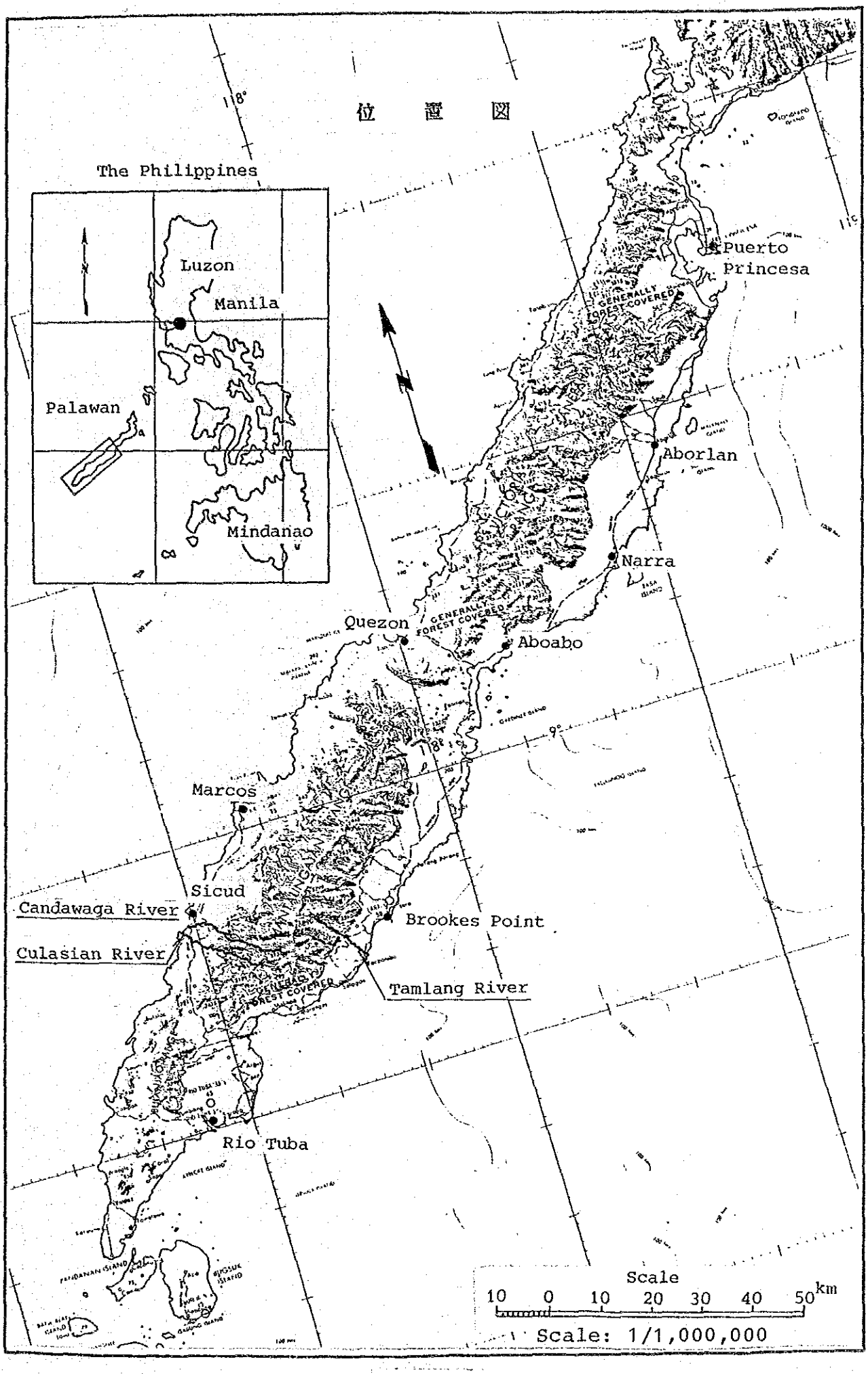
I hope that this report will serve for the development of the Rio Tuba Nickel Mine and contribute to the promotion of friendly relations between our two countries.

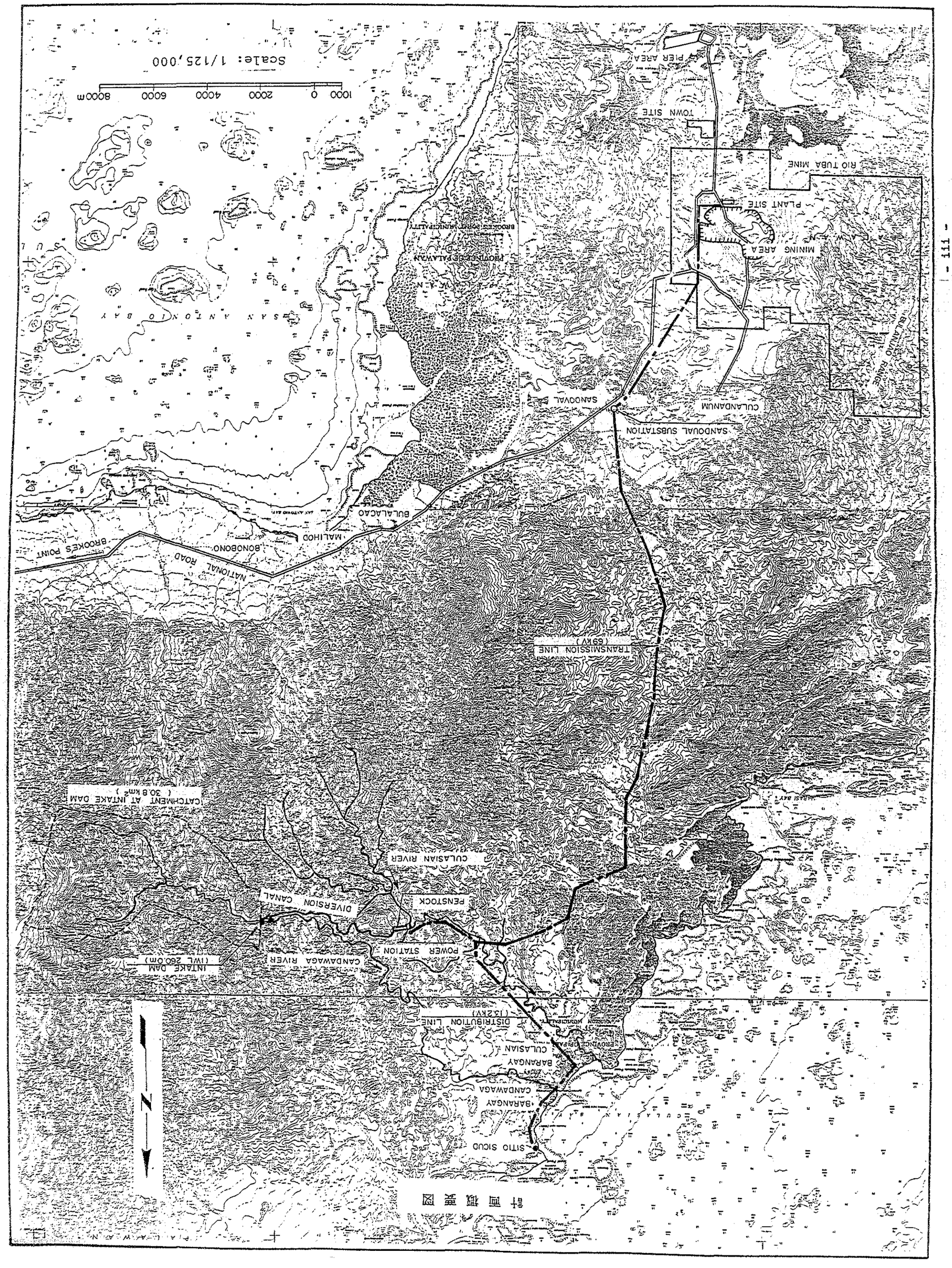
I wish to express my deep appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

August, 1985

Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency


位 置 図
The Philippines
Luzon
Manila
Palawan
Mindanao
Puerto Princesa
Aborlan
Narra
Quezon
Aboabo
Marcos
Sicud
Candawaga River
Culasian River
Brookes Point
Tamlang River
Rio Tuba
GENERALLY FOREST COVERED
Scale
10 0 10 20 30 40 50 km
Scale: 1/1,000,000


計画概要図
SITIO SICUD
BARANGAY
CANDAWAGA
BARANGAY
CULASIAN
DISTRIBUTION LINE
(15.2KV)
POWER STATION
PENSTOCK
DIVERSION CANAL
CANDAWAGA RIVER
INTAKE DAM
(IWL 260.0M)
CATCHMENT AT INTAKE DAM
(30.8 km2)
CULASIAN RIVER
TRANSMISSION LINE
(69KV)
SANDOVAL SUBSTATION
SANDOVAL
CULANDANUM
BULALACAO
MALIHOD
BONOBONO
NATIONAL ROAD
BROOKE'S POINT
PIER AREA
TOWN SITE
RIO TUBA MINE
PLANT SITE
MINING AREA
BLANUAO RANGE
SAX ANTONIO BAY
Scale: 1/125,000
0 2000 4000 6000 8000m
N

ABBREVIATIONS

JICA	-	Japan International Cooperation Agency
NPC	-	National Power Corporation
NEA	-	National Electrification Administration
MERALCO	-	Manila Electric Company
PALECO	-	Palawan Electric Cooperative, Inc.
MOE	-	Ministry of Energy
MHS	-	Ministry of Human Settlements
NEDA	-	National Economic and Development Authority
NCSO	-	National Census and Statistics Office
NIA	-	National Irrigation Administration
PIADP	-	Palawan Integrated Area Development Project
PAGASA	-	Philippine Atmospheric Geophysical and Astronomical Services Administration
ADB	-	Asian Development Bank
UNDP	-	United Nation Development Programme
EEC	-	European Economic Community
MNR	-	Ministry of Natural Resources

US$	-	United States Dollars
₱	-	Phillippine Pesos
¥	-	Japanese Yen
FC	-	Foreign Currency
LC	-	Local Currency
EIRR	-	Economic Internal Rate of Return
FIRR	-	Financial Internal Rate of Return
O & M	-	Operation and Maintenance
CIP	-	Communal Irrigation Project
EL.	-	Elevation in m AMSL (above mean sea level)
WL.	-	Water level in m AMSL
F.W.L.	-	Flood water level in m AMSL

mm	-	millimeter (s)
cm	-	centimeter (s)
m	-	meter (s)
km	-	kilometer
ha	-	hectare
km^2	-	square kilometer (s)
ℓ	-	liter
m^3	-	cubic meter
m^3/sec	-	cubic meter per second
mm/hr	-	millimeter per hour
hr	-	hour
kg	-	kilogram
t (ton)	-	metric ton
DMT	-	dry metric ton
WMT	-	wet metric ton
%	-	percent
^oC	-	degree centigrade
o	-	degree
ø	-	diameter

BTU	-	British Thermal Unit
rpm	-	revolution per minute
Hz	-	Hertz (cycles per second)
kcal	-	kilocalorie
V	-	volt
A	-	ampere
kV	-	kilovolt
kVA	-	kilovolt ampere
MVA	-	megavolt ampere
W	-	watt
kW	-	kilowatt
MW	-	megawatt
kWh	-	kilowatt hour
MWh	-	megawatt hour
GWh	-	gigawatt hour

SUMMARY

CONCLUSION AND RECOMMENDATIONS

A. Summary

Background

1. The Project area is located in the southern part of Palawan Island in the Philippines. The island covers an area of approximately 14,900km^2 with a population of approximately 370,000 and is one of the most depressed area in the country.

2. The main industries on Palawan Island are agriculture, forestry and mining. Major agricultural products are rice, coconuts, and corn; however, agricultural land (115,000ha) accounts for only 25% of cultivable area. Although forest resources are abundant, secondary processing of wood is not industrialized. In addition, timber logging industry has been curtailed due to the government policy for timber export. Mining products consist of nickel, chromite, silica , etc., of which nickel and silica are the major items.

3. The Rio Tuba Nickel Mine is the largest mining enterprise on Palawan Island exporting approximately 500,000DMT a year to Japan. The mine is operated by the Rio Tuba Mining Corp., Philippine-Japanese joint venture enterprise.

4. This hydropower development study forms a part of the infrastructure survey for the Rio Tuba Mine requested by Pacific Metals Co., Ltd., one of major Japanese investors.

5. The Rio Tuba Nickel Mining Corp. has been contributing to rural development and improvement of living standards of residents in Rio Tuba Town and the surrounding area by construction of mine related facilities such as a school, hospital, church, etc. with financing from the Japan International Cooperation Agency (JICA). The project which proposes construction of a hydropower plant in combination with the planned diesel plant (5,000kW x 3 units), aims to increase the economic effectiveness of the newly proposed segregation plant, and at the same time, to contribute

to rural area development supplying a certain amount of economical electricity for domestic demand in southern Palawan.

6. PALECO presently manages generation, distribution and sale of electric power on Palawan Island. At present; PALECO comprises 4 electrical systems; the Puerto Princesa, Narra-Aborlan, Brooke's Point and Cuyo Island systems. PALECO presently owns 7 diesel generators, with a total maximum output of 6,830kW. Other areas, except for those mentioned, remain unelectrified and only about 15% of the province's total population presently benefits from electrification. PALECO is making commendable efforts to promote rural electrification, though actual progress is hindered by the difficult economic situation.

