

昭和54年度

# ルソン島超高压送電系統開発計画

## 事前調査報告書

(フィリピン共和国)

1980年3月

国際協力事業団

鉦計資

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受入 月日	84. 4. 21
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## ま え が き

本件事前調査は、フィリピン共和国ルソン島における電力需要増と電源開発計画に対応して同国NAPOCOR(NATIONAL POWER CORPORATION)が進めようとしているEHV(EXTRA HIGH VOLTAGE)送電システムの開発計画調査について、日本からの技術協力によって実施するべくフィリピン政府から日本政府に要請がなされ、日本政府がその実施に当たり、国際協力事業団に委託したものである。

本調査は、フィージビリティスタディの実施要請に基づき、その計画の目的、内容、関連情報等具体的な計画内容の掌握及び対象地域の電力系統の現状を予備的に調査し、次に行うべきフィージビリティスタディに関し、先方政府とスコープオブワーク等を協議するとともに収集資料等に基づき本格調査の立案を目的とした。

調査団は中村一氏(東電設計㈱)を団長とする5名の編成により、昭和55年1月14日から30日までの間現地調査をし、帰国後資料の検討解析を行い整理したものである。

本件事前調査の結果が、今後実施される本格調査の実施等に際し参考となることを期待したい。

おわりに調査の任に当たられた団員の労を多とするとともに調査に際して多大の協力をいただいたフィリピン政府関係者、在フィリピン日本大使館、外務省及び通商産業省の関係各位に対し、心から謝意を表すものである。

1980年 3 月

国際協力事業団

理事 岸 田 静 夫





## 伝 達 状

国際協力事業団

総裁 有田 圭輔 殿

ここに、ルソン島超高圧（以下EHVと言う）送電系統開発計画に関し、その事前調査の報告書を提出いたします。

調査団は昭和55年1月14日から1月30日までの17日間フィリピン共和国マニラ市に主として滞在し、フィリピン共和国電力公社（National Power Corporation：NAPOCOR又はNPC）の当該計画関係者と数回に亘って会談をもつと共に、資料の収集に努めました。

その結果、調査団はフィリピン共和国ルソン島に将来EHV送電系統が必要であることを認識し、フィージビリティ調査に関する内容と範囲についてNPC側と協議し1月28日合意書（Implementing Arrangement）に調印いたしました。

そもそも、ルソン島にEHV送電系統を導入しようとする背景には、石油エネルギーからの脱却というフィリピン共和国の政策が大きなウエイトを占めているものと考えられます。即ち、現在発電量の約81％はマニラ周辺地区の石油火力に依存していますが、相次ぐOPECの攻勢による石油の価格高騰と、量的入手難、更には環境問題から新規火力の開発はもとより、これらの既存火力も漸次水力、地熱或は原子力へ代替させようとする計画が見られます。

北部ルソンの山岳地帯に開発が計画されている数箇所の大容量水力発電所は、何れも需要地マニラから350～400km離れた遠隔電源となるので、発生電力の輸送にはEHV送電系統の導入が必要となります。

一方、ルソン島南部に開発が見込まれている地熱電源の、マニラ地区への送電にもEHV送電線が必要になるかと考えますが、地熱開発計画は急がれているとはいえ不確定な要因もありますので、今後行われるフィージビリティ調査では開発計画の確定している北部の水力電源開発に対応したEHV送電計画を主体に、総合的に実施すべきものと考えられます。

最後に、今回の事前調査に当たり、色々と教示を賜りました、外務省、通産省、国際協力事業団の関係各位並びに現地調査にご協力を頂きました在マニラ日本大使館、JICAマニラ事務所の方々に心から謝意を表します。

ルソン島超高圧送電系統  
開発計画事前調査団

団長 中村 一

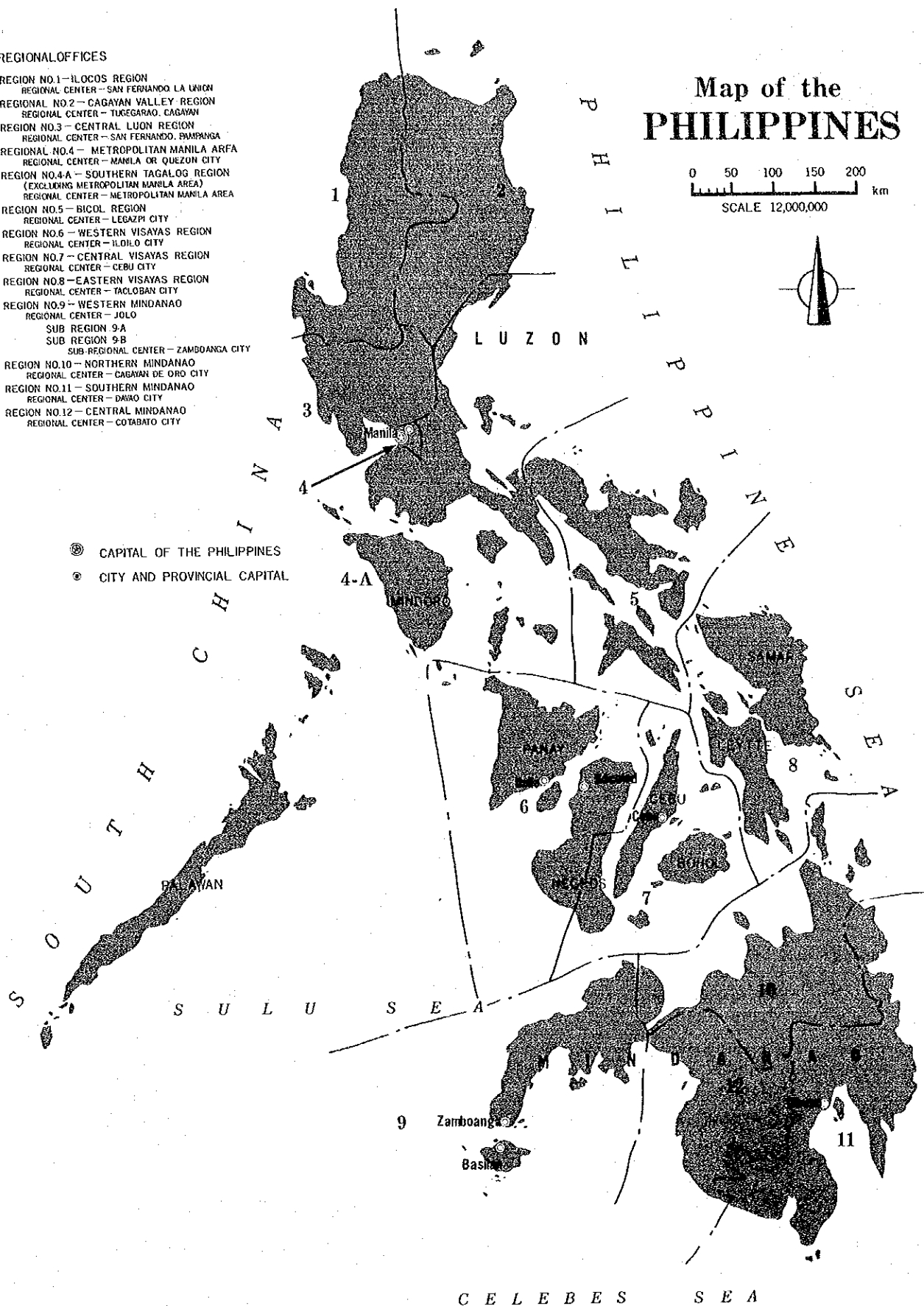
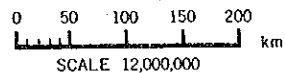


**REGIONAL OFFICES**

- REGION NO.1 - ILOCOS REGION  
REGIONAL CENTER - SAN FERNANDO, LA UNION
- REGION NO.2 - CAGAYAN VALLEY REGION  
REGIONAL CENTER - TUZEGARAO, CAGAYAN
- REGION NO.3 - CENTRAL LUON REGION  
REGIONAL CENTER - SAN FERNANDO, PAMPANGA
- REGIONAL NO.4 - METROPOLITAN MANILA AREA  
REGIONAL CENTER - MANILA OR QUEZON CITY
- REGION NO.4-A - SOUTHERN TAGALOG REGION  
(EXCLUDING METROPOLITAN MANILA AREA)  
REGIONAL CENTER - METROPOLITAN MANILA AREA
- REGION NO.5 - BICOL REGION  
REGIONAL CENTER - LEGAZPI CITY
- REGION NO.6 - WESTERN VISAYAS REGION  
REGIONAL CENTER - ILOILO CITY
- REGION NO.7 - CENTRAL VISAYAS REGION  
REGIONAL CENTER - CEBU CITY
- REGION NO.8 - EASTERN VISAYAS REGION  
REGIONAL CENTER - TACLOBAN CITY
- REGION NO.9 - WESTERN MINDANAO  
REGIONAL CENTER - JOLO
- SUB REGION 9-A  
SUB REGION 9-B  
SUB-REGIONAL CENTER - ZAMBOANGA CITY
- REGION NO.10 - NORTHERN MINDANAO  
REGIONAL CENTER - CAGAYAN DE ORO CITY
- REGION NO.11 - SOUTHERN MINDANAO  
REGIONAL CENTER - DAVAO CITY
- REGION NO.12 - CENTRAL MINDANAO  
REGIONAL CENTER - COTABATO CITY

- ⊙ CAPITAL OF THE PHILIPPINES
- CITY AND PROVINCIAL CAPITAL

# Map of the PHILIPPINES





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# I. 調査団の構成



## I. 調査団の構成

団長	中村 一	東電設計株式会社取締役電気本部長
団員	保坂 光男	東電設計株式会社電気第二部次長
〃	尾崎 之孝	東電設計株式会社電気第三部次長
〃	大藤 紘	東電設計株式会社電気第三部次長
〃	浅井 功	国際協力事業団鉱工業計画調査部 資源調査課 副参事



## II. 調 査 日 程



## II. 調査日程

日順	月 日	曜日	行 程	調 査 内 容
1	1月14日	月	成田→マニラ	移動
2	15	火	マニラ	NPC表敬, 調査スケジュール打合せ
3	16	水	〃	日本大使館, JICA事務所表敬及び関係資料要請(NPCにて)
4	17	木	〃	情報収集
5	18	金	〃	〃
6	19	土	〃	調査団打ち合わせ, 資料整理
7	20	日	〃	〃 〃
8	21	月	マニラ→マガット→ジェネド→マガット マニラ	発電所サイト及び送電線ルート空中視察(保坂及び大藤団員) Implementing Arrangement (I/Aという。)原案作成(中村団長及び尾崎団員)
9	22	火	マガット→バギオ→マニラ マニラ	発電所サイト及び送電線ルート空中視察(保坂及び大藤団員) I/A原案作成(中村団長及び尾崎団員)
10	23	水	〃	I/Aに関する打合せ
11	24	木	〃	〃
12	25	金	〃	I/A原案作成(中村団長及び尾崎団員)マクバン, カラヤン, マラヤ各発電所視察(保坂及び大藤団員)
13	26	土	〃	資料整理
14	27	日	〃	〃
15	28	月	〃	I/A調印(JICAマニラ事務所神田所員立合)
16	29	火	〃	日本大使館, JICA事務所, 内容説明及び挨拶
17	30	水	マニラ→成田	帰国





### III. 調 査 結 果



### III. 調査結果

#### 1. フィリピン共和国の概要

フィリピン共和国は大小7,109の島より成り、国土面積は約300,000 km<sup>2</sup>と我が国の本州と北海道を合わせたほどで、その内最大の島はルソン島である(参考資料1)。気候は熱帯性気候に属し、平均気温は27℃、年間を通じ寒暑の差は少いが比較的涼しいのは12月から2月で、4月5月が最も暑い。

降雨量に関してはルソン島だけで82ヶ所の観測所があり(参考資料2)、多雨地帯は北に偏っているが中央山岳地帯にも降雨量の多い地点がある(参考資料3)。

ルソン島は山地の多い島であり、多数の河川が発達しているが、中でも最大なものはバブヤン海峡に注ぎ込んでいるカガヤン河であり37の流量測定所の中で他水系に比較して流域面積流量とも格段に多い(参考資料4, 5)。

人口は1975年現在4,200万人で、その1割以上に当たる497万人が首都マニラ圏に集中している(参考資料1)。

人口増加率は2.9%と高い(参考資料6)。10才以上の人口は3,140万人、その内就労希望者数は1,624万人あり就業率は95%であるが、半就労者が多く労働供給力には余裕があるとみなされている(参考資料7)。

1978年の国民総生産は1972年標準で825億ペソ、農漁林業、鉱工業、第三次産業の比率はそれぞれ26%、35%、39%となっている(参考資料8)。

農産物の主なものは米、砂糖きび等であり、ココナッツ等の果実がこれに次いでいる(参考資料9)。

漁獲高は金額で米を上回っている(参考資料10)。

主要鉱産物は銅及びニッケルで、銅はカナダと共に日本に対する2大供給国となっている。

工業は食品など軽工業が主体であるが(参考資料10)、機械、金属、化学なども投資奨励法や輸出奨励法の後押しで次第に比重が高まりつつある。

フィリピンの電気事業は公営ではフィリピン電力公社(National Power Corporation : NPC)が、民営ではマニラ電力会社(Manila Electric Company : MECO)が主力であり、両者合わせて年間約104億kWhの電力を売買している(参考資料11, 12)。このほか、送電網の不備な遠隔地では自家発電に依存している場合も多い。発電設備は全国で

約337万kW(参考資料13, 14)あるものの電力需要は急増しつつあり, 年間約7,000万バレルもの石油を海外に依存(参考資料15)しているが, 石油産出のない同国としてはこれ以上の石油消費の増加を防止する目的で, 政府は長期エネルギー計画を策定し, その方策としてフィリピン水域の海底油田を探索するかたわら, 現在火力発電への依存を軽減するため, 水力, 地熱や原子力発電の開発を積極的に進める方針を打ち出している。同国における主要な輸送手段は道路輸送(バス, トラック)と海上輸送である。とりわけ海運は島しょ国家として重要で, マニラ市, セブ市を中心に各地に通じている。これに対して鉄道の輸送機能は小さいが, 大量輸送手段として近年改めて見直しされる状況にある。

道路の総延長は1973年現在78,653kmであり, その内訳は国道22,603km, 州道29,209km, 町村道19,444km, 市道7,397kmとなっている。一方, 舗装率はコンクリート, アスファルトを含めて20.1%で, 極めて低い。

貿易収支は, 1977年の輸出31億ドルに対して輸入は39億ドルと赤字基調である。外国よりの経済協力については国際金融機関のものが多いが, 国別にみると日本がトップにあり, アメリカがこれに次いでいる(参考資料16)。

フィリピン共和国は, 現在国家開発10ヶ年計画(1978~1987)を実施中であり, その重点項目は地域開発, 農業開発, 国民福祉向上, インフラストラクチャーの整備, 工業開発, 公共事業推進, 天然資源開発, マニラ都市開発の8項目である。特に工業開発については11項目の具体的なプロジェクト(参考資料17)を掲げて経済発展に努力している。

## 2. フィリピン共和国の電気事業

### (1) 電気事業者

フィリピンの電気事業は、国全体の発電並びに送変電設備を建設、管理、運営し、電気事業者に電気を卸売するフィリピン電力公社（National Power Corporation : NPC）組織図は参考資料18参照）と、マニラ市とその周辺都市部に電力供給を行う私営のマニラ電力会社（Manila Electric Company : MECO）、及びNEA（National Electrification Administration）の下部機構として配電事業を行う Coop（Electric Cooperative）とから成立っている。これらの関係は図2-1に示してある。

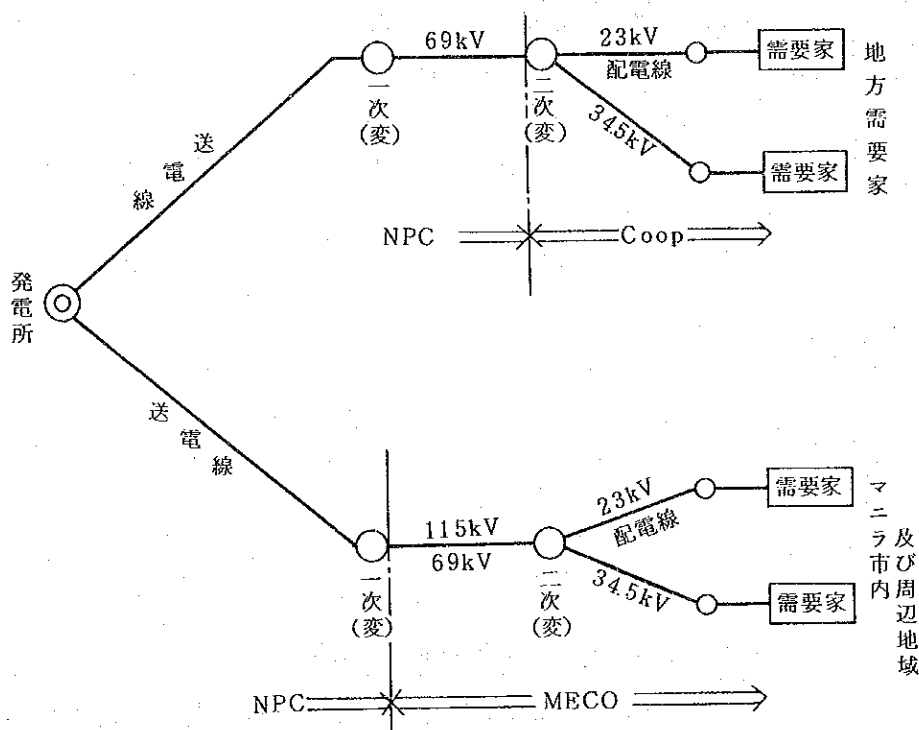


図2-1 電気事業の供給方法概念図

Coop とは一般的に地域の小電力業者がある程度まとまって1つの組織体を結成して、地域の電化を促進するものであり、これらの結成、運営に当たっては政府の援助がある。