7. Objective demands for hydropower under the present project are 8,500kW for the new segregation plant of the Rio Tuba Mine (flat demand throughout the year) as well as domestic use under PALECO.

Abstract of the Project

8. The hydropower development under the present study utilization of the water resources of the Candawaga River which flows through the southern part of Palawan Island to the west coast. The river originates in Mt. Mantalingajan (2,086m) the highest mountain on the island, and has a very steep gradient. A powerhouse is proposed on the Culasian River to utilize larger head by trans-basin diversion. Annual rainfall in this basin is above 3,000mm. Meteorological and topographical conditions of the area are thus suitable for hydropower development.

9. Hydropower will be supplied to the Rio Tuba Mine via a transmission line approximately 38km in length, and the proposed substation serving the PALECO domestic supply area is located 27km from the powerhouse along the transmission line.

10. The outline of the optimum hydropower development plan under the present project is as follows:

Name of the Project:	Candawaga Hydropower Project
Intake Site, Intake Water Level:	Candawaga River, EL. 260.0m
Outlet Location, Tailrace Water Level:	Culasian River, EL. 63.0m

Catchment Area:	30.8km^2
Name of Powerhouse:	Culasian Powerhouse
Generation Method:	Run-of-river type
Max. Output:	6,000kW (firm output 780kW in dry season)
Max. Discharge:	3.85m^3/s (firm discharge 0.57m^3/s in dry season)
Effective Head for Max. Output:	185.1m
Annual Generated Energy:	32.1 GWh (29.02 GWh at Rio Tuba Mine)
Length of Headrace:	8,252m (incl. penstock)
Turbine:	Horizontal shaft Francis type 2 units
Generator:	Horizontal shaft three-phase synchronous type 2 units
Transmission Line:	Voltage 69kV, 1 cct, total length 38km
Construction period:	28 months
Construction Cost:	3.95 billion yen (incl. interest during construction, exchange rate as of March 1985)

11. A maximum of 2,100kW of the output generated by the Candawaga River Hydropower Project is planned for supply to PALECO for domestic use. As the output in dry season is insufficient to fulfill PALECO domestic demand, supplemental supply will be obtained from the diesel plant presently planned by the Rio Tuba Mining Corp.

Economic Feasibility and Effects of the Project

12. Annual average cost of hydropower for the 45-year project life is ¥11.14/kWh, which is economical compared to the same (¥20.68/kWh) of diesel generation for a 45-year period.

13. Benefit/cost ratio (B/C ratio) of the Project as compared to fuel cost of the alternative diesel generation plan is 1.078, and the difference in annual cost (B-C) is ¥31.1 million.

14. Fuel savings with the hydropower plant are ¥307 million/year as compared with the diesel generation plant even in a case where fuel cost does not increase in future.

15. The unit rate for electricity sold to PALECO is designated at ¥17.87/kWh and unit cost is ¥24.12/kWh including additional transmission

cost by PALECO, which is clearly cheaper than the present ¥35.95/kWh PALECO power generation cost. Thus, hydropower development will contribute to stabilization or actual reduction of electric cost and improvement of living standards in rural areas.

16. Financial Internal Rate of Return (FIRR) of the Project is 10.55%, and Economic Internal Rate of Return (EIRR) is 12.60%.

17. The annual energy of 29.0GWh supplied at Rio Tuba Mine produced by the hydropower plant is equivalent to an annual 5,600t (about 37,000 barrels) of Bunker C oil, and thus hydropower will contribute to reduction in oil imports and improvement of the national economy.

18. The domestic supply portion (2,100kW) will satisfy 15,000 households and 3,700 commercial enterprises in 1998, thereby upgrading residents' living standards in the concerned area.

19. The west coast of Palawan Island where the Project is located, lacks transportation facilities except for small boats. Only small villages are scattered in this undeveloped area. The Project plans to construct a temporary pier at the coast and a 9km access road from the coast to the powerhouse site. The facilities can be used for transportation even after construction, thus contributing to community development. Moreover, power will be distributed to the small village (presently 600 households) near the mouth of the Candawaga & Culasian rivers.

B. Conclusion and Recommendations

1. Technical soundness, financial viability and economic feasibility of the Project has been confirmed in this report, and early implementation is recommended in order to facilitate rural development as well as to contribute to economical operation of the proposed segregation plant of the Rio Tuba Mine.

2. The project construction period is estimated at 28 months, and the period for other works including detailed design, preparation of tender specifications, bidding and other procedures for the Project is estimated at about 2 years. Hydropower operation is therefore scheduled to start

within eight months after operation commencement of the new Rio Tuba Mine segregation plant. Project implementation should be promoted in consideration of these conditions.

3. The Project area is covered with tropical jungle. River gradient is very steep, about 1/40 to 1/30, with large boulders in some areas. The majority of mountain slopes are very steep ranging from about 40°-50°. Transportation is very difficult as there are no roads and the Project site is more than 10km from the coast. These conditions should be taken into consideration in the implementation schedule for detailed design and construction.

4. Discharge data used in planning was analysed by the tank-model method with the rainfall data observed at Rio Tuba Mine. However, further observation of rainfall, water level and discharge of the rivers is required and correlation between rainfall and discharge around the Project site should be studied.

5. Sensitivity analysis was conducted on the basis of possible factors such as increase and decrease in investment, variations in diesel fuel cost, and growth rate of domestic power demand. Hydropower development, which consists of effective use of replenishable natural resources, requires a substantial initial investment; however, operation and maintenance costs are low and resistant to inflation. Although the latter point is not clearly definable through financial and economic analysis, it should be considered in evaluation of the Project from a long-term perspective.

6. This Project is envisioned to increase the added value and profitability of nickel ore produced at the Rio Tuba Mine as an export product, and to facilitate reduced electric rates and stabilization of domestic power supply in the rural areas. For the above importance, the Project is recommended for a long-term low interest public loan.

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INTRODUCTION

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INTRODUCTION

1.1 Background

Nickel deposits were discovered in Bataraza Municipality on Palawan Island in the Philippines in the 1960s. During the period of prospecting and development, the Rio Tuba Nickel Mining Corporation (hereinafter referred to as the Rio Tuba Mining Corp.) was established in July 1969. This corporation was predominantly supported, both technically and financially, by the American UOP Company from discovery of the ore untill the early 1970s. Subsequently, the Rio Tuba Mining Corp. requested a group of Japanese companies (Pacific Metals Co., Ltd., Nippon Mining Co., Ltd., and Sumitomo Metal Mining Corp., Ltd.) to undertake a feasibility study from 1971 to 1972 to determine a mining plan with a target of extracting 2 million DMT/year.

In March 1973, Pacific Metals acquired all stocks held by UOP becoming chief stockholder of the Rio Tuba Mining Corp. In 1974, the said company formulated a basic production plan of 500,000DMT/year as a step towards commencement of mine operation.

Nippon Steel Corp., Nisshin Steel Corp., Ltd., and Nissho Iwai Corp., invested in the venture and, with a loan from the Export - Import Bank of Japan, mine construction commenced in June 1975. In December of the following year, the main mine facilities were completed. At the same time, the Pacific Metals Co., Ltd. received financing from the Japan International Cooperation Agency (JICA) for construction of mine related facilities such as a school, hospital, church, etc., contributing to improvement of living standards in Rio Tuba Town and the surrounding area.

The first load of ore was exported to Japan in April 1977 and operation continued smoothly for several years. However, after a peak in 1979, production inevitably decreased due to the drop in nickel demand arising from the worldwide increase in oil prices. As a countermeasure, the Rio Tuba Mining Corp. has prepared a segregation plan to produce higher grade ore with a nickel content of 55%, adding value to presently exported 2.2% nickel content ore. The Rio Tuba Mining Corp. requested the

Pacific Metals Co., Ltd. to conduct a feasibility study on the proposed segregation plant and the study is presently in-progress.

The proposed segregation plant will require a year-round electric power supply of 8,500kW. Although the Rio Tuba Mining Corp. plans to supply this power with three newly proposed units of 5,000kW Diesel generators, a feasibility study was also commenced on possible use of hydropower at a site 40km northeast of the mine on the Tamlang River. Use of hydropower would reduce production costs and increase management effectiveness.

With regards to domestic power supply on Palawan Island, PALECO is undertaking power generation and distribution on Palawan Island under the jurisdiction of NEA. However, total electrification rate for the entire island is only about 15% while Bataraza Municipality where the Rio Tuba Mine is located remains unelectrified. Existing PALECO facilities are insufficient to supply demand in the rural area. Moreover, electric rates of PALECO are the highest of any in the Philippines. Taking into account conditions in and out of the Rio Tuba Mine, Pacific Metals Co., Ltd. requested JICA to conduct a feasiblity study, as a step towards a possible JICA loan, on the Tamlang river hydropower development plan to reduce energy cost for the proposed segregation plant as well as to contribute to rural electrification around the mine. JICA conducted the feasiblity study on the Tamlang hydropower plan for the period from January to June 1984.

Survey results revealed, however, that Tamlang River water resources were insufficient to fulfill the combined power demand of the Rio Tuba Mine and surrounding rural area. Consequently, a revised hydropower plan was proposed utilizing the Candawaga and Culasian rivers on the west coast of Palawan Island, the hydropower potential of which had appeared promising in the Tamlang survey. JICA, requested by Pacific Metal Co., Ltd. to undertake a study on the proposed revised plan, dispatched a team from Chuo Kaihatsu Corp. and EPDC International to the field. The present report incorporates the results of this survey.

1.2 Study Objectives and Scope

The primary objective of hydropower development is to supply electricity to the proposed segregation plant planned by the Rio Tuba Mining Corp. At the same time, hydropower development is envisioned to provide an inexpensive source of electricity to be distributed through PALECO thereby contributing to rural electrification and development, and improvement in living standards.

The study aimed to formulate the optimum hydropower development plan for achievement of the above objectives using the water resources of the Candawaga and Culasian rivers on the southwestern coast of Palawan Island. To this end, technical and economic feasibility were evaluated based on data obtained in the field and home office analysis. Financial feasibility analysis for the entire segregation plan was not conducted in the present report as the plan is still under study and appropriate financial figures for the same are therefore unclear.

1.3 Need for Hydropower Development

(1) Need for Hydropower Development

An economical power source is essential for establishment of the proposed Rio Tuba segregation plant. The most economic power source would be combined use of diesel generation and hydropower as use of the latter as a supplementary power source reduces the cost of diesel fuel in this case.

As study results clearly showed, the site of the proposed Candawaga hydropower development scheme has abundant water resources and excellent topography for low cost hydropower generation. Power costs with utilization of hydropower from the Candawaga River are noticeably cheaper than those for diesel generation as shown below (Detailed cost evaluation is presented in CHAPTER VII).

Candawaga hydropower generation cost:	¥11.14/kWh
Diesel fuel cost:	¥20.68/kWh

(2) Combination of Hydropower and Diesel Generation

Potential hydropower generation varies greatly between rainy season and dry season, and is also easily affected by weather fluctuations. Accordingly, to ensure a stable and constant power supply, combined use of hydropower and diesel generation is required. An example of the typical operation pattern envisioned in rainy and dry seasons is outlined below.

TYPICAL OPERATION PATTERN

Item		Rainy Season (kW)	Dry Season (kW)
Output	Diesel	5,000	10,000
	Hydropower	6,000	780
	Total	11,000	10,780
Consumption	Rio Tuba Mine	8,500	8,500
	Residential	2,100	2,100

(3) Tamlang River Hydropower Development

The Tamlang River hydropower development scheme, which was studied from January to June 1984, is designed as a reservoir type scheme with the capability for variation in daily load. Accordingly, this scheme is suitable for supply of forecasted rural electric demand in the southern portion of Palawan Island (daily load factor: 32%); however, the scheme is insufficient for supply of annual electric demand (8,500kW) at the Rio Tuba Mine. Moreover, the proposed dam with reservoir requires a higher development cost than that for the run-of-river type proposed in the Candawaga River scheme.

As the primary objective of the Project is reduction in diesel fuel costs at the mine, the Candawaga River scheme is considered the most appropriate hydropower development plan. Reduction in diesel fuel costs at the mine and supply of rural electric demand could be achieved through a combination of the

above two schemes. In consideration of construction cost and other factors, subsequent study of the same is required.

1.4 Study Schedule and Content

(1) Study Schedule and Team Members

The study consists of field work conducted from 19 March 1985 to 7 May 1985 and home office works in the same year from 8 May to 9 August.

Team members are as presented below. Mr. Hosogai, Technical Cooperation Dept., Ministry of International Trade and Industry and Mr. Yanaka, Mine and Industry Development Cooperation Dept., JICA participated in field works from 19 to 28 March, 1985.

Position	Name	Company
Team Leader	Minoru Sayama	CKC
Civil Engineer	Kazuhiko Fushimi	EPDCI
Electro-Mechanical Engineer	Kunio Kuroda	CKC
Economist	Masaaki Nagata	ECFA
Geologist	Chuei Ito	CKC
Hydrologist	Keiji Sasabe	CKC
Surveyor	Mitsugu Yanase	EPDCI
Drilling Engineer	Masanori Nukazuka	CKC

(2) Field Work

1) Discussions with Related Agencies

Discussions were held in Manila and Palawan Island with the following agencies and data were obtained.