Coop は NPC より電力を買い、自分の設備を通じて需要家に供給しており、地区内での供給設備の建設、保守運用を行っている。中には自家発電設備を持つ Coop もある模様である。

ルソン島における現在の Coop の結成数は次表2-1（参考資料19参照）に示

すごとく 36 に達しており、電化率が低いルソン島北部カガヤン地区も総合開発とあいまって電化計画が具体化されつつある。

表 2 - 1 ルソン島の Coop 数 (1978 年)

Region No	Cooperative Name	Coop 数
I	• Ilocos Norte • La Union • Abra • Banguet • Ilocos Sur • Mt. Province • W. Pangasian • C. Pangasian	8
II	• Isabela • Cagayan I • Cagayan II • Nueva Vizcaya	4
III	• Bataan • Bulacan I • Bulacan II • Nueva Ecija I • Nueva Ecija II • Pampanga • Zambales • Tarlac	8
IV	• Batangas I • Batangas II • Carvite • Laguna • Rizal I • Rizal II • Quezon	7
V	• Albay • Camarines Sur I~IV • Camarines Norte • Camarines • Sorsogon I, II	9
	計	36

従来 MECO は発電から配電までを行なってきたが、フィリピン政府の方針として 1978 年以降電源、主要送変電設備（配電設備を除く）についてはすべて NPC に移管し、MECO はマニラ市内及び周辺地区の配電に当たることとなった。

## (2) 電気料金体系

NPC に於ける現在の電気料金体系は「燃料費調整方式」を採用しており Luzon Grid, Cebu Grid, Negros-sub Grid, Bohol sub-Grid, Mindanao Grid 各グリッドに於いてそれぞれ異った電気料金でそれぞれの配電事業者に売電している（参考資料 20 参照）。

### 3. ルソン島における電力供給の現状

#### (1) 電力需要動向

ルソン島における過去数年の電力需要の推移は、表3-1のとおりである。これで見ると1978年以前の電力需要（最大電力）の伸び率は、2年程低迷しているが、1979年になって最大1,905 kW、対前年比約7%の伸び率を示した。

今後の電力需要の伸び率も電化計画の拡大、地域開発の進展などにより年7%程度の増加で推移することが予想されている。

表3-1. ルソン島における電力需要実績

年	1976	1977	1978	1979	(予想) (1980)
最大電力 (MW)	(9.6%) 1,659	(3%) 1,709	(4.2%) 1,780	(7%) 1,905	(7%) 2,038
電力量 (GWh)	9,626	10,357	11,223	11,765	12,497

( ) 内は対前年伸び率

#### (2) 発電設備

前記(1)の電力需要をまかなう電源設備は、表3-2のような構成となっており、1979年末現在の設備出力の合計約2,972 MW、その構成概要は水力537 MW (18%)、火力2,215 MW (75%) 及び地熱220 MW (7%) となっている。

これらの設備は、マニラ市近郊にある老朽火力が主力となっており、1979年末における需給バランスをみると36% (1,067 MW) が予備力となっている。これは需要規模に比し、大きすぎるユニット容量 (300 MW又は350 MWユニット) が採用されている点と、流通設備も1回線送電線が多いなどの理由に基づくものであろう。従って設備稼働率は低い。

表 3 - 2 主要発電設備 (1979年)

発電所名	運開	容量 (MW)	発電所名	運開	容量 (MW)
(水力)… (537 MW)			(火力)… (2,215 MW)		
Ambuklao	1956/12	50 (25×2)	Bataan 1	1972/9	75
“	57/9	25	“ 2	77/9	150
Angat	67/7	12 (6×2)	Malaya 1	74/7	300
“	67/10	100 (50×2)	“ 2	79/1	350
“	68/6	50	Snyder 1	71/6	200
“	68/8	50	“ 2	72/6	300
Binga	60/1	50 (25×2)	Gardner 1	68/8	150
“	60/3	50 (25×2)	“ 2	70/1	200
Buhi-Barit	57/9	2	Tegen 1	65/9	100
Caliraya	41/	24 (8×3)	“ 2	“	100
“	48/	8	Rockwell 1-5	55/9	110
Pantabangan	77/5	100 (50×2)	“ 6-8	63/10	180
Batocan	48/	16			
			(地熱)… (220 MW)		
			Tiwi 1	79/1	55
			“ 2	79/5	55
			Mak-Ban 1	79/5	55
			“ 2	79/8	55

(3) 電力流通設備

電圧階級としては送変電設備において230kV, 115kV (69kV), 配線設備においては34kV, 23kVが採用されている。送電設備としては, 1回線送電線が多く, また変圧器バンク構成なども供給負荷に対して適正でないものが多く, このため, 設備の単一事故時にも, 比較的広範囲に及ぶ長時間停電の機会が多いようである。



#### 4. ルソン島における設備形成の方向性

##### (1) 電力需要想定

ルソン島における今後の電力需要としてNPCは、表4-1を想定している。

表4-1 最大電力想定(1979年12月想定)

年	最大電力 (MW)	年	最大電力 (MW)	
1979	1,905	1988	3,502	伸び率 1979~1990
1980	2,038	1989	3,747	
1981	2,180	1990	4,009	7%
1982	2,333	1991	4,250	1990~1995 6%
1983	2,496	1992	4,505	
1984	2,671	1993	4,775	
1985	2,858	1994	5,061	
1986	3,058	1995	5,365	
1987	3,272			

(発電端)

1990年までは年間約7%、それ以降は約6%の伸び率となっている。

また、地域的には今後ともルソン島中央部にあるマニラ市周辺の開発が進められ工場立地も推進される模様であるので、その進展の度合い如何によってはこの地域での需要密度の増加、需要率の増大は今後著しいものと考えられる。

##### (2) 電源開発計画

前記の想定需要に対応する供給力の主体は、当面マニラ近郊にある Rockwell, Tegen, Gardner, Snyder 及び Malaya などの合計200万kWに及ぶ火力群である。

しかし、これらは至近年に予想される輸入石油の減少、マニラ市周辺地域における公害規制の強化などに伴って逐次休廃止の計画を余儀なくされている。また供給力の抜本的対策として始められた原子力建設も、原子炉の安全問題を起因として進捗率30%で工事中断の止むなきに至っている。

このため現在は見掛け上大きな予備力を持っているものの、今後の電源開発の進捗状況、流通設備の増強の程度によっては、至近年度1982~85年に於いてかなりの需

給ひっ迫も予想される。

この対策として、ルソン島南部の地熱開発に大きな期待が寄せられているのであるが、将来に対する抜本的な供給力確保の方向性としては、ルソン島北部における大水力地点の開発であろう。

なお、年次的な電源開発計画は表4-2のとおりであるが、その概要は、1990年までの10年間に開発される北部水力電源5地点2,170 MW、南部地熱開発2地点550 MWで、ともに需要中心であるマニラ市より300～400 kmの遠隔地にあり、さらに電源地点近傍における需要はほとんど期待できないため、発電力のほぼ全量を長距離送電しなければならない。

表 4 - 2 電 源 開 発 計 画

▲は廃止

[ ] 内原子力

年	最大需要 電力(MW)	発電設備 出力(MW)	予 備 力		電 源 開 発 計 画 (MW)		
			MW	%	水 力	火 力	地 熱
(既設) 1980	2,038	(2,972) 3,192	1,091	34.2			•Tiwi 3, 4 (110) •Mak-Ban 3, 4 (110)
1981	2,180	3,204	1,024	32.0	•Masiway (12)		
1982	2,333	3,314	981	29.6			•Tiwi 5, 6 (110)
1983	2,496	3,489	993	28.5	•Kalayaan (300) •Magat 1.2 (180)	(•Rockwell 1-8) (▲305)	
1984	2,671	3,619	948	26.2	•Magat 3.4 (180)	•Coal thermal I (300) (•Gardner ▲350)	
1985	2,858	3,839	981	25.6			•Geo. 1-4 (220)
1986	3,058	4,439	1,381	31.1	•Magat 5.6 (180)	•Coal thermal II (300) (•Snyder ▲500)	[PNPP (620)] (Nuclear Power)
1987	3,272	4,699	1,427	30.4	•San Roque 1, 2 (260)		
1988	3,502	5,109	1,607	31.5	•Gened (300)		•Geo. 5, 6 (110)
1989	3,747	5,489	1,742	31.7	•Gened (300) •Kanan (280)	(•Tegen ▲200)	
1990	4,009	5,979	1,970	32.9	•Chico IV (360) •San Roque 3 (130)		
1980 ~1990					MW (2,482)	MW (600) (▲1,355)	MW (660) [620]
1991	4,250	6,449	2,199	34.1	•Chico II (360)		•Geo. 7, 8 (110)
1992	4,505	6,869	2,364	34.4	•Tabn (120)	•Coal thermal III (300)	
1993	4,775	7,279	2,504	34.4		•Coal thermal IV (300)	•Geo. 9, 10 (100)
1994	5,061	7,579	2,516	33.2	•Abra 3 (300)		
1995	5,365	8,139	2,774	34.1	•Didyon (360) •Abra (200)		
1980 ~1995					MW (3,822)	MW (1,200) (▲1,355)	MW (880) [620]

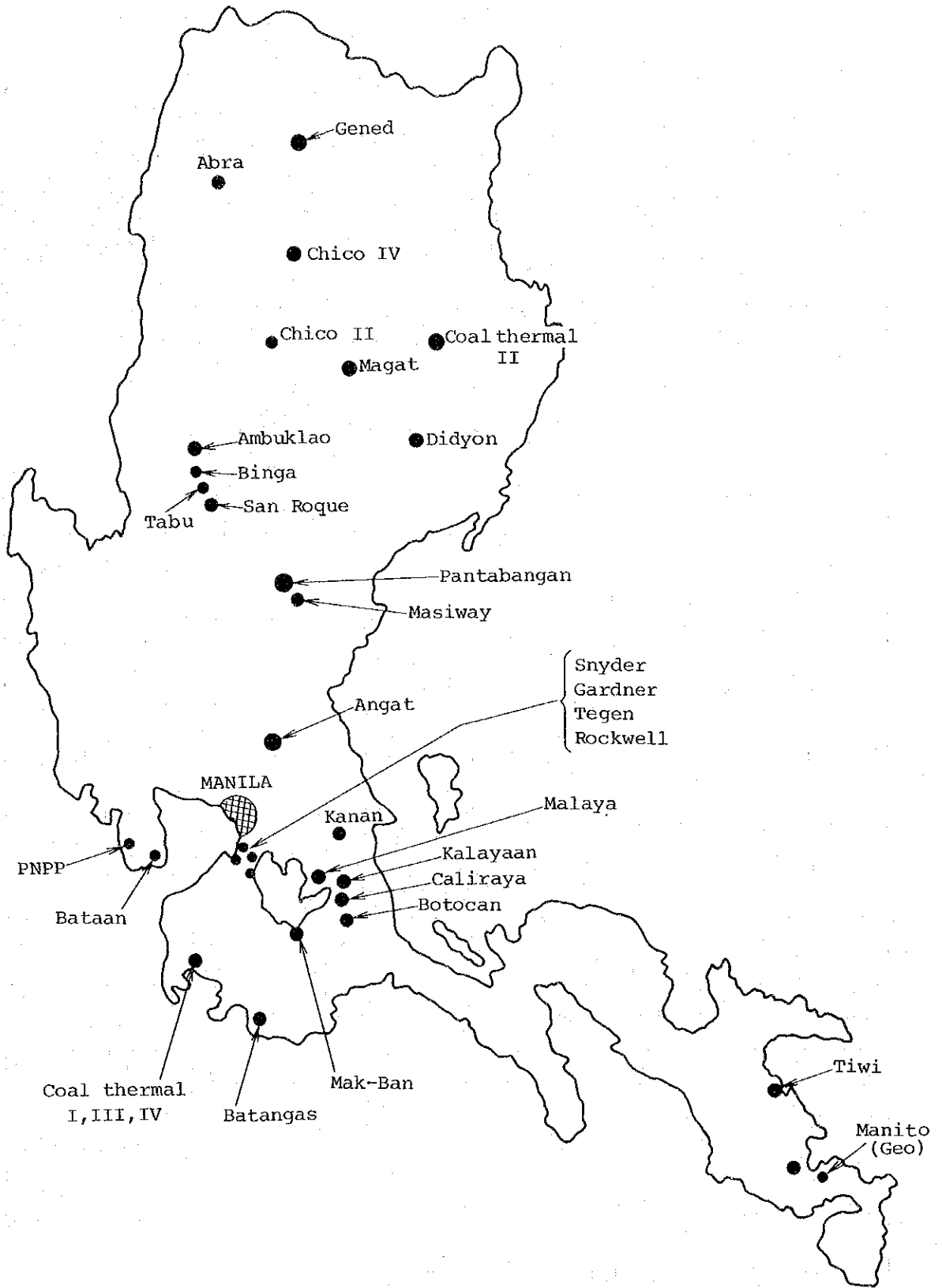


図 4-1 ルソン島電源地点図

### (3) 電力流通設備計画

前記の需要動向、電源開発計画に対応する既設 230 kV 系統の現状としては、マニラ市周辺地域と一部北西部沿岸に連なる 1 回線送電線と南部地熱電源からの 1 回線送電線があり建設中もしくは計画中の送電線としては、南部系統の 230 kV 2 回線化と、北部カガヤン地区と既設系統を結ぶ 2 回線送電線がある。

#### 1) 北部系統

北部系統における電源開発計画に対する流通設備計画は、至近年度に運開が予定されている水力電源（Magat：540MW=90MW×6 ユニット）に対応して上記 230 kV 送電線の工事が現在進められているが、将来の北部電源の開発に対応するためには、長距離送電線の新設が必要である。

電源開発の将来規模は、1990 年頃で約 960MW、1995 年頃で約 1,940MW という大きな発電力を計画しており、更にその他に 500MW 程度の発電力の増加も考えられている。

このような大きな発電力と需要地点（マニラ市周辺）への送電距離を考慮すると安定度の点から見て、230kV 送電線の新設では対処不可能である（仮に 230kV 送電線に対応した場合の定態安定極限電力は約 400MW と推算される）。このため送電方式としては交流 500kV 送電を考慮せざるを得ない。（直流送電も考えられるが一般に 400 km 程度の距離では経済的でない。）

すなわち Gened - San Manuel - San Jose 間に 500 kV 送電線を建設し、可能な期間 230kV 運転を行い、時期を選んで必要区間の 500kV 昇圧を行うことが適当と考えられる。

#### 2) 南部系統

南部系統の 230kV 送電線 2 回線化後における定態安定極限電力は、北部系統と同様に送電距離が長いために約 350MW という小さい容量となり、せいぜい南部地区における地熱発電 6 ユニット（1 ユニット 55MW）の送電が限度と考えられる。

このため、1985 年以降に運開が計画されている地熱発電力（約 1,000MW）の送電対応として、新たな送電線の建設が必要と考えられるが、電源開発地点から需要地点までの送電距離は 400 km もあり、230kV 送電線の 2 回線程度の増設では、定態安定極限電力の増分もわずかであり単一設備の事故時を考慮すると、所要供給力の定安確保は不可能である。

### 3) 中部系統

中部系統（San Jose - Kalayaan 間）については、南北電源の適切な開発、並びに San Jose, Malaya などの二次側供給系統（230kV 以下の系統）の整備、拡充、Taal 湖南側における二次側供給ルート確保などの対策により、230kV 系統での対応も考えられるが、電源開発の動向によっては新たな 500kV 送電線が必要と考えられる。なお、上記 500kV 送電線の新設いかんにかかわらず、Malaya - Kalayaan 間の 230kV 既設送電線の建替増強は負荷供給上で不可欠と思われる。

前記の 3 系統（北部、中部、南部）のいずれにしても設備計画の策定時には全系統（電源開発から二次側供給系統まで）を含めた総合計画の中で詳細に検討を行い、送電線規模、運開時期を決定する必要がある。