- Rio Tuba Nickel Mining Corp.
- National Economic and Development Authority (NEDA)
- Asian Development Bank (ADB)
- Palawan Integrated Area Development Project (PIADP)
- National Power Corporation (NPC)
- National Electrification Administration (NEA)

- Palawan Electric Cooperative (PALECO)
- National Irrigation Administration (NIA)

2) Topographical Survey

The following topographical surveys were carried out in the field.

a) River profile survey for Candawaga River: length 10km
River profile survey for Culasian River: length 4km

b) Survey of intake dam and preparation of topographical map
scale: 1/500 area: 0.16km^2

c) Survey of proposed canal route and preparation of topographical map
scale: 1/2,000 area: 1.29km^2

d) Survey of proposed penstock and powerhouse and preparation of topographical map
scale: 1/200 area: 0.07km^2

3) Geological Survey

Geological data were collected for the entire Project area, and surface, geological and riverbed material surveys were conducted. In addition, drilling was conducted at the following sites.

- Proposed Culasian powerhouse and penstock sites
No. of borings: 3 depth: 55m

- Proposed powerhouse and penstock sites for Candawaga alternative plan
No. of borings: 3 depth: 45m

4) Hydrological and Meteorological Survey

Hydrological and meteorological data were collected from the Rio Tuba Mine, PAGASA, NIA and PIADP, and discharge measurements were made in the field.

5) Hydropower Plan Survey

Survey was conducted for selection of sites for proposed facilities such as the intake dam, canal, penstock and powerhouse. Prices of construction materials were also surveyed.

6) Power Demand Survey

Present electrification conditions and future demand in the Rio Tuba Mine was studied based upon discussions. Present electrification and economical conditions in southern area of Palawan Island were investigated through interviews in barangays.

7) Economic Survey

Necessary data for financial and economic analysis were collected, and discussions with related agencies were conducted.

(3) Home Office Work

Various data obtained were analysed and the following works were undertaken in consideration of the contents of discussions in the field.

- Power demand forecast
- Optimization of power generation plan
- Determination of main features of power generation and required facilities
- Formulation of basic design and implementation plan, and estimation of construction cost
- Financial and economic evaluation
- Study of impact on rural society

CHAPTER II

SOCIO ECONOMIC CONDITIONS

CHAPTER II

SOCIOECONOMIC CONDITIONS

2.1 Conditions in the Philippines

2.1.1 Population

A national census is conducted in the Philippines every five years by the National Census and Statistics Office (NCSO). Although the most recent census was scheduled for completion in May 1985, the results of the same have not yet been released. Data available from the 1980 census show a total population of 48 million as of 1 May 1980. The Inter-Agency Committee on Population and Housing Statistics (IACPHS) composed of experts from various agencies, estimates total population in 1984 at 53.4 million. This represents a double increase in comparison with the total population of 27 million recorded in May 1960.

The Philippines has the largest population growth rate in southeast Asia, with an average annual growth rate of 2.91% for the period from 1960 to 1980. However, in comparison with the growth rate of 3.08% from 1960-74, the rate has decreased in the last ten years at 2.78% from 1970-74 and 2.71% from 1975-80. This trend reflects the impact of the Government's efforts in promoting family planning. IACPHS forecasts average annual population growth rates of 2.44% from 1984-87 and 2.26% from 1988-92, with an estimated total population of 64.2 million in 1992.

There are marked regional variations in population growth rates. In Metro-Manila and Region IV to the south of the same, for example, the average growth rates for 1960-80 were 4.49% and 3.49%, respectively. Conversely, growth rates in Region VI (Iloilo Is. and Western Negros Is.) and Region VIII (Samar Is. and Leyte Is.) for the same period were 1.95% and 1.59%, respectively. These figures indicate the trend towards urbanization in the Philippines. In 1970, the urban population represented 31.83% of the total population; by 1980, urban population had increased to 37.31%. At the same time, however, the Government's resettlement policy has resulted in a significant movement of people from city slums and overpopulated islands to comparatively less developed areas.

Palawan Island has also received a large number of immigrants from Luzon Is. (Manila) and the Visayas, despite the great distance and lower level of development. The average annual population growth rate in the past twenty years was 4.21% which, unlike other areas, represents an increasing trend (average growth rate for 1975-80 was 4.4%).

2.1.2 Economy

(1) Economic Situation in 1984

The economic situation in the Philippines rapidly deteriorated in 1984. A negative GNP growth rate (-5.5%) was recorded for the first time since the end of World War II and per capita GNP decreased to -7.7%. This situation resulted from a variety of factors, including inflation, tight credit, worsening of the foreign exchange situation, and a slump in agricultural production due to poor weather (particularly typhoons).

Due to the economic and financial crisis, proposed capital investment was not forthcoming and domestic capital formation dropped ₱15.5 billion or 38.2% in comparison with the previous year (at constant 1972 prices). On the other hand, despite the domestic situation, private consumption (expenditure) continued to rise. Consequently, production could not meet demand and stocks decreased along with investment. Moreover, government expenditure was restricted, decreasing 9.1% in comparison with the previous year (at constant 1972 prices).

From the above, it is clear that private consumption remained the major stimulus to the domestic economy, accounting for 71% of total demand. The major reasons for continued private consumption were heavy compaign spending by candidates for the National Assembly elections in May and consumer hedging against further peso devaluations.

Devaluation of the peso, rising production costs and high interest rates accelerated inflation, with an annual the inflation rate of 49.3%. In the latter half of the year, the inflation rate as compared to the same month of the previous year was particularly high at 60.5% in August, 62.9% in September, 64.0% in October,

54.0% in November and 47.7% in December. Although inflation appears to decrease from November, this impression arises from the sharp increase in inflation since November 1983. In comparison with the same month of the previous year. inflation still increased at a rate of 3.8% in November and 1.5% in December. Items for which inflation is particularly noticeable include fuel, electricity and water. If 1978 is given a value of 100, total price index increase as of December 1983 is 346.3 versus an average price increase of 539.9 or five times the former for the above mentioned items.

Due to drastic reduction in import bills (-20%) and increased exports (8.5%), the current account deficit declined to US$ 1.1 billion or 43.8% in comparison with the previous year. Import reductions were a result of the devaluation of the peso, foreign exchange shortages and import restrictions. Increased exports on the other hand, rather than representing a broad overall increase, primarily resulted from the sudden rise in the international market price of coconut due to a drop in Philippine coconut production.

Exports of recently important non-traditional electrical, electronic and manufactured goods did not benefit much from the devaluation of the peso and increased foreign demand due to input supply and credit shortages.

Import restrictions and shortage of foreign exchange thus adversely affected industries, particularly in the manufacturing sector, with numerous enterprises falling into bankruptcy or reducing operation. As a result, a large number of workers were laid off and unemployment rose to 6.2% (7.4% according to ADB statistical information), an increase of 1.6% in comparison with the previous year. Moreover, the rate of underemployment, including day laborers and those in the informal sector rose to as much as 36.2%.

Negotiations with IMF for a standby credit of SDR 615 million (US$ 650 million) bogged down over reduction of excessive liquidity, which sharply increased in the latter half of 1983 and showed little progress throughout 1984. In order to absorb the

excessive liquidity, the Government of the Philippines employed open market operations which increased interest rates and tightened credit. These efforts to curb money supply, coupled with a second setback in July when the Central Bank made an emergency loan to compensate the sudden withdrawal of substantial deposits from city banks, further hardened the IMF attitude.

In the latter half of 1984, however, narrow money (M_1) was reduced to ₱3.2 billion, only slightly over the ceiling of ₱3.1 billion due to a second increase in interest rates, adoption of the floating exchange rate system for the peso and implementation of a series of large scale tax increases. On 14 December 1984, more than one year after negotiations had begun the IMF board of directors formally approved standby credits to the Philippine Government. The Philippine Government had made great strides towards improvement since 1983 when the moratorium on re-payment of foreign debts was declared. With negotiations concluded, the first step was taken towards normalization of the economy.

(2) Economic Outlook for 1985

Successful conclusion of negotiations with IMF and subsequent credits from IMF and private commercial banks removed the major obstacle to economic recovery of the Philippines. However, the economic crisis which began in 1983 still continues while economic growth prospects remain bleak.

In order to improve the balance of payments position and promote economic recovery, the Government of the Philippines is enacting a variety of strict measures including new taxes, controls on public spending, adoption of a more flexible exchange system, and abolition of administered price. Government expenditure and capital formation are projected to decline by 3.5% and 5.1%, respectively as a result of the above measures, and consequently, the prospects for economic expansion in 1985 are slight. As consumer prices will likely continue at a high level, private consumption is not expected to increase at the same pace as in 1984. However, it is projected to play an important role in stimulating the domestic economy in 1985.

Repeated devaluations of the peso since June 1983 will stimulate exports to a small extent. However, foreign demand and price factors, domestic supply constraints, and shortage of foreign exchange are expected to be major constraints against increase in exports. Imports, on the other hand, will be curbed by import restrictions, shortage of foreign exchange and weak domestic demand, and the merchandise trade deficit is therefore expected to decline from US$ 613 million in 1984 to US$ 319 million. As a result, the current account deficit is likewise expected to decline from US$ 1.4 billion in 1984 to US$ 1.2 billion.

In comparison with 1984, the inflation rate is projected to decrease but it will still remain at a high 25%. Projections for the labor sector indicate that envisioned employment opportunities are insufficient for the increased labor force, and the unemployment situation will deteriorate raising the rate to 8.6% while hidden unemployment or underemployment will be considerably higher.

(3) Prospects Beyond 1985

Economic growth in the Philippines will depend on effectiveness of administrative and economic management, in particular, drastic structural reforms. A fairly optimistic forecast projects an average annual economic growth rate of 3.2% by 1990; however, this growth rate is still the lowest in Southeast Asia. Capital formation is expected to remain at its present low level resulting in an investment gap which will persist until 1987. Although the investment gap may be financed by foreign borrowings and be complimented by stabilization measures through new fiscal and monetary policies, it has grown so large it will take several years to eliminate.

Re-devaluation of the peso and strict import restrictions are estimated to continue until the end of 1986. Such cautious economic management coupled with recovery of the foreign market are projected to bring about a trade surplus by early 1987 and subsequent balance of current accounts. However, fulfillment of each condition required for redemption of its foreign debts is the

major factor in improvement of the overall balance of payments in the Philippines.

By the end of the 1980s, repayment of debts is expected to reach a very high level, rising from a forecasted US$ 2.9 billion in 1983, to a peak in 1987 and then gradually declining by 1990. Thereafter, balance of payments is projected to remain in chronic deficit and additional financing and restructuring of debt repayment will be required.

In order to implement the economic adjustment program, the Government of the Philippines will require capital loans totalling US$ 2.2 billion. These loans will rebuild depleted foreign exchange reserves, finance the growth of GNP, and meet debt service requirements. In this way, the debt service ratio is expected to fall from 35.7% in 1983 to less than 30% by the end of the 1980s.

Although tight monetary conditions are expected to reduce inflation, general prices will remain at a high rate. Despite the various constraints, the Philippine economy is expected to improve by the 1990s and both unemployment and underemployment rates are expected to decrease gradually.

2.1.3 The Five-Year Development Plan

The original objectives of the Five-Year Philippine Development Plan, 1983-87, were substantially revised in response to the socio-economic crisis which arose in 1983, and the Updated Philippine Development Plan, 1984-87 was issued in September, 1984. Recognizing that economic growth in the Philippines in the past ten years had been overly dependent on the world economy and imports and therefore extremely vulnerable to external fluctuations and recession, the revised plan aims to achieve i) sustained economic growth; ii) a more equitable distribution of wealth and incomes; and, iii) total human development, focusing on strengthening self-reliance.

This self-reliant development strategy gives highest priority to the welfare of vulnerable groups of society including farmers, fishermen and wage-earners. Improved productivity of primary agricultural products, agro-based industries, small-scale industries, and labor intensive

industries are also being emphasized. Improved productivity will stabilize prices and contribute to the country's industrial competitiveness. This will raise incomes, savings and investments, and will also generate foreign exchange reserves for critical imports and minimize the need for foreign borrowing.

The public expenditure program was also substantially revised, maintaining present social services while emphasing a shift in the infrastructure program towards maintenance and completion of on-going projects. New construction will be concentrated on rural road networks, irrigation and similar infrastructures which benefit the majority of people.

The Philippine Government places emphasis on several aspects concerning energy and development of natural resources, both of which are closely related to the present nickel segregation and hydropower development plan in Palawan Province. A shift from reliance on imported oil to use of indigenous energy sources is promoted in energy development. Target for dependence on oil imports is 44.1% in 1987 reduced from 56.5% in 1984 (See TABLE II-2). The rural electrification program, as in the previous five-year plan, will also be promoted, increasing the electrification rate from 43.7% in 1984 to 62% by 1987, the final year of the plan. Funds for realization of both energy development and the electrification program will be less dependent on government funding. As for development of natural resources, the Government is encouraging greater domestic processing to raise the domestic value-added.