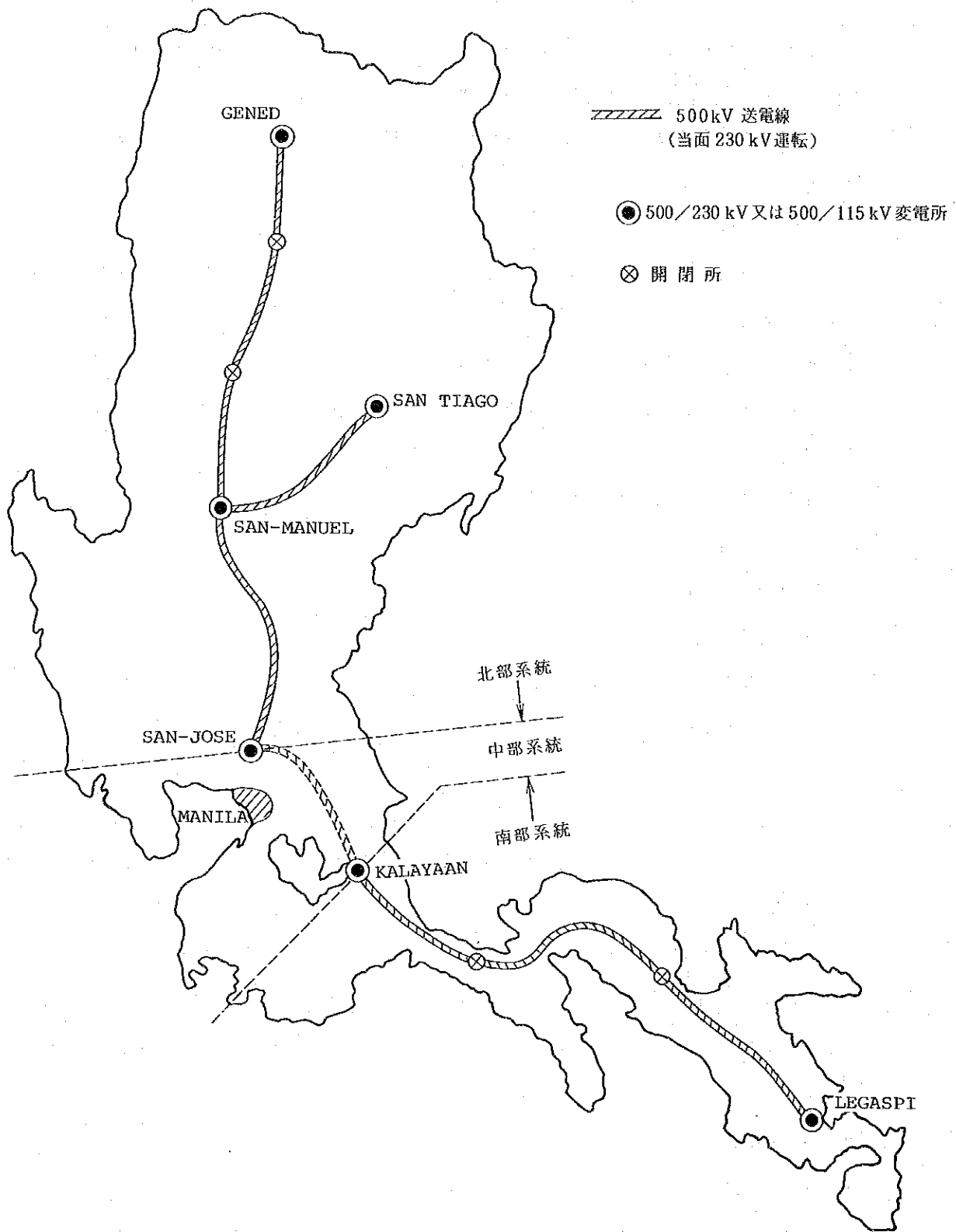


図 4 - 2 将来の EHV 送電系統の概要

## 5. フィージビリティ スタディ (F/S) 調査項目

本調査の目的は、1995年までのルソン島グリッドに於ける超高圧 (EHV) 送電系統計画の確立と関連する設備の基本設計を行うものである。

その概略の範囲を次に示す。(尚、詳細は添付資料 Implementing Arrangement を参照のこと)。

### (1) 需要想定

地域全体の需要実態を把握し、今後の経済動向及び国家長期計画等をも考慮し、適切な需要想定を確立する。

### (2) ルソングリッドの現状の確認及び検討

現在の系統図、インピーダンス図及電力設備の特性等の実態を調査、検討する。

### (3) 供給信頼度の評価

電源並びに系統の信頼度の基準を確立する。

### (4) 電源開発計画

電源開発計画の見直しを行う。

### (5) 基幹送電系統計画

過去の基幹送電系統計画の見直しを行う。

更に、系統の制御、保護、通信、給電方式も検討し、EHV 系統計画を決定する。

### (6) EHV 送電線の基本計画

環境規制も考慮し送電線ルートを決定する。

設計基準を検討し、回線数、導体サイズ、導体構成、鉄塔のタイプ等を決定し、基礎の設計も行う。

### (7) EHV 変電所の基本計画

変電所の位置と規模について決定する。

設計基準を検討し、保護装置も含めた単線結線図を作成し、機器配置平面図を作成する。

### (8) 工事費の見積り

### (9) 工事工程表の作成

### (10) 経済評価及び財務評価



6. 添付資料

Implementing Arrangement

IMPLEMENTING ARRANGEMENT ON THE TECHNICAL  
COOPERATION BETWEEN

JAPAN INTERNATIONAL COOPERATION AGENCY

A N D

NATIONAL POWER CORPORATION

F O R

THE FEASIBILITY STUDY ON EHV TRANSMISSION SYSTEM  
DEVELOPMENT PROJECT IN LUZON ISLAND

AGREED BETWEEN


JAPAN INTERNATIONAL COOPERATION AGENCY

A N D

NATIONAL POWER CORPORATION

DATED: JANUARY 28<sup>th</sup> 1980

  
JOSE J. VELLANOS  
Senior Vice President  
National Power Corporation

  
HAJIME NAKAMURA  
Team Leader, Japanese Survey Team  
Japan International Cooperation Agency

1. Introduction

In response to the request of the Government of the Republic of the Philippines, the Government of Japan has agreed to provide technical assistance through JICA in carrying out a feasibility study on the Luzon Extra High Voltage (EHV) power transmission system development project in close cooperation with the Government of the Republic of the Philippines and NPC.

2. Background

The main energy sources which are under consideration by National Power Corporation, hereinafter called "NPC" for future development of Luzon Island are potential hydroelectric power sites located in Northern Luzon, geothermal power sites located in Southern Luzon and Nuclear power plants to be constructed near Manila. This is in consistency with the National policy of the Philippines Government to lessen dependency on fuel oil due to its acute shortage and high cost.

The capacities of these projected power plants will be of large scale so as to meet increased power requirements resulting from future economic growth.

The said hydroelectric power sites in Northern Luzon are located about 350 to 450 kilometers from Manila, the load center of the island. These power plants under planning are Magat, Gened, Chico IV and so forth.

Magat Power Plant, located in the large Cagayan River basin, will be commissioned in 1983-1984 with initial installed capacity of 360 MW and finally 540 MW in 1986. Gened Power Plant, planned to be located in the Abulug River Basin, will be completed in 1988-1989 with an installed capacity of 600 MW. Chico IV site (360 MW) is now in the planning stage and scheduled to come into stream in 1990.

If the power generated by these power plants will have to be mostly transmitted to Manila Area, it will be impossible for sending large power by means of 230 KV transmission lines only.

Therefore, introduction of EHV transmission system will be inevitable.

On the otherhand, the installation of a nuclear power plant near Manila is now under construction. Although its commissioning year is postponed from 1984 to 1986, the operation of the nuclear power plant with Kalayaan pumping-up hydro-plant, which is scheduled for commissioning in 1983, will have to be considered in the near future. So, it will be necessary to review the interconnecting transmission lines between San Jose and Kalayaan relating to the improvement of the bulk of transmission lines in and around Metro Manila.

Moreover, NPC is now working on the right-of-way and/or environmental problems in this area.

To alleviate these problems, introduction of an appropriate improvement on the 230 KV transmission lines and/or introduction of EHV transmission line to the center grid in Luzon may have to be considered.

Consequently, EHV interconnection of the existing power systems with the new power plants planned by NPC will be desirable to meet the reliability and demand of future power supply.

Therefore, the objectives and scope of work for the feasibility study should be as follows:

3. Objective of the Study

The broad objective of the feasibility study proposed herein is to define the optimum plan of EHV transmission system in the Luzon grid until the year 1995 by reviewing the previous related studies and to prepare a basic design of such facilities, hereinafter called the "Project".

4. Scope of Work

A feasibility study of the Project to be carried out by JICA Experts is to work out the load forecast and the

system engineering of the Luzon grid, and to prepare a revised power development plan and a basic design of main power facilities which can meet the system requirements until 1995. Appendix I gives a summary of the scope.