In consideration of the above, the hydropower development plan of the Rio Tuba Mining Corp. which proposes electrification for both nickel segregation and rural supply, fulfills the objectives of the Updated Five-Year Philippine Development Plan.

2.1.4 Electricity

(1) Agencies Concerned

Various public and private organizations are responsible for electric supply in the Philippines including NPC, MERALCO, NEA and electric cooperatives.

NPC, under the jurisdiction of MOE, is responsible for planning, construction, and management of electric facilities and sale of electric power at the national level. NEA, which is subordinate to MHS, is in charge of cooperatives, as well as planning of rural electrification and construction of electrical facilities in areas other than the Manila vicinity. The said agency is also responsible for planning and construction of hydropower projects of less than 5,000kW and dendro-power generation projects. Power projects 5,000-20,000kW in scale are implemented upon consultation between NPC and NEA.

Cooperatives and public and private enterprises in rural areas, and MERALCO in and around Manila, procure electricity from NPC for distribution. Electric supply for large scale demand such as Government agencies and commercial and industrial enterprises is distributed directly by NPC. Cooperatives own diesel generation facilities for rural distribution. Municipalities and some private enterprises also have their own generation facilities.

(2) Power Supply and Demand

Total capacity of power generation facilities in the Philippines was 5,908.9MW in 1984 (TABLE 2-3). Oil thermal accounted for 2,689.3MW of the total (45.6%) while hydropower accounted for 1,666.1MW (28.2%), geothermal for 894.0MW (15.1%), coal-fired thermal plants for 479.7MW (8.1%) and dendro, solar and others for 179.8MW (3%). The scale of geo-thermal power generation in the Philippines is second in the world.

Total capacity increased by 173.4MW (3.0%) in comparison with 1983. Of the total facilities, NPC owns 5,196MW or 87.3%. Regional variations occur in type of facility, with hydropower predominant in Luzon and Mindanao, geothermal on Luzon Island and thermal power in the Manila area.

Total generated energy was 21,115GWh at the end of 1984 (TABLE 2-4). This represented a reduction of 327GWh (1.5%) in comparison with the previous year reflecting the slump in commercial and industrial power demand due to the economic

recession. Oil thermal generation accounted for 9,310GWh or 44.1% of total generation, hydropower for 5,266GWh (24.9%), geothermal generation for 4,536GWh (21.5%), coal-fired thermal generation for 1,186GWh (5.6%) and others for 827GWh (3.9%). NPC produced 18,693GWh or 88.5% of total energy, 16,830GWh of which was sold to MERALCO, electric cooperatives and large scale power consumers.

Energy consumption of various sectors is as shown in TABLE 2-5. Influenced by the economic slowdown, commercial consumption decreased by 284GWh (8.2%) and industrial by 310GWh (3.5%) in comparison with 1983. Of total consumption, industrial consumption accounted for 8,656GWh (41.0%), residential for 4,118GWh (19.5%), commercial for 3,167GWh (15.0%), auxiliary use and loss for 4,012GWh (19.0%) and others for 1,162GWh (5.5%). The Manila area accounted for 58% of total consumption while the Luzon system accounted for 20%, the Visayas system comprising several islands, for 6% and the Mindanao system for 16%.

Power development in the Philippines is proceeding in accordance with the Power Expansion Program 1981-90 drawn-up by NPC in October 1981 and revised in 1983. According to NPC demand forecasts of November 1984, energy demand will increase from 18,682GWh in 1983 to 31,629GWh in 1993 at an average annual growth rate of 5.4%. Maximum power demand is likewise projected to increase from 3,108MW to 5,156MW at an average annual rate of 5.2%. To meet this demand, development of power sources other than oil thermal is being promoted. An increase in hydropower generation of 3,220MW is planned by 1993 for a total of 8,100MW. Dependence on oil thermal for power generation is correspondingly forecasted to decrease from 63% in 1980 to 35% in 1993.

However, as a result of the economic recession, NPC power generation for 1985 is projected at 17,500GWh, a 6.4% reduction from 1984. Delays in the power facility development plan are therefore envisioned. According to the Updated Philippine Development Plan 1984-87, oil imports should be reduced to 50% of total energy in 1985 and to 42% in 1987, and diversification of energy sources is emphasized. Oil imports accounted for 58.3% of total energy in 1984.

(3) Rural Electrification

The rural electrification program in the Philippines began in 1969. NEA was established under MHS for program implementation. The program aims to promote comprehensive socioeconomic development in rural communities through electrification and it is being implemented with the support of NEDA. NEA will supply the electricity required for modernization and is promoting agricultural mechanization, irrigation, small and medium scale industries and commercial enterprises in rural communities, and construction of various facilities. Through establishment of mini-dams, the electrification program is presently contributing to irrigation, manufacture of kilns for charcoal making, school lighting and local manufacturing.

The electrification rate[1/] in the Philippines was 47.2% at the end of 1984, as shown in TABLE 2-6. In regions supplied by cooperatives the electrification rate is 43.7% while substantial differences occur among cooperatives, with electrification rates ranging from 2-94%.

An outline of cooperatives is presented in TABLE 1-7. By the end of 1984, there were 120 cooperatives supplying electricity to 1,220 municipalities and 18,250 barangays. Of 5.72 million households in the electrification area, 2.5 million households (43.7%) are electrified.

The target of the rural electrification plan is an electrification rate of 62% by 1987 and electrification of the entire country by 1990. More than 10 years were required for electrification of the first million households in 1979. Electrification of the next million households was completed by 1982, in only 3 years. Despite the recent severity of the economic situation, rural electrification is steadily progressing.

1/ Electrification ratio is against the objective electrification population, not against the total population.

NEA is also promoting development of alternative power sources as part of the rural electrification program. At present, NEA owns 10 hydropower plants totalling 12,325kW and three plants totalling 2,260kW are under construction. By 1990, NEA plans to develop 63 dendro-power plants (200MW). Of these however, only 4 are actually under construction or completed.

2.2 Conditions in Palawan Province

2.2.1 General

(1) Area and Location

Palawan Province is composed of 1,769 islands, including Palawan Island itself. With a total area of about 14,900km^2, the Province is one of the largest in the Philippines comprising 5% of total national area. Palawan Island is located approximately 240km southwest of Manila. Total length is 425km while maximum width is about 40km (near Brooke's Point) and minimum width is about 8.5km.

(2) Topography

Topography, flora and fauna in the Palawan archipelago are similar to those of Borneo. Balabac, the southernmost island of the former, is only 78.5km distant from the northern tip of Borneo. An extensive mountain range runs through the center of Palawan Island dividing the island into the east coast and west coast areas. Average elevation in the mountain is 1,100m while the highest peak, Matalingajan, is 2,086m, located near the Project area. A coral reef extends along the coast, particularly the west coast, presenting a hazard to ships.

(3) Administration

Palawan Province is composed of one city and 21 municipalities, including the newly formed Marcos Municipality which seperated from Quezon Municipality in 1984. Of these, 11 municipalities and one city are located on Palawan Island. Municipalities are further subdivided into barangays, the smallest administrative unit. Barangays generally consist of rural communties called sitios. The proposed powerhouse site is situated

in Barangay Candawaga, Marcos Municipality while the Rio Tuba Mine is located in Barangay Rio Tuba, Bataraza Municipality.

(4) Population

Population statistics from the 1980 national census were the most recent data available. According to the same, population of Palawan Province is about 310,000 with a population density of 25 persons/km^2, and population of Palawan Island is about 270,000. Although Palawan Province comprises 5% of total area, it contains only 0.8% of the total population of the Philippines. Immigration of people from overpopulated islands and Manila's slums to Palawan Island is accordingly being strongly encouraged. The population growth rate of the Province from 1975 to 1980 was 4.38%, far exceeding the national average of 2.71%. According to provincial government forecast, the population growth rate will decrease to 3.38% from 1980-85 and 2.78% from 1985-90. However, of those barangays visited and surveyed in the present study, the majority tended towards increased growth rates due to both natural and artificial (immigration) causes.

Population and related data for each municipality in the proposed electrification area and Project area are as presented in the following table.

POPULATION IN THE PROJECT AREA

Municipality	Population (1980)	No. of Household Members	No. of Households	Population Growth Rate (1975-80)
Bataraza	17,973	3,845	4.7	2.99
Quezon (including Marcos)	33,032	6,653	5.0	4.52
Brooke's Point	46,320	8,926	5.2	4.61
Narra	30,099	5,383	5.6	3.57
Aborlan	11,799	2,185	5.4	2.45

Source: Economic Profile of Palawan Province, 1984

The majority of residents in the Project area are not original inhabitants but rather immigrated at various periods from

the Visayas Region and Luzon Island. The native people of Borneo origin, are few in number and live mainly in the mountains, having little connection with monetary economy and modern life.

2.2.2 Electrification

PALECO presently manages generation, distribution and sale of electric power on Palawan Island. Established in November 1974, it developed steadily and has been promoting electrification of Palawan Island. At present PALECO comprises 4 electrical systems; the Puerto Princesa system, the Narra-Aborlan system (95km south of Puerto Princesa), Brooke's Point system (192km south of Puerto Princesa), and the Cuyo Island system (280km northeast of Puerto Princesa) which began operation in March 1984.

Electrification status in Palawan Island is presented in TABLE 2-8. By the end of 1984, 6 municipalities and 90 barangays had been electrified. Of the total number of potential households for electrification (24,524), 60% or 13,728 were already electrified by 1984, benefiting 15% of the Province's total population. This represents an increase of 2 municipalities, 24 barangays and 2,054 households, a 17.6% increase in comparison with 1983. Number of households supplied by PALECO and changes in amount of power sold are depicted in FIG. 2-1. The number of supply households is increasing steadily; however, the amount of power sold decreased at the beginning of 1984.

PALECO presently owns 7 diesel generators, totalling 6,830kW of power. These facilities are delineated in the table below.

Location	Capacity (kW)	No. of Generators	Total Capacity (kW)
Puerto Princesa	5,500	1	5,500
Narra	300	1	
	500	1	800
Brooke's Point	100	1	
	300	1	400
Cuyo	30	1	
	100	1	130
Total			6,830

Strengthening of facilities to 1,300kW and 800kW in Narra and Brooke's Point, respectively is planned during 1985. Construction of a dendro-power plant at Puerto Princesa is also planned and ipil ipil is now being planted. Although installation of equipment is planned in May, a detailed construction plan has not yet been drawn up.

Total length of PALECO transmission and distribution line is 550km, including 297km of 13.2kV and 7.62kV transmission line and 253km of 200V distribution line. In 1984, PALECO completed a 70km extension, while another 30km to join the Narra-Aborlan and Brooke's Point systems and 21km for electrification of Quezon are planned for completion by 1986.

Maximum demand in 1984 totalled 2,835kW including 2,200kW in Puerto Princesa, 350kW in Narra-Aborlan, 210kW in Brooke's Point and 75kW in Cuyo. This total represents an increase of 55kW in comparison with the previous year and is primarily due to electrification of Cuyo Island.

Energy consumption in 1984 was 7,280MWh, representing a reduction of 207MWh or 2.8% from the previous year. In particular, demand from the commercial sector dropped significantly, decreasing 760MWh (29.1%) to 1,849MWh, despite an increase of 486 users or 24.4%. Of total consumption, 30% was residential and the remaining 70% was for the industrial sector and public buildings.

Electric rates in 1984 varied from ₱2.72 - ₱4.51/kWh at an average of ₱3.54. In April 1985, the rate was ₱4.17/kWh for residential use and ₱4.22 for industrial or commercial use. As shown in TABLE 2-9, unit power generation cost at generator end in 1984 was ₱2.52/kWh while the rate at consumer end was ₱3.67.

PALECO has made commendable efforts to promote rural electrification in the midst of a difficult economic situation. Its efforts have concerned not only electricity but have also included construction of a mini-dam in Narra to irrigate 100ha of land. PALECO has also produced a total of 5 charcoal kilns, with a manufacturing capacity of 40-50t.

Aborlan, Narra and Brooke's Point municipalities are located southeast of Puerto Princesa. The above area, which is served by a national road, is more developed than western Palawan. However, energy consumption in this region is very low compared to the rest of the Philippines.

Power conditions are presented in TABLE 2-10 and 2-11. Power consumption in 1984 was 786MWh and 407MWh in Narra and Brooke's Point, respectively. Of this, 337MWh (43%) and 211MWh (52%), respectively were for residential use. The power system in this area provides a 24-hour supply of electricity. A 24-hour supply service was established in Brooke's Point in March 1984 and despite a reduction in total PALECO energy consumption of 2.8% and of 2.1% in Narra, energy consumption in Brooke's Point increased by 65% in comparison with the previous year. This increase apparently is largely due to the impact of the increased supply hours.

Besides PALECO, there are also several other power generation facilities in southern Palawan Island. The Tagbita Silica Mine 20km southwest of Barangay Culasian owns diesel generators with a capacity of 1,200kW. Power from the same, however, is not supplied to residents or employees but is instead used solely for mine operation.

The municipal offices of Bataraza and Quezon also own diesel generating facilities; however, due to lack of repair and poor management they are presently not in operation. In addition, a few privately owned small diesel generators were observed. Electricity is supplied to Rio Tuba Town, where mine workers reside, by diesel generating facilities for residential use. Residents in the surrounding area however, receive no power supply.

2.2.3 Industry

Agriculture is the main industry in Palawan Province, comprising the majority of GDP. Other major industries include mining, particularly of nickel and silica sand, forestry and fishery.

(1) Agriculture

Of the total working population in Palawan Province, 55.8% are engaged in agriculture; however agriculture accounts for only 29.8% of income, indicating relatively low productivity. About 30% of area on Palawan Island (454,408ha) is cultivable land, but only 25% or 115,323ha is actually cultivated. Main agricultural products are paddy, coconut, and corn and these crops occupy 86% of total cultivated area.

Paddy is cultivated in 40% of total farm area, and 56% of this is irrigated, 28% is rainfed, and 16% is upland paddy. Paddy production in 1982 was 29% less than in 1980 at about 90,000t due to drought and insects. Consequently supply was 5,000t short of the province's demand. Major paddy producing areas include Narra (19%), Brooke's Point (16%) and Quezon (12%), all of which are in the proposed electrification area. Paddy yield per hectare varied widely averaging from 60-80 cavans for irrigated fields and from 15-25 cavans for upland cultivation according to interviews conducted during the field survey. Yield in the newly irrigated areas on the west coast are generally higher with an average yield of 100 cavans/ha in Panitian barangay near Quezon. Buying and selling prices are controlled and the Government purchases polished rice at ₱6.30/kg and unhulled rice at ₱3.20/kg.

Coconut cultivation area in 1982 was 44,133ha, or 38% of total cultivated land. In 1975, coconut cultivation covered only 31,273ha, indicating an increase of more than 40% in 7 years at an annual growth rate of 5%. Brooke's Point produces 34% of total coconut yield followed by Puerto Princesa, Bataraza and Quezon. According to the Philippine Coconut Authority report, there were about 4.107 million coconut trees (an average of 93 trees/ha) in Palawan Province in 1982, 79% of which were in the bearing stage.

Coconuts are harvested 4 times annually yielding 172 million coconuts (an average of 53 fruits/tree) from which 57,333t of copra is derived. To obtain 1kg of copra therefore, 3 to 4 coconuts are required. A single coconut weighs about 1kg and middlemen pay the farmers ₱3/kg. In addition, cost for seasonal laborers during coconut harvest is 50¢/kg. A large amount of coconuts is exported to Malaysia to obtain higher profits.

Corn, a typical upland crop is cultivated in 8,815ha or 7.6% of total cultivated area and is used for animal feed. Average yield/ha is 24 cavans (double cropped) with an average price of ₱2.40/kg. Although corn cultivation is increasing, recent yields have been low due to insect infestations.

(2) Fishery

There are 61 fishing villages in Palawan Province with 12,705 households or 18% of total households engaged in the fishing industry. Workers engaged in the same number about 28,000 with a total catch of about 38,000t in 1982. Due to limitations of the market, however, marketed amount was only 38% of the total.

(3) Forestry

About 68% of total area in Palawan Province is covered by forest, two-thirds of which is commercial timberland. The Philippine Government recently strengthened lumbering regulations, particularly restricting approval of lumbering permits to enterprises which export only rough timber. Consequently, lumber production dropped a significant 44% to 236,000m^3 in 1982 compared to the previous year. Since 1983, WESTPAL Co., which had operated widely in Quezon Municipality was forced to shut down operation in 1984 after failure to obtain a lumbering permit.

(4) Mining

There are 8 mines within the Province as well as several small-scale permittees or licensees operating in the Province. Of the total 8 mines, 5 mine silica sand, 2 exploit chromite and the remaining Rio Tuba Mine extracts nickel. Although silica sand accounted for 72% of minerals exploited in 1981, nickel was by far the most lucrative, income from nickel amounting to about ₱83 million which is 7 times the income from silica sand and 69% of total mine income. The largest silica sand producer is Tagbita Silica Industries Corp., which commenced operation in 1978 in Barangay Tagbita, Marcos Municipality on the west coast and opposite side of the island from the Rio Tuba Mine. This company operates modern equipment with only 120 employees , including 4 diesel generators (total capacity: 1,200kW). The said company mines and processes 60,000t of silica sand annually for use in manufacture of San Miguel beer bottles.

(5) Other Industries

Although there were 390 industrial enterprises recorded in 1978, the majority of these were medium to small-scale such as rice mills, bakeries and lumber mills. Development of larger scale modern industries is presently limited by availability of materials and infrastructures and market conditions.

Palawan Province has great potential as an attractive tourist area and development is expected to result in a promising tourist industry. The number of foreign tourists has increased in recent years and in 1983, 2,417 foreigners visited the Province. Of these, 871 were American, 587 were Japanese, 328 were German and the remainder were from various other countries. Recently, Philippine Airlines has implemented a tourist attraction scheme. Palawan has become particularly popular among nature lovers and scuba divers and in the last few years the number of Japanese, German and French tourists has sharply increased.

Oil drilling off the coast of Palawan Island began in 1977. However, in 1984 world oil prices were low and out of five sites designated for exploitation only two were being developed. Oil production dropped to 3.89 million barrels, 21% less than the previous year. Moreover, all oil is sent directly to the oil refinery in Bataan on Luzon Island, without benefiting the Palawan economy.

2.2.4 Palawan Integrated Area Development Project (PIADP)

Elimination of regional discrepencies is a priority goal of the 5-year plan and accordingly, the Government of the Philippines established the National Council on Integrated Area Development (NACIAD). At present, integrated area development is being promoted in nine areas including Palawan. Of these, development in Mindro Island was completed in 1983. Technical cooperation is provided by JICA, UNDP, USAID, ADB and EEC, while funds are provided by OECF, the World Bank Group (IBRD-IDA), ADB, USAID, EEC, and the Australian Development Assistance Bureau (ADAB). Including the above 9 areas, 13 areas are planned for integrated area development under the next Five-Year Plan 1988-92.

PIADP covers the southern portion of Palawan Island comprising two-thirds of the island's area. Technical cooperation is provided by UNDP while financing is by ADB and EEC. The First Phase consists of implementation of each type of social development program (agriculture, roads, harbor, health and sanitation, etc.).

The implementation period for this stage was originally planned from 1982-88; however, the completion date was extended to 1989 in the Updated Five-Year Development Plan. Although power, industry and other fields are planned for inclusion in the Second Phase, the implementation period and objectives for the same have not yet been identified for financial as well as other reasons.

Main PIADP project components and present state of progress are outlined below.

(1) Communal Irrigation Projects

There are 16 projects, 10 of which are to be implemented, in Quezon Municipality. These projects include rehabilition of existing irrigation facilities in 8 localities covering a total of 2,400ha, and construction of new facilities in 8 localities covering a total area of 2,550ha. A 200ha expansion is planned in Candawaga, the catchment for the proposed powerhouse under the present plan. Feasibility studies on each project, excluding the Candawaga extension plan and a few others, have been completed; however, due to delayed disbursement from ADB after the declaration of a moratorium on foreign debts by the Philippine Government, construction has not yet commenced.

(2) Road Networks

The major objectives of the plan are improvement of 61km of the all weather trunk road between Brooke's Point and Rio Tuba, and construction of a 81km extension of the main road running from Aramaywan to Quezon and Marcos on the west coast. The former is almost completed while the latter is completed from Aramaywan to Quezon and construction on the Quezon-Marcos portion, particularly on the final section from Malatgao to Marcos, is scheduled to commence soon under a Korean contractor. Completion of the final section is envisioned by the end of 1986.

In addition to the above main road development plans, development of 20 feeder roads (total extension: 157.4km) is also planned, and the majority of construction has been completed.

(3) Harbors

Feasibility studies on rehabilitation of existing harbor facilities in Puerto Princessa and construction of facilities in Brooke's Point have been completed; however, actual construction has not yet commenced.

(4) Rural Water Supply Projects

Rehabilitation of existing springs and tubewells and construction of new facilities is planned in 646 sites throughout the area. Feasibility studies have been completed but in the majority of cases construction has not yet begun.

(5) Integrated Environment Program

The environmental regulation plan and monitoring system are aimed at optimum use of natural resources in the Project area while maintaining the ecological balance. A feasibility study is presently in progress by a British consultant with tied-financing from EEC.

2.3 Economic Indicators

Major economic indicators in the Philippines are attached hereunder.

SELECTED PHILIPPINE DEVELOPMENT INDICATORS
Summary Table

Item	Actual		Estimate	Compound Annual Growth (%)	Annual Growth (%)
	1972	1983	1984	1972-84	1983-84
I. NATIONAL INCOME ACCOUNTS					
Gross National Product (Million Pesos, at Current Prices)					
Gross National Product	55,939	379,347	535,885	20.7	41.3
Personal Consumption	40,013	268,188	404,367	21.3	50.8
Government Consumption	5,260	30,890	33,404	16.7	8.1
Gross Domestic Investment	10,890	104,414	99,278	20.2	—4.9
Exports of Goods and Nonfactor Services	9,877	75,267	113,294	22.5	50.5
Imports of Goods and Nonfactor Services	10,334	100,536	116,212	22.3	15.6
Gross National Product (Million Pesos, at Constant 1972 Prices)					
Gross National Product	55,939	98,767	93,345	4.4	—5.5
Gross Domestic Product	56,464	100,068	96,073	4.5	—4.0
By Industrial Origin					
Agriculture, Fishery and Forestry	16,135	24,845	25,141	3.8	1.2
Agriculture	11,436	19,619	20,438	5.0	4.2
Fishery	2,689	4,407	4,032	3.4	—8.5
Forestry	2,010	819	671	—8.7	—18.1
Industry	18,068	35,955	32,746	5.1	—8.9
Mining and Quarrying	1,346	1,966	1,589	1.4	—19.2
Manufacturing	14,014	25,108	23,732	4.5	—5.5
Construction	2,240	7,689	6,214	8.9	—19.2
Electricity, Gas and Water	468	1,192	1,211	8.2	1.6
Services	22,261	39,268	38,186	4.6	—2.8
Transport, Communication and Storage	2,732	5,266	5,019	5.2	—4.7
Trade	7,527	13,930	14,247	5.5	2.3
Finance and Housing	4,515	7,726	7,255	4.0	—6.1
Other Services	7,487	12,346	11,665	3.8	—5.5
By Region[1]					
National Capital Region (NCR)	16,690	32,359	30,882	5.3	—4.6
Region I	2,392	3,787	3,550	3.3	—6.3
II	1,805	2,585	2,421	2.5	—6.3
III	4,824	8,731	8,533	4.9	—2.3
IV	7,666	13,872	13,142	4.6	—5.3
V	2,040	3,087	2,843	2.8	—7.9
VI	5,552	8,288	7,856	2.9	—5.2
VII	4,013	7,098	6,771	4.4	—4.6
VIII	1,687	2,327	2,283	2.5	—1.9
IX	1,437	3,323	3,262	7.1	—1.8
X	2,583	4,492	4,384	4.5	—2.4
XI	3,817	6,564	6,491	4.5	—1.1
XII	1,958	3,555	3,658	5.3	2.9

SELECTED PHILIPPINE DEVELOPMENT INDICATORS
(Summary Table)

	Actual 1972	Actual 1983	Estimate 1984	Compound Annual Gr. (%) 1972-84	Annual Gr. (%) 1983-84
GNP Per Capita (In Pesos)[2]					
At Constant 1972 Prices	1,437	1,897	1,750	1.7	—7.7
At Current Prices	1,437	7,287	10,045	17.6	37.8
Savings and Investments (Million Pesos, at Current Prices)					
Gross Domestic Investments	10,890	104,414	99,278	20.2	—4.9
Gross National Savings	11,133	78,020	81,074	18.0	3.9
Personal Savings	4,130	8,508	(6,614)	—	—
Corporate Savings	843	16,209	14,449	26.7	—10.9
General Government Savings	719	14,123	18,196	30.9	28.8
Capital Consumption Allowance	5,303	39,180	55,043	21.5	40.5
Capital Transfers from Abroad	138	0	0	—	—
Investment-Savings Surplus (Gap)	243	(26,394)	(18,204)	—	—
II. OTHER MACRO INDICATORS					
Consumer Price Index, Philippines (1978 = 100)					
All Items	46.4	190.5	286.4	16.4	50.3
Food, Beverages and Tobacco	48.1	176.5	271.4	15.5	53.8
Clothing	42.4	194.5	303.7	17.8	56.1
Housing and Repairs	44.4	200.3	266.6	16.1	33.1
Fuel, Light and Water	43.4	281.6	426.8	21.0	51.6
Services	46.7	216.8	311.9	17.1	43.9
Miscellaneous	42.0	180.6	278.1	17.1	54.0
Employment (Million Persons)[3]					
Total	11.98	19.52	19.67	4.2	0.8
Agriculture	6.33	10.19	9.73	3.6	—4.5
Nonagriculture	5.65	9.33	9.94	4.8	6.5
Workers Placed Overseas ('000)	14.40	434.20	425.10	32.6	—2.1
Foreign Exchange Remittances of Overseas Contract Workers ($ Million)[4]	5	944	490[5]	—	—34.0
No. of Graduated Apprentices & Learners Under MOLE Training Program	840	20,387	20,007	30.2	—1.9
No. of Trainees Graduated from NMYC Skills Training Programs	16,549[6]	186,222	152,167	32.0	—18.3
Open Unemployment Rate (%)[3]	6.1	4.6	6.2	—	—
Underemployment Rate (%)[3]	11.6	30.1	36.2	—	—
Visible Underemployment Rate[7]	5.6	17.3	22.5	—	—
Invisible Underemployment Rate[8]	6.0	12.8	13.7	—	—
Legislated Daily Minimum Wages[9]					
Non-Agriculture					
Metro Manila	8.00	34.22	48.47	16.2	41.6
Outside Metro Manila	8.00	33.14	47.38	16.0	43.0