#### 4.1 Load Forecast

##### (1) Review and/or study of load forecast

- i) Analysis of past load increase
- ii) Analysis of economic growth
- iii) Study of the National Economic Plan  
(industrialization plan, rural electrification plan, etc.)
- iv) Study of population increase and movement
- v) Study of macroscopic load forecast
- vi) Study of microscopic load forecast
- vii) Forecast of required total energy consumption
- viii) Forecast of required energy consumption  
in cities, towns and villages
- ix) Study of daily, seasonal and yearly load  
curves
- x) Peak demand forecast
- xi) Survey of privately-owned power plants and  
consumption

#### 4.2 Recognition of the Latest Status of the Luzon System

- (1) Study of latest system maps and/or diagram
- (2) Study of latest impedance maps and/or diagram
- (3) Study of characteristics of power facilities

- i) Generators
- ii) Transmission lines
- iii) Substations
- iv) Others

#### 4.3 Evaluation of System Reliability

- (1) Review of the reliability criteria applied for previous plans
- (2) Evaluation of power source reliability
- (3) Evaluation of transmission system reliability
- (4) Determination of future system planning criteria
  - i) Study of failure of generating plants, transmission lines and transformation plants

#### 4.4 Development Planning of Power Source

- (1) Detailed review of previous power development plan
- (2) Determination of optimum power development plan
  - i) Calculation of system reliability
  - ii) Study of possible power supply
  - iii) Study of reserve capacity
  - iv) Study of maximum power unit capacity
  - v) Study of retirement schedule of power source

#### 4.5 Development Planning of the Bulk Transmission System

- (1) Review of previous bulk transmission system plans

- (2) Selection of basic route of transmission lines
- (3) System analysis
  - i) Reliability of transmission systems
  - ii) Optimum transmission voltage levels
  - iii) Power flow and voltage fluctuation range
  - iv) Frequency
  - v) Stability
  - vi) Short circuit current
  - vii) Neutral grounding system
- (4) Determination of EHV system planning and its commissioning year
- (5) Study of protective relaying and telecommunication system
- (6) Study of control and operation systems
- (7) Study of load dispatching systems

Technical services to be performed by NPC relating to above Items 4.1, 4.2, 4.3, 4.4 and 4.5 are as follows:

- (1) Provisions of all previous reports relating to Luzon power system development plans.
- (2) Provision of previous data on load forecasts
- (3) Provision of planned sites for generating plant expansion



- (4) Provision of all data concerning system analysis
- (5) Provision of planning criteria and operating standards

#### 4.6 Basic Design of EHV Transmission Line

- (1) Study of design criteria
- (2) Determination of transmission route
  - i) Study of environmental impacts
- (3) Study of insulation level
  - i) Lightning-proof
  - ii) Switching surge
  - iii) Ferranti effect
  - iv) Salt contamination
- (4) Determination of power conductor characteristics
  - i) Size and configuration of conductors
- (5) Determination of structural design of steel towers
  - i) Number of circuits
  - ii) Type of towers
  - iii) Design of foundations
  - iv) Survey of boring logs

#### 4.7 Basic Design of EHV Substation

- (1) Study of design criteria
- (2) Study of insulation coordination
- (3) Determination of substation sites and scale

- i) One-line diagram
- ii) Layout drawings
- iii) Control and protective relaying systems

Technical services to be performed by NPC relating to above Items 4.6 and 4.7 are also to provide data on meteorology, load conditions, typhoons, salt contamination, lightning damage, telecommunication line routes, design standards of 230 KV system and transport of heavy materials.

4.8 Preparation of Cost Estimates of the Project

4.9 Preparation of Construction Schedule and Program of the Project

Technical services to be performed by NPC relating to above Items 4.8 and 4.9 are also to provide data/information of technical capabilities of local contractors, local aerographic surveyors and ground surveyors, construction records of 230 KV facilities, labor costs, locally procured material cost/lists, transportation costs and facilities, custom duties, etc.

4.10 Economic/Financial Studies of the Project

Technical services to be performed by NPC relating to this Item are to provide data on the financial status of NPC, interest rate of locally financed

loans, electric tariffs, operation and maintenance costs, tax system, etc.

5. Estimated Period of Feasibility Study (hereinafter called the "Study")

The tentative time schedule of the Study is as per Appendix II.

6. Reports

The following reports will be prepared in English and submitted to the Government of the Philippines within the time period specified below:

- a) Inception Report ( 20 copies)
- b) Draft System Engineering Report  
Draft Engineering Report ( 20 copies) within seven (7) months after commencement of the Study
- c) Draft Feasibility Report  
Draft Feasibility Report ( 20 copies) within nine (9) months after the commencement of the Study
- d) Final Feasibility Report  
Final Feasibility Report ( 50 copies) within two (2) months after completion of discussions of the Draft Feasibility Report.

7. Local Counterpart of the Study

7.1 NPC EHV Committee

NPC will establish an EHV Committee responsible for coordinating the JICA Experts' work. The Committee will, from time to time, meet and confer with the JICA Experts and be responsible for reviewing targets, approaches, methods, basic assumptions and interim reports.

7.2 In carrying out the Study, NPC will assign its engineers as listed below, to participate in the Study to be done by the JICA Experts for the required period of the Study. It is the objective of NPC that these NPC engineers should gain as much experience as possible during the effective study period of the Project. The JICA Experts will undertake to assist to the maximum extent in the furtherance of this objective by doing major study work in Manila. NPC personnel to be assigned are:

- 2 system planning engineers
- 2 relay/protection engineers
- 2 transmission engineers
- 2 substation engineers

8. Requested Cooperation of Governments of the Philippines and Japan

8.1 Technical Assistance Necessary for Satisfactory Completion of the Study

Technical services by the Philippines are given in Paragraph 4, Scope of Work.

8.2 Cooperation of the Government of the Philippines (through NPC)

- a) To provide adequate office accommodations near or in NPC headquarters.
- b) To provide local transportation facilities for the entire Study period required by the JICA Experts.
- c) To arrange free access to all areas and use of lands required by the JICA Experts in carrying out the Study.
- d) Customs clearance, handling and storage at the port/airport and inland transportation in the Philippines of equipment, machines, instruments, tools and other articles brought into the Philippines for performance of the Study and for the JICA Experts' personal use.
- e) To provide the JICA Experts with available data, information and materials necessary for the Study.

- f) To provide local administrative support including clerical, secretarial, and drafting services required by the JICA Experts in carrying out the Study.
- g) To obtain official permission for JICA Experts to enter into, stay and work in, and depart from the Philippines.
- h) To exempt from any taxes, duties, surcharges and the like to be imposed on the equipment imported to the Philippines for the survey and on the JICA experts for their personal belongings carried to or sent to the Philippines. Further, income tax, local tax, sales tax and any taxes to be imposed on income of JICA experts will be exempted.

### 8.3 Cooperation of the Government of Japan

- a) To send the Japanese Study Team to conduct the Study.

THE SCOPE OF STUDY

<u>Transmission Lines</u>	<u>Location</u>		<u>Distance-Length</u> (Approximately)
	<u>From</u>	<u>To</u>	
EHV Transmission Line	Gened	San Jose	400 KM
*EHV or 230 KV Transmission Line	San Jose	Kalayaan	60 KM