SELECTED PHILIPPINE DEVELOPMENT INDICATORS
(Summary Table)

	Actual 1972	Actual 1983	Estimate 1984	Compound Annual Gr. (%) 1972-84	Annual Gr. (%) 1983-84
Agriculture					
Plantation	4.75	27.97	39.66	19.3	41.8
Nonplantation	4.75	20.95	29.92	16.6	42.8
III. GOVERNMENT FINANCE					
National Government (Billion Pesos, Cash Basis)					
Current Receipts	5.9	46.6	57.6	20.9	23.6
Tax Revenues	5.0	39.6	50.9	21.3	28.5
Nontax Revenues	0.9	7.0	3.7	18.2	−4.3
Current Expenditures	5.3	34.5	42.7	19.0	23.8
Current Surplus	0.6	12.1	14.9	30.7	23.1
Capital Expenditures and Net Lending	1.0	18.5	23.2	30.0	25.4
Total Expenditures	6.3	53.1[1]	65.9	21.6	24.1
Overall Surplus/-Deficit	−0.4	−6.4	−8.3	28.8	29.7
Local Government (Billion Pesos, Cash Basis)					
Current Receipts	0.7	3.9	4.4	16.6	12.8
Total Expenditures	0.6	2.8	3.2	15.0	14.3
Total Government Revenue Effort (National Plus Local, in Percent)	11.8	13.3	11.6	—	—
Public Corporations (Billion Pesos)[10]					
Capital Investments	3.1[6]	19.3	11.9	18.3	−38.3
Internal Cash Generation	0.1[6]	3.6	0.8	29.7	−77.8
Social Security Contributions[11] (Million Pesos)	749.5	3,887.3	4,256.0	15.6	9.5
Selected People-Oriented Development Program Expenditures (Cumulative Since 1962, In Billion Pesos)					
Education	8.5	49.5	58.4	17.4	18.0
Energy Self-Sufficiency	0.7	51.0	58.4	44.6	14.5
Transport and Communications	3.4	31.7	34.6	21.3	9.1
Food Self-Sufficiency	2.5	27.2	28.9	22.6	6.2
Water Resources	0.9	22.0	24.9	31.9	13.2
Health	1.6	14.2	17.1	21.8	20.4
Livelihood and Housing[12]	0.4	10.2	11.7	32.5	14.7
Agrarian Reform	0.3	4.3	4.5	25.3	4.7
Total	18.3	210.1	238.5	23.9	13.5

SELECTED PHILIPPINE DEVELOPMENT INDICATORS
(Summary Table)

	Actual 1972	Actual 1983	Estimate 1984	Compound Annual Gr. (%) 1972-84	Annual Gr. (%) 1983-84
IV. MONETARY AGGREGATES					
Total Liquidity (Outstanding, in Billion Pesos)[13]	11.9	113.0	120.4	21.3	6.5
Money Supply	6.5	32.5	33.6	14.7	3.4
Quasi-Money	5.4	63.4	76.4	24.7	20.5
Savings Deposits	4.3	34.1	38.2	20.0	12.0
Time Deposits	1.1	29.3	38.2	34.4	30.4
Deposit Substitutes	N.A.	17.1	10.4	—	--39.2
Reserve Money (Outstanding, in Billion Pesos)	4.4	29.9	33.4	18.4	11.7
Total Net Domestic Credits (Outstanding, in Billion Pesos)[13]	16.3	166.6	154.0	20.6	--7.6
Public	3.2	29.8	31.0	20.8	4.0
Private	13.1	136.8	123.0	20.5	--10.1
Selected Interest Rates (%)[14]					
Savings Deposits	—	9.7	11.6	—	—
Time Deposits (All maturities)	—	17.1	32.7	—	—
Secured Loans (All maturities)	—	21.7	39.7	—	—
Manila Reference Rates (MRR)					
60 days	—	16.6	34.6	—	—
90 days	—	17.1	36.5	—	—
180 days	—	16.9	37.4	—	—
Treasury Bills (91 days)	—	15.4	42.2[15]	—	—
Central Bank Bills (All maturities)	—	—	40.0	—	—
Interbank Call Loan Rate (IBCL)	—	31.0	15.2	—	—
V. TRADE INDICATORS					
Merchandise Exports (F.O.B., Million US$)[16]					
Traditional	947	1,820	1,472	—	--12.0
Coconut Products	228	639	638	—	16.9
Sugar Products	216	282	231	—	--10.7
Forest Products	225	327	237	—	--19.6
Mineral Products	233	413	222	—	--41.5
Others	45	159	144	—	--26.0
Nontraditional Manufactures	95	2,588	2,817	—	22.5
Electrical and Electronic Equipment and Components	2	1,053	1,225	—	26.6
Garments	2	542	529	—	11.4
Chemicals	6	86	94	—	18.0

SELECTED PHILIPPINE DEVELOPMENT INDICATORS
(Summary Table)

	Actual 1972	Actual 1983	Estimate 1984	Compound Annual Gr. (%) 1972-84	Annual Gr. (%) 1983-84
Machinery and Transport Equipment	3	35	32	—	2.7
Food Products and Beverages	15	175	119	—	—28.5
Gifts and Houseware	13	140	124	—	—0.7
Furniture and Parts	2	84	81	—	6.0
Footwear	1	55	40	—	18.5
Textile Yarns/Fabrics	5	29	20	—	—22.8
Copper Metal	—	26	103	—	708.8
Nonmetallic Mineral Manufactures	8	26	20	—	—21.2
Builders' Woodwork	8	39	36	—	—0.8
Others	30	298	394	—	72.4
Nontraditional Nonmanufactures	59	506	444	—	—4.0
Iron Ore Agglomerates	—	114	94	—	—7.2
Bananas	24	105	113	—	16.7
Nickel	—	54	9	—	—81.3
Fish, Fresh or Simply Preserved	9	77	61	—	—13.4
Coffee, Raw, Not Roasted	—	47	67	—	48.4
Others	26	109	100	—	—1.5
Others	5	91	136	—	77.1
Total	1,106	5,005	4,869	—	7.9
			5,391 (Jan.-Dec.)	14.1	7.7
Imports by Commodity Groups (F.O.B., US$ Million)[16]					
Food and food preparations	175	528	396	—	—21.7
Beverages and tobacco	9	73	26	—	—58.9
Crude materials, inedible	70	233	218	—	0
Mineral fuels and lubricants	149	2,123	1,538	—	—20.6
Animal and vegetable oils and fats	4	25	29	—	22.8
Chemicals	148	771	564	—	—22.0
Manufactured goods	214	931	528	—	—40.1
Machinery and transport equipment	418	1,592	921	—	—38.1
Miscellaneous manufactures	34	178	121	—	—28.2
Others	9	1,033	1,146	—	25.6
Total	1,230	7,487	5,487	—	—20.8
			6,070 (Jan.-Dec.)	14.2	—18.9
Terms of Trade (1972 = 100)	100	61.3	59.8	—4.2	—2.4
International Commodity Prices (Current)					
Lumber ($/Cu. Meter)	62[17]	80	63	0.1	—21.3
Copper ($/Ton)	1,071[18]	1,551	1,378	2.1	—11.2
Sugar ($/Metric Ton)	160	187	116	—2.6	—38.0
Coconut Oil ($/Metric Ton)	234	727	1,127	14.0	55.0
Petroleum Crude ($/BBL)[19]	1.9	29.5	29.0	25.5	—1.7

SELECTED PHILIPPINE DEVELOPMENT INDICATORS
(Summary Table)

	Actual 1972	Actual 1983	Estimate 1984	Compound Annual Gr. (%) 1972-84	Annual Gr. (%) 1983-84
VI. BALANCE OF PAYMENTS AND EXTERNAL DEBT					
Balance of Payments (US$ Million)[5]					
Exports	1,106	5,005	4,002	—	8.5
Imports	1,230	7,487	4,493	—	−19.9
Trade Balance	−124	−2,482	−491	—	−74.5
Services (Net)	−55	−740	−761	—	120.6
Transfers (Net)	188	472	180	—	−50.0
Current Account Balance	9	−2,750	−1,072	—	−43.8
Long-Term Loans (Net)	140	1,392	198	—	−80.6
Direct Investments (Net)	−22	112	62	—	−30.3
Short-Term Capital (Net)	27	−837	357	—	—
Errors and Omissions	−83	−168	303	—	—
Nonmonetary Capital Account Balance	62	499	920	—	9.8
Monetization of Gold	7	183	118	—	−31.8
Overall Surplus/Deficit	94	−2,068	−34	—	−96.2
Debt Service (US$ Million)	404	1,896[20]	1,864[20]	13.6	−1.7
Debt Service Ratio (%)	19.0	16.1	17.2	—	—
International Reserves (US$ Million)	549	865	886[21]	—	—
Increase/Decrease in Reserves[22]	−173	847	−21	—	—
Rate of Exchange (Average)					
US$1.00 = Peso	6.6748	11.1127	16.6984	7.9	50.3
₱1.00 = US$	0.1498	0.0900	0.0599	−7.4	−33.4
Total Foreign Exchange Liabilities (US$ Million)	2,663	24,845	25,418	20.7	2.3
By Maturity Structure					
Medium-and Long-Term	1,890	15,235	15,926	19.4	4.5
Short-Term	773	9,610	9,492	23.2	−1.2
By Borrower					
Monetary	—	8,317	8,230	—	−1.0
Public	—	4,801	5,207	—	8.4
Private	—	3,516	3,023	—	−14.0
Nonmonetary	—	16,344	16,951	—	3.7
Public	—	11,288	12,151	—	7.6
Private	—	5,056	4,800	—	−5.1
Red Clause[23]	—	184	237	—	28.8
Public	—	142	190	—	33.8
Private	—	42	47	—	11.9
VII. AGRICULTURE AND AGRARIAN REFORM					
Agricultural Production (Thousand Metric Tons)					
Palay	5,114	7,295	8,199	4.0	12.4

SELECTED PHILIPPINE DEVELOPMENT INDICATORS
(Summary Table)

	Actual 1972	Actual 1983	Estimate 1984	Compound Annual Gr. (%) 1972-84	Annual Gr. (%) 1983-84
Corn	2,177	3,134	3,271	3.4	4.4
Sugar (Raw)	2,553	2,000	1,997[5]	—	—
Coconut (Copra)	1,703	2,148	1,400	—1.6	—34.8
Fish	1,122	2,110	2,207	5.8	4.6
Agrarian Reform Program (Cumulative)[5]					
No. of Certificates of Land Transfer Issued	423	640,358	656,557	84.5	2.5
No. of Tenant Recipients	423	427,960	439,501	78.4	2.7
No. of Hectares	682	735,407	754,030	79.3	2.5
No. of Landowners Compensated	94[24]	9,832	10,984	61.0	11.7
No. of Tenant Beneficiaries Under Leasehold Operations	62,622	484,748	513,289	19.2	5.9
No. of Settler-Families	41,002	57,104	57,382	2.8	0.5
Agricultural Crop Yield Per Hectare					
Palay (Cavans)	30	48	50	4.3	4.2
Corn (MT)	0.83	0.99	1.0	1.6	1.0
Crop Insurance Certificates Issued (Since May 1981)	—	170,073	171,338[5]	—	0.7
Insurance Payments to Farmers (Since May 1981, Million Pesos)	—	447	491[5]	—	9.8
VIII. NATURAL RESOURCES					
Forestry Production (in '000 Cu.M.)[25]					
Logs	8,461	4,430	4,000	—6.1	—9.7
Lumber	1,411	1,222	1,020	—2.7	—16.5
Plywood	642	459	381	—4.3	—17.0
Veneer	234	445	100	—6.8	—77.5
Mineral Production (in '000 M.T.)					
Copper Metal	213.7	271.4	225.0	0.4	—17.1
Gold ('000 Kg.)	18.9	25.4	24.8	2.3	—2.4
Nickel Metal	0.4	13.9	11.9	32.7	—14.4
IX. INDUSTRY					
Livelihood Programs (Cumulative Since Start of Program)					
Kilusang Kabuhayan at Kaunlaran					
No. of Projects Approved	—	22,237	23,289	—	4.7
Amt. of Financial Assistance (Million Pesos)	—	1,596	1,756	—	10.0
No. of Beneficiaries	—	285,253	294,498	—	3.2
Small- and Medium-Scale Industries					
No. of Projects					
SMILE	—	10,063	10,104	—	0.4

SELECTED PHILIPPINE DEVELOPMENT INDICATORS
(Summary Table)