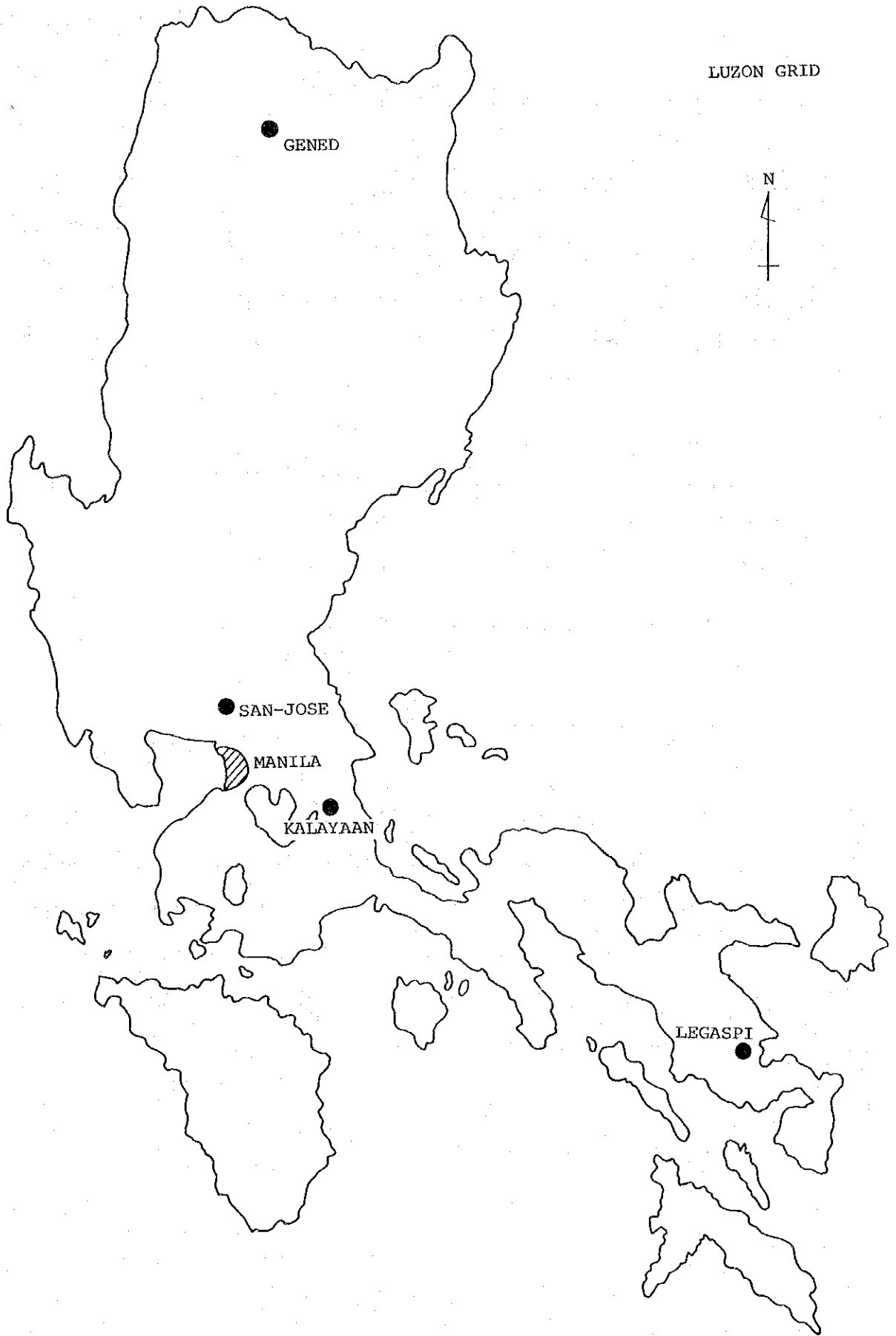
Substations

	<u>Voltage Regulation</u>
Gened	500 - 230 KV
San Jose	500 - 230 KV
*Kalayaan	—

NOTES:

- (1) \* These items should be decided by the evaluation of feasibility study. Consequently, this includes necessary study of the Luzon Grid bulk transmission system.
- (2) Above items should include 500 KV bus connection and 500 KV transformer secondary disconnecting switches up to 230 KV bus.

LUZON GRID








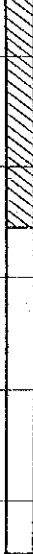

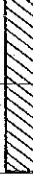


APPENDIX II

TENTATIVE TIME SCHEDULE

of  
STUDY

 Philippines  
 Japan

Working Item	Month Calendar Month	1	2	3	4	5	6	7	8	9	10	11
Initial field investigation	1980 6								1981 1			
System engineering												
Discussion of draft system engineering report												
Basic design of transmission and substation												
Discussion of draft report on feasibility												
Completion of feasibility report												



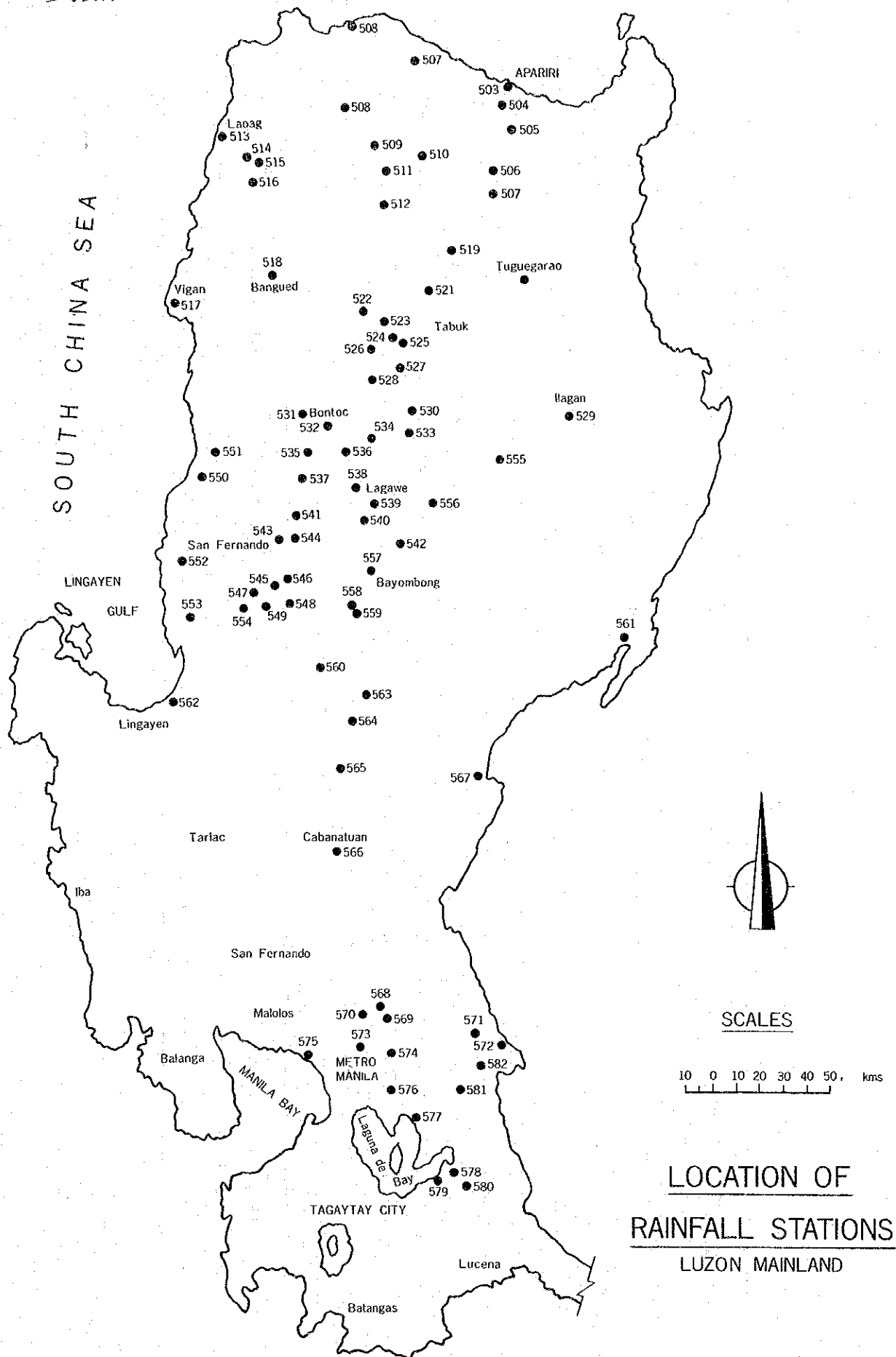
#### IV. 参 考 资 料



POPULATION, LAND AREA AND DENSITY OF THE POPULATION BY REGION AND PROVINCE: CENSUS YEARS 1918-75

Region and Province	Population (in thousands)				Land Area (Sq. Km.)	Density (persons/sq. km.)							
	1975 (May 1)	1970 (May 6)	1960 (Feb. 15)	1948 (Oct. 1)		1939 (Jan. 1)	1918 (Dec. 31)	1975 (May 1)	1970 (May 6)	1960 (Feb. 15)	1948 (Oct. 1)	1939 (Jan. 1)	1918 (Dec. 31)
Philippines	42,071	36,684	27,088	19,234	16,000	10,314	300,000.0	140.2	122.3	90.3	64.1	53.3	34.4
National Capital Region (Metro Manila)	4,970	3,967	2,462	1,559	993	460	636.0	7,814.5	6,237.4	3,871.1	2,467.0	1,561.3	723.3
1. Ilocos Region	3,269	2,991	2,427	1,943	1,729	1,477	21,568.4	151.6	138.7	112.5	90.1	80.2	68.5
2. Cagayan Valley	1,933	1,691	1,202	775	714	348	36,403.1	53.1	46.4	33.0	21.3	19.6	9.6
3. Central Luzon	4,210	3,615	2,525	1,838	1,569	1,039	18,230.8	230.9	198.3	138.5	100.8	86.1	57.0
4. Southern Tagalog	5,214	4,456	3,082	2,085	1,815	1,232	46,924.1	111.1	95.0	65.7	44.4	38.7	26.3
5. Bicol Region	3,194	2,967	2,363	1,667	1,347	840	17,632.5	181.1	168.3	134.0	94.5	76.4	47.6
6. Western Visayas	4,146	3,618	3,077	2,530	2,174	1,347	20,223.2	205.0	178.9	152.2	125.1	107.5	66.6
7. Central Visayas	3,387	3,032	2,523	2,119	1,955	1,486	14,951.5	226.5	202.8	168.7	141.7	130.8	99.4
8. Eastern Visayas	2,600	2,381	2,042	1,764	1,463	978	21,431.5	121.3	111.1	95.3	82.3	68.3	45.6
9. Western Mindanao	2,048	1,869	1,351	763	603	320	18,685.1	109.6	100.0	72.3	40.8	32.3	17.1
10. Northern Mindanao	2,314	1,954	1,297	923	707	360	28,327.8	81.7	69.0	45.8	32.6	25.0	12.7
11. Southern Mindanao	2,715	2,201	1,354	577	447	163	31,692.9	85.7	69.4	42.7	18.2	14.1	5.1
12. Eastern Mindanao	2,070	1,942	1,383	791	484	264	23,293.2	88.9	83.4	59.4	29.2	20.8	11.3