	Actual 1972	Actual 1983	Estimate 1984	Compound Annual Gr. (%) 1972-84	Annual Gr. (%) 1983-84
CIGLF	—	3,155	3,173	—	0.6
IGLF	236[26]	1,904	2,177	22.4	14.3
Loans Approved (Million Pesos)					
SMILE	—	1,604.7	1,623.9	—	1.2
CIGLF	—	142.7	143.3	—	0.4
IGLF	154.1[26]	1,173.1	1,657.8	24.1	41.3
BOI — Approved Equity Investments (In Million Pesos)					
Local	269.6	2,239.5	2,213.8	19.2	—1.1
Foreign	308.5	2,977.8	3,900.5	23.5	31.0
Total	578.1	5,217.3	6,114.3	21.7	17.2
X. INFRASTRUCTURE					
Physical Accomplishments (Cumulative)					
Total Road Network (Km.)	88,483	155,467	159,183	5.0	2.4
Total Length of Existing Bridges (L.M.)	279,411	337,739	345,054	2.2	1.8
No. of Ports	622	854	956	3.6	11.9
Access to Potable Water Supply, Population Served (%)	39.0	62.0[27]	—	—	—
No. of Duly Organized Water Districts	5[28]	289	289	40.2	0
Total Area Irrigated ('000 Has.)	682	1,476	1,507	6.8	2.1
Telephone Density (Main Telephone Line/100 Population)	0.55	0.91	0.92	4.4	1.1
No. of Rural Telephone Exchanges	15	37	49	10.4	32.4
No. of Telegraph Stations	—	2,104	2,131	—	1.3
No. of Post Offices in Operation	1,577	2,073	2,095	2.4	1.1
XI. ENERGY					
Energy Consumption, By Source (In Million Barrels of Fuel Oil Equivalent)					
Domestic	4.0	34.02	39.47	21.0	16.0
Oil	—	4.65	3.51	—	—24.5
Hydro	3.8	5.12	9.13	7.6	78.3
Geothermal	—	7.03	7.82	—	11.2
Coal	0.2	2.63	4.13	28.7	57.0
Bagasse	n.a	5.47	6.57	—	20.1
Agriwaste	—	8.63	7.85	—	—9.0
Other Nonconventional	—	0.49	0.46	—	—6.1
Imported	59.8	64.45	54.45	—0.8	—15.5
Oil	59.8	63.54	53.09	—1.0	—16.4
Coal	—	0.91	1.36	—	49.5
Total	63.8	98.47	93.92	3.3	—4.6
Imported Oil Dependency Ratio (%)	94	65	57	—	—

SELECTED PHILIPPINE DEVELOPMENT INDICATORS
(Summary Table)

	Actual 1972	Actual 1983	Estimate 1984	Compound Annual Gr. (%) 1972-84	Annual Gr. (%) 1983-84
Percent of Households Serviced By Cooperatives	9[28]	40	44	—	—
Percent of Towns Energized By Cooperatives	6[28]	89	91	—	—
XII. POPULATION					
Population Level (Thousands)[29]					
Philippines	38,917	52,055	53,351	2.66	2.49
NCR	4,397	6,540	6,740	3.62	3.05
Region I	3,127	3,754	3,828	1.70	1.96
II	1,803	2,399	2,459	2.62	2.51
III	4,005	5,196	5,324	2.40	2.48
IV	4,446	6,703	6,894	3.72	2.85
V	3,082	3,744	3,832	1.83	2.35
VI	3,862	4,866	4,977	2.14	2.31
VII	3,201	4,032	4,113	2.11	2.01
VIII	2,489	2,963	3,018	1.62	1.83
IX	1,956	2,734	2,798	3.03	2.34
X	2,114	3,012	3,094	3.22	2.74
XI	2,424	3,645	3,740	3.68	2.61
XII	2,009	2,467	2,532	1.95	2.64
Population Characteristics					
Crude Birth Rate (Per 1,000 Pop.)	38.9	32.9	32.5	—	—
Crude Death Rate (Per 1,000 Pop.)	10.3	8.2	8.1	—	—
Age Dependency Ratio (%)	91.6	79.9	78.9	—	—
Contraceptive Prevalence Rate (Per 100 Married Couples of Reproductive Age)	23	34	35.6	—	—
XIII. EDUCATION					
Enrolment (In Million Persons)	9.72	13.50	13.98	3.1	3.6
Elementary	7.02	8.72	8.85	1.9	1.5
Secondary	1.87	3.20	3.44	5.2	7.5
Tertiary	0.83	1.58	1.69	6.1	7.0
Cohort Survival Rate[30]					
Elementary (Gr. I to Gr. VI)	56.7[31]	65.2	64.8[32]	—	—
Secondary (Yr. I to Yr. IV)	66.6[31]	75.0	75.1[32]	—	—
Transition Rate[33] (Elementary to Secondary)	70.4	85.8[32]	93.6[32]	—	—
No. of Public Schools	29,388	36,536	—	—	—
No. of Classrooms Constructed	419	13,092	3,486	19.3	−73.4
Pupil-Textbook Ratio	10:1	2:1	2:1	—	—
No. of Scholarship Grants	250	9,583	10,133	36.1	5.7

SELECTED PHILIPPINE DEVELOPMENT INDICATORS
(Summary Table)

	Actual 1972	Actual 1983	Estimate 1984	Compound Annual Gr. (%) 1972-84	Annual Gr. (%) 1983-84
XIV. HEALTH AND NUTRITION					
Life Expectancy (In Years)	57.0	62.5	62.8	0.8	0.5
Infant Mortality Rate (Per 1,000 Live Births)	78.4	59.3	58.0	—	—
Crude Death Rate (Per 1,000 Population)	10.3	8.2	8.1	—	—
Hospital Bed-Population Ratio	1:815	1:616	1:634	—	—
No. of Rural Health Units (Cumulative)	1,324	2,018[27]	1,991	3.4	—0.7
No. of Barangay Health Stations (Cumulative)	3,023[34]	7,250[27]	7,991	11.4	5.0
Medicare					
Coverage (Cumulative, Million Persons)	7.8	21.1	24.0	9.8	13.7
Beneficiaries (Thousand Persons)	55.4	1,461.0	1,406.5	30.9	—3.7
Disbursements (Million Pesos)	12.6	400.3	414.4	33.8	3.5
Nutrition					
Calorie Intake as Percent of Requirement	88.6[35]	89.0[27]	—	—	—
Protein Intake as Percent of Requirement	102.9[35]	99.6[27]	—	—	—
XV. HOUSING					
Housing Construction (In Dwelling Units)					
Total	11,821	58,545	56,667	14.0	—3.2
Construction of New Units	4,552	38,543	42,728	20.5	10.9
Upgrading of Marginal Settlements	4,192	7,134	4,783	1.1	—32.9
Development of Sites and Services	3,077	12,868	9,156	9.5	—28.8
Housing Finance (Cumulative)					
Mortgage Purchases (Million Pesos)	—	2,835.4	5,177.7	—	82.6
Pag-IBIG	—	1,952.1	n.a	—	—
Bliss	—	464.3	n.a	—	—
Open Housing	—	242.9	n.a.	—	—
Existing Mortgages	—	176.1	n.a	—	—
Number of Beneficiaries	—	38,069	71,568	—	88.0
Number of Units Acquired	—	22,831	40,066	—	75.5
Pag-IBIG					
Membership (In Million)	.093[36]	2.08	2.1	—	1.0
Collection (In Million Pesos)	.175[36]	1,873.8	3,083.0	—	70.2
XVI. SOCIAL SERVICES					
No. of Disadvantaged Individuals Reached (In Million Persons)	1.0[28]	—	6.2	19.2	23.7

SELECTED PHILIPPINE DEVELOPMENT INDICATORS
(Summary Table)

	Actual 1972	Actual 1983	Estimate 1984	Compound Annual Gr. (%) 1972-84	Annual Gr. (%) 1983-84
Social Security (GSIS & SSS)					
Coverage (Cumulative, Million Persons)	3.8	10.9	11.07	10.2	1.9
Benefit Payments (Million Pesos)	267.5	2,380.0	2,417.1	22.1	1.6
Contributions (Million Pesos)	749.5	3,887.3	4,256.0	17.1	9.5

FOOTNOTES:

[1]Figures may not add up to total due to rounding.
[2]Using medium assumptions for population of 2.5 and 2.49 percent growth in 1983 and 1984, respectively.
[3]1972 figures are from August survey; 1983 and 1984 figures are from third quarter surveys for each particular year.
[4]Remitted through the banking system.
[5]January to September 1984; growth rates computed based on January to September 1984 as against the same period in 1983, except for growth rates in crop insurance certificates issued and insurance payments to farmers which were based in the end-December 1983 level; for agrarian reform, cumulative as of September 1984.
[6]1976 data.
[7]Percentage of those who worked for less than 60 days within a quarter and are still looking for additional work to total employment.
[8]Percentage of those who worked for 60 days within a quarter and are still looking for additional work to total employment.
[9]Weighted average for the year.
[10]1976 data include only corporations covered by the government infrastructure program; 1983-84 data include the NDC, EPZA, LRTA, PPA, MMTC, PNR, NIA, LWUA, MWSS, PNOC, NPC, NEA, and NHA.
[11]Include contributions of both employers and employees.
[12]Includes IGLF loan releases which started in 1952.
[13]Refers to the monetary system.
[14]Weighted average as of December.
[15]Simple average of offered rates for December 1984.
[16]January to November 1984; growth rates computed based on January to November 1984 as against the same period in 1983.
[17]Export unit value for developing countries.
[18]London metal exchange, cash, wirebars.
[19]Saudi Arabian light.
[20]Based on actual repayments of fixed-nonmonetary external debt. Debt service ratios are per R.A. 6142, as amended.
[21]As of end-December 1984.
[22]Positive entries indicate a decrease in assets or an increase in liabilities; negative entries indicate an increase in assets or decrease in liabilities.
[23]Pre-export advances.
[24]1974 data.
[25]Production figures in 1972 are for the period July 1971 — June 1972.
[26]Cumulative from 1952 to 1973.
[27]1982 data.
[28]1973 data.
[29]1983 and 1984 data were based on the 1980 Census of Population and Housing, revised population projection, series 2.

[30]Defined as the proportion of enrolment in the beginning grade or year that reached the final grade or year at the end of the required number of years of study.
[31]1973-74 data.
[32]Refer to public schools only.
[33]Defined as the proportion of students who graduate from one level of education and move on to the next higher level.
[34]As of 1975.
[35]1978 data.
[36]1979 data.

n.a. — Data not available.

CHAPTER III

RIO TUBA MINE

CHAPTER III

RIO TUBA MINE

3.1 History

Nickel deposits were discovered in Bataranza, Palawan Island in 1960. Exploration and prospecting ensued with financial and technological support from an American company, UOP Co. In July, 1969, the Rio Tuba Mining Corp. was established with joint investment by UOP Co. and the Philippine investors. In 1970, 110 mine lots were leased to the company by the Government.

A feasiblity study on the mining of 2 million DMT/year was completed in March 1973 by a group of Japanese companies (Pacific Metals Corp., Ltd., Nippon Mining Co., Ltd., and Sumitomo Metal Mining Corp., Ltd.) at the request of the Rio Tuba Mining Corp. In 1973, Pacific Metals Co., Ltd. acquired all stocks held by UOP Co. (40% of total stocks) becoming chief stockholder in the Rio Tuba Mining Corp. A feasibility study on extraction of one million DMT/year was subsequently completed by Nippon Mining Co., Ltd. This objective, however, was reduced to 500,000DMT in 1974 due to deterioration of the economic situation after the oil crisis.

In 1975, Nippon Steel Corp., Nisshin Steel Co., Ltd., and Nissho Iwai Corp. invested 5.2%, 4.0% and 4.0%, respectively in the Rio Tuba Mining Corp., while Pacific Metals Co., Ltd. investment was 26.8%.

Construction was begun in the same year, with funding from the Export-Import Bank of Japan and main mining facilities were completed by December 1976. During this period, the Rio Tuba Mine Corp. constructed a school, hospital, church, etc. in the town site with a loan from JICA. Mine operation commenced from January 1977 and 22,000WMT of ore were exported to the Pacific Metals factory in Japan by April of the same year. In 1983, the Rio Tuba Mining Corp. switched from its diesel drier to sunlight drying.

Export volume from the mine since 1977 is presented in the table below.

TABLE 3-1 EXPORT VOLUME AND FINANCIAL CONDITION

Item \ Year	1977	1978	1979	1980	1981	1982	1983	1984
Export Volume (DMT)	374,975	660,354	727,899	599,766	630,417	430,925	437,036	538,732
Sales (US$'000)	8,130	9,843	13,543	17,958	16,251	9,897	6,340	8,494
Net Income Before Taxes (US$'000)	128	2,330	1,924	3,297	144	-950	-278	1,179

3.2 Power Conditions

(1) Electrical Facilities

The Rio Tuba Mine is equipped with three 700kW diesel generators at the plant site, and 160kW and 50kW diesel generators at the pier site. The power plant facilities at the plant site were jointly manufactured by Japanese companies in 1976 and are functioning efficiently. There are also about 6.5km of 4.16kV and 230V distribution line.

Operation and maintenance of the above facilities is performed by a total of 32 workers in 3 shifts. Overhaul of the generators takes place once in every 3,000 operation hours. The most recent overhaul was conducted from Sept. to Oct. 1983 after total operation hours of 27,000. The next overhaul is scheduled for 1985.

In general, maintenance and equipment condition is good and repairs are performed with adequate technical skill. A single line diagram for the plant and pier site is presented in FIG. 3-1. The electrical systems of the 2 sites, however, are unconnected.

(2) Power Supply Conditions

Since the Rio Tuba Mine commenced operation in 1977, efforts have been made to reduce production costs. Energy-saving sunlight drying was adopted in 1983 in place of the drier facility and

consequently energy consumption was reduced by as much as 44%, dropping from 3,794MWh in 1982 to 2,130MWh in 1983. In addition diesel fuel was changed from diesel oil to Bunker C oil. As a result of the above measures, energy costs were reduced from 5% to 3.4% of total production costs.

Power supply conditions at the Rio Tuba Mine are presented in FIG. 3-2, and TABLE 3-1. Annual generated energy in 1984 was 2,136MWh which, in comparison with 1983, represents an increase of only 6MWh (0.3%). Excluding auxiliary use, energy consumption was 1,747MWh, an increase of 36MWh (2.1%) from the previous year. Seasonal fluctuations seldom occurred and monthly energy consumption was 128-175MWh. Energy consumption in the dry season was 3 to 4 times greater in the wet season when the mechanical drier was in use.

Maximum demand for the Rio Tuba Mine is presently 400kW versus only 310kW in 1983. The main cause for the increase is considered to be extension of the use of refrigerators to all mine workers. An example of the most recent daily load curve is presented in FIG. 3-3. Maximum demand when the drier is in use is 1,100kW.

Average unit energy cost for the Rio Tuba Mine in 1984 excluding interest and depreciation was ₱1.60/kWh. In December 1984, price of Bunker C increased 2.23 times from ₱2.17/ℓ to ₱4.84/ℓ, while energy cost price also increased to ₱2.57/kWh. Cost reductions due to use of Bunker C are clearly evident when energy cost price is converted to US dollars.

3.3 Proposed Segregation Plant

After mine development, the Rio Tuba Mining Corp. had been exporting wet unprocessed ore with a nickel content of only 2.3% to Japan. Since the sudden worsening of market conditions for nickel following the second oil crisis, the corporation has been considering establishment of a segregation plant with new segregating facilities. This plan is aimed at increasing the added value of nickel ore by producing a higher quality product with a nickel content of 55%, and thereby reducing shipping costs

to Japan. Hydropower development under the present Project is considered a potential source of economical power for operation of the proposed facilities. Components of the said plan are outlined below. As the plan is still under study, however, the said components are tentative.

(1) Segregation Plant Outline

The segregation plant consists of several interrelated facilities which process nickel ore. The ore is first crushed in an impact crusher, calcinated in a rotary kiln, subsequently deoxidized, salified and roasted in a mechanical kiln, cooled and finally dressed by magnetic separation. Design capacity is 30DMT/hr (proposed operation: 25DMT/hr).

(2) Production Plan

The present ore production volume of 500,000DMT/year will remain unchanged with 40% of this volume (200,000DMT/year) to be processed by the proposed segregation plant. The remaining 60% (300,000DMT/year) will continue to be exported to Japan as dry unprocessed ore.

Ore will be mined during the dry season, stored in the stock yard and processed in the proposed facilities through the year. To process 200,000DMT/year at a rate of 25DMT/hr, annual hours of operation required will total 8,000 and annual production will amount to 7,200t of processed ore with 55% nickel content.

(3) Power Plan

Including auxiliary use, 8,500kW of power will be required for plant operation, the majority of which is needed for the mechanical kiln. To supply this requirement, the Rio Tuba Mining Corp. is planning to use three 5,000kW diesel generators, including a stand-by generator.

Main features of the proposed diesel generators are as listed below.

1) Generator

Type:	V type 16 cylinder diesel generator

Capacity:	5,000kW x 3
Rated Speed:	720rpm

2) Fuel

Type of Fuel:	Bunker C
Fuel Consumption:	193g/kWh
Heat Rate:	9,660kcal/ℓ

3) Generation Conditions

Ordinary Use:	2 units
Standby Generator:	1 unit
Periodic Inspection:	every 3,000 operation hours
Operation Commencement:	January, 1989 (projected)

CHAPTER IV

POWER DEMAND FORECAST

CHAPTER IV

POWER DEMAND FORECAST

4.1 Objectives of Load Forecast

The proposed 6,000kW hydropower plant on the Culasian River will supply power to the Rio Tuba Mine via a 69kV transmission line, 38km in length and also to PALECO. The latter will in turn provide a low cost and stable electric supply to rural communities not presently electrified, thereby contributing to the rural electrification program and improvement in rural living standards.

In consideration of these overall objectives, load forecast was focused on the following:

a) Estimation of power demand for domestic use and determination of power allocation to PALECO and the Rio Tuba Mine.

b) Assessment of hydropower effectiveness in relation to Rio Tuba Mine power demand and to PALECO demand.

4.2 Study of Domestic Power Supply

(1) Present Conditions

As discussed in Section 2.2.2, Quezon, Bataraza and Marcos municipalities are not yet electrified. Although electrification of Quezon is planned by 1986, PALECO has no concrete plans for electrification of Bataranza and Marcos. However, upon implementation of the proposed Project, PALECO intends to facilitate electrification of Bataraza and Brooke's Point municipalities through construction of a transmission line. In the area south of Quezon along the west coast, PALECO has no plan for construction of a transmission line due to such factors as the small population and lack of an adequate road network.

(2) Residents' Interests

The Team conducted an interview survey in 22 barangays and sitios in the municipalities of Quezon, Narra and Brooke's Point to determine the relationship between such factors as annual income,

fuel consumption and design for electrification among low, middle, and high income households. Details are discussed in Chapter 9.

Survey results revealed that a monthly average of 5.5ℓ of kerosene are consumed even by low income households, and about ₱64 are expended for lighting. In addition, approximately 60% of households spend about ₱47.5/month on dry-cell batteries for radios.

The majority of people expressed the desire to become recipients of any further power supply. As the present minimum PALECO electricity rate is ₱50 (upto 12 kWh), residents' capacity to pay was deemed sufficient. After the conversion from kerosene to electricity, the minimum electricity rate of ₱50 will increase the number of hours for lighting by 2 to 3 times the number of hours for kerosene.

(3) Load Forecast

Two methods are generally employed for forecast of residential power demand as follows:

a) Macro Method
This method is applied for long term or large scale forecasts using economic indicators such as GNP, economic growth rate, mine production, etc.

b) Accumulation Method
This method is used when the macro method is inapplicable. Forecasts are based on the sum of the values for lighting, electricity used in offices, large scale consumption and other factors.

The accumulation method was used in the Project to forecast demand in each municipality in accordance with the following conditions.

1) Demand forecast is limited to the following barangays.

Municipality	Barangay
Aborlan	all barangays
Narra	- do -
Brooke's Point	- do -
Quezon	Quezon, Tubon, Pin Aglabanan, Panitian

Bataraza	Bataraza, Inogbong, Bonobono, Malihud, Bulalacao, Tarusan, Sandoval, Culandanum, Ocayon, Rio Tuba (excluding Rio Tuba Town)
Marcos	Culasian, Candawaga

2) Load forecast was made for a period of 20 years commencing with hydropower plant start-up assumed in August 1989.

3) Residential power demand forecasts were made on the following premises:

a) Population increase was estimated for each municipality on the basis of the 1980 census data and in consideration of past population increase rates, roads, progress of development, migration trends, etc. As shown in TABLE 4-1, a population growth rate of 1.2-4.5% was adopted.

b) Household number was calculated as population divided by the average number of persons per household using data from the 1980 census. Average number of persons per household in each municipality is as follows:

Municipality	No. of Persons/Household
Aborlan	5.4
Narra	5.6
Brooke's Point	5.2
Bataraza	4.7
Quezon	5.0
Marcos	5.0

c) Initial electrification rate in each municipality is estimated at 20-50% and targeted electrification rate is estimated at 50-70% with an annual growth rate of 5%. Targeted electrification rate forecast took into account the difficulties of supply to remote mountain communities and isolated houses.

d) The number of electrified households was obtained by multiplication of the electrification rate and the number of households;

e) Electrical appliances were estimated for each income level, and an initial average peak load of 80W per household with a 4% growth rate was assumed; and,

f) A load factor of 25% was determined by estimation of residential power supply usage.

4) Demand for commercial use, public buildings, street lights, and small scale industry was estimated from number of users and peak load per user.

a) Number of users was assumed as 10-30% of the number of residential user households in each municipality.

b) Peak load per user was estimated at 170W and peak load growth rate at 5%.

c) Load factor was estimated as 35% based on usage conditions.

Residential demand forecast from 1989 to 2008 are tabulated in TABLE 4-2 to 4-8. Power demand in 1993 is estimated at 2,129kW and 7,100MWh while that for 1998 is estimated at 3,278kW and 11,010MWh.

4.3 Study of Rio Tuba Mine Power Supply

(1) Present Conditions

Energy conditions at the Rio Tuba Mine are described in Section 3.2. Since mine operation commenced in 1977, the Rio Tuba Mining Corp. has implemented various measures reduce the costs of nickel production. Sun light drying was adopted in 1983 in place of the original diesel-powered ore drier, and generator fuel was switched from diesel oil to Bunker C oil in 1982. Both measures have succeeded in reducing costs. The diesel generators are generally well-maintained, and the quality of repair work is high. Moreover, maintenance of heavy equipment used in strip mining is also high quality. With some technological additions, operation and maintenance capacity is considered sufficient for the proposed hydropwer plant.

(2) Load Forecast

The Rio Tuba Mining Corporation is planning construction of a segregation plant to raise the added value of nickel ore. Main electrical equipment includes such items as the kiln motor, boremill and compressor while total capacity of the facilities is about 8,500kW. The proposed power source is diesel generators (3 units of 5,000kW). The new diesel generators will not be connected

to the three existing 700kW diesel generators. As continuous year-round operation is indispensable segregation facilities at the Rio Tuba Mine are also planned for continuous use.

Demand forecast of load (existing facilities for mining, offices, town site appliances) for the existing diesel generators which have an independent electrical supply will not be studied under the present Project as the focus of study is the segregation plant. Maximum energy demand for the Rio Tuba Mine is 8,500kW and annual electric energy is forecasted at 74,460MWh. Yearly demand increase was not considered based on the basic segregation plan of the Rio Tuba Mine.

4.4 Allocation for Mine and Domestic Use

Demand forecasts for domestic and mine use discussed in Section 4.2.2 and 4.3.2 are summarized in TABLE 4-9. The proposed hydropower plant is designed to generate the maximum output of 6,000kW in wet season, although in dry season output will decrease to 780kW at the lowest water level. Capacity of the diesel generators is 10,000kW as only 2 generators will operate at one time, and minimum combined diesel and hydropower capacity in dry season will thus be 10,780kW.

After subtracting the 8,500kW energy requirement of the Rio Tuba Mine, a maximum of 2,280kW may be supplied to PALECO. That portion which is not covered by hydropower may be supplemented by diesel generation for an appropriate fee to be determined by the Rio Tuba Mining Corp.

Taking into account various losses, the maximum demand of 2,100kW which is projected for 1993 was considered as domestic energy appropriate for supply to PALECO. This is 35% of the maximum output, 6,000kW, of the hydropower plant. The energy available for PALECO use is thus 7,100MWh which is equivalent to 22.1% of potential energy (32,100MWh) of the power plant. Under the proposed plan, energy available for PALECO use is sufficient to meet demand up to 1993 without using the existing generators.

4.5 Demand and Supply Balance for Mine Use

Demand and supply balance estimation was conducted according to the following conditions:

a) Start-up of the proposed hydropower project is designated as August 1989;

b) Forecasted demand up to 1992 will be supplied while 2,100kW of peak energy and 7,100MWh/year will be supplied for the same thereafter;

c) Hydropower plant shutdown and auxiliary energy use are considered;

d) Transmission line and transformer losses are considered; and,

e) The existing Rio Tuba Mine diesel generator is not considered as a source of power supply.

As the hydropower plant will only be available for use for 5 months in the first year, available energy from hydropower in the said year is projected at 15,680MWh versus 56,920MWh of diesel energy. Thereafter however, annual available energy from hydropower is projected at 22,600 to 24,940MWh and from diesel at 47,660 to 50,000MWh considering domestic supply. Thus 31.1-34.4% of energy demand for the Rio Tuba Mine segregation plant can be supplied by hydropower.

4.6 Demand and Supply Balance for PALECO

PALECO has a total capacity of 1,200kW diesel generators at Narra and Brooke's Point in the area of demand forecast under the present study. After the completion of the proposed hydropower plant, projected power supply from the Rio Tuba Mine varies from 1,127kW in 1989 to 1,886kW in 1992, in accordance with domestic demand. After 1994, 2,100kW of power will be supplied by Rio Tuba Mine.

Accordingly, power supply capacity of PALECO is 1,200kW up to 1988, 2,327-3,086kW in 1989-1992 and 3,300kW after 1993. The proposed hydropower plant thus enables supply of electricity to 15,000 additional households and 3,700 commercial users in 1998.