Source: NEDA



LOCATION OF  
RAINFALL STATIONS  
LUZON MAINLAND

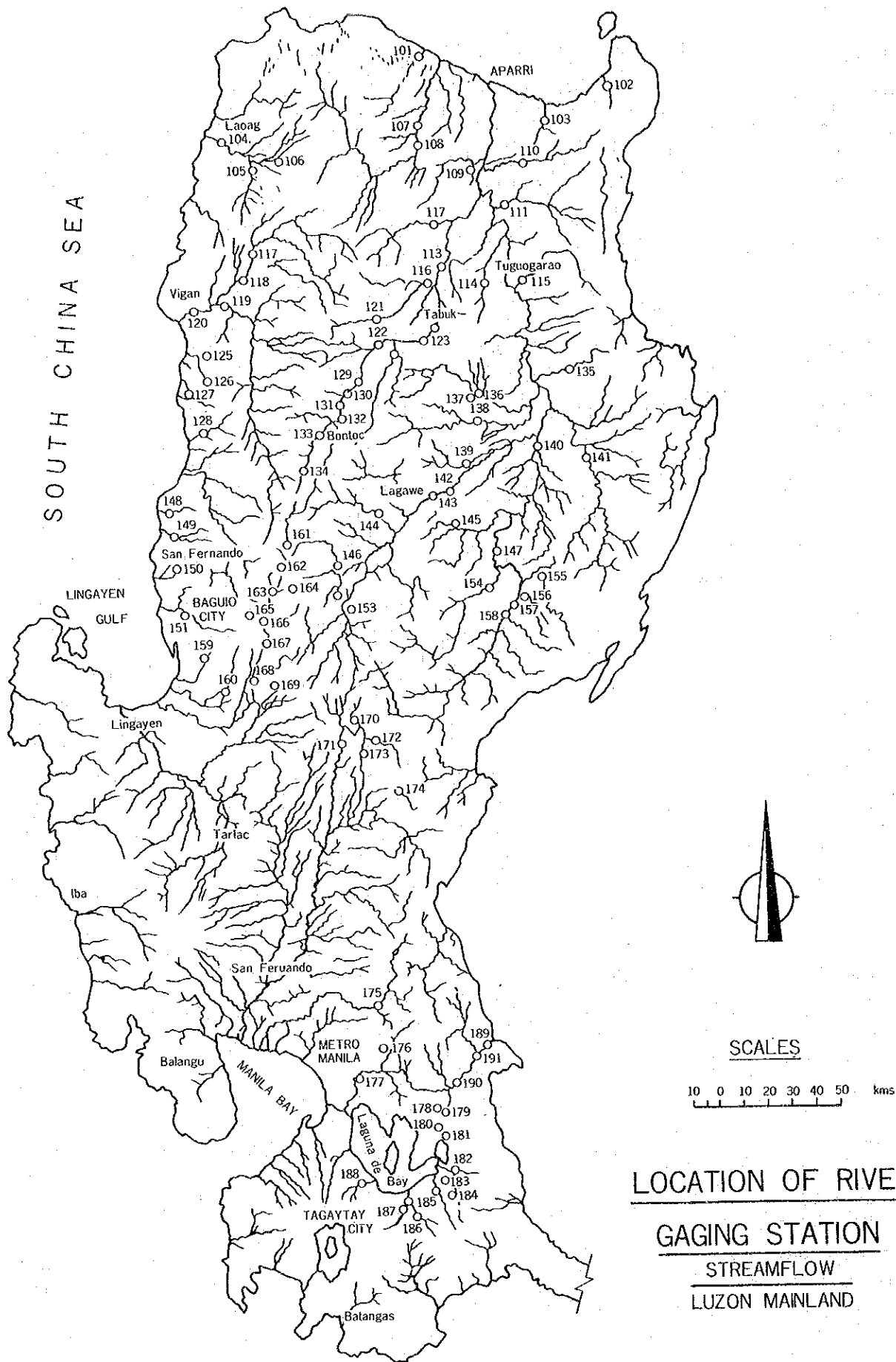
Average Annual Rainfall by Station

STA NO.	STATION	ELEVATION (m)	AVERAGE ANNUAL PRECIPITATION (mm)
501	CLAVERIA, CAGAYAN	40	4112.1
502	BAGGO, RAMPLONA, CAGAYAN	5	-
503	APARRI	4	2263.9
504	CALAYAN, CAGAYAN	13	2335.3
505	LAL-LO, CAGAYAN	1	2179.1
506	AGGUNETAN, CAGAYAN	5	1876.8
507	NASSIPING, CAGAYAN	5	2053.4
508	BAYAG, KALINGA APAYA	500	4202.4
509	RALIWANAN, KAFUGA	500	6332.3
510	MATAGUISI, PUDTOL	50	4648.8
511	KABUGAO, KALINGA APAYAO	300	4916.9
512	LENENG, KALINGA APAYAO	200	3285.5
513	LAOAS CITY	4	1979.1
514	BONGA RGS, PANGAY	70	2419.6
515	BONGA, DINGPAS	70	5406.0
516	ALABAAN, ILOCOS NORTE	50	2476.8
517	VIGAN, ILOCOS SUR	33	2455.8
518	LAGANGILANG, ABRA	539	3228.2
519	CAGUMITAN, TUAO, CAGAYAN	20	1763.4
520	TUGUEGARAO	22	1772.8
521	PINUKPUK	123	2522.6
522	SALEGSEG I	922	1596.7
523	SALEGSEG II	730	2768.8
524	TOMIANGAN, KALINGA APAYAO	431	-
525	NANENG	423	2969.0
526	LATAWAN	833	2719.9
527	GUILGUILA	500	2735.0
528	BASAO	829	3196.6
529	ILAGAN, ISABELA	47	1986.0
530	GABIT, ROXAS, ISABELA	50	-
531	BANGA-AN	1610	2130.1
532	BONTOC	855	2474.1
533	NATONIN	900	3367.9
534	BARLIG	1500	3991.3
535	BAUKO	1200	2302.0
536	MOUNT POLIS	1900	4426.9
537	MOUNT DATA	1500	3163.6
538	NAMULDITAN	900	3887.5
539	LAGAWE	480	2319.1
540	NAYON	320	1678.7

STA NO.	STATION	ELEVATION (m)	AVERAGE ANNUAL PRECIPITATION (mm)
541	BUGUIAS	1500	2183.2
542	MAGAT REF PROJ.; BAGABAG	250	1945.4
543	ATOK, SAYANGAN, BENGUET	2250	4931.0
544	ADADAY, KABAYAN, BENGUET	870	2458.3
545	AMBUKLAO	735	2176.9
546	KARAO, BENGUET	1000	2336.2
547	KM 21 ATOK, TURLAY	1700	3493.8
548	BOBOK, BOKOD, BENGUET	1525	2532.2
549	BINGA, ITOGON, BENGUET	587	2546.4
550	AMBURAYAN, LA UNION	200	2567.3
511	TAGUDIN, ILOCOS SUR	20	2599.6
552	NAGUILIAN-MAMATING	100	2426.6
553	TUBAO, MASALEP, LA UNION	50	1814.0
554	RAGUIO CITY	1481	3766.3
555	DIAMANTINA, CABATUAN	110	1643.3
556	CAGULAY, SANTIAGO, ISABELA	100	-
557	SOLANO, ISABELA	300	5066.4
558	SALINAS REF PROJ, N.V.	600	1747.1
559	BARRAT, BOMRANG, N.V.	550	1967.6
560	CONSUFLO, STA FE, N.V.	560	2248.8
561	CASIGUPAN, QUEZON	3	3435.4
562	DAGUPAN CITY	1	2436.8
563	DUPX, NUEVA VIZCAYA	540	1407.6
564	PANACION, CAPANGLON, N.F.	250	1356.3
565	TALAVERA, SAN JOSE	200	2174.3
566	CARANATUAN CITY	30	1993.7
567	BALER, QUEZON	4	3251.6
568	ANGAT DAM, SAN LORENZO	40	3274.5
569	IPO DAM, NOSZACARAY	147	2970.0
570	MINUYAN, SANJOSE	132	2795.5
571	NATATIO, QUEZON	350	6310.4
572	INFANTA, QUEZON	5	3397.4
573	LA MESA DAM,	61	2241.8
574	MONTALBAN, RIZAL	21	3397.7
575	PORT AREA, MANILA	17	2358.1
576	ANTIPOLO, RIZAL	201	2431.2
577	CLOP, TANAY, RIZAL	10	1830.3
578	CARIRAYA,	266	2333.5
579	STA CRUZ, LAGUNA	5	2039.0
580	LUMOT, CAVINTI, LAGUNA	240	3271.5
581	DARAITAN, QUEZON	420	3257.9
582	BAYOKAN, QUEZON	750	4369.3

Source; NPC





RIVER GAGING STATIONS IN LUZON  
In Alphabetic Order of River Names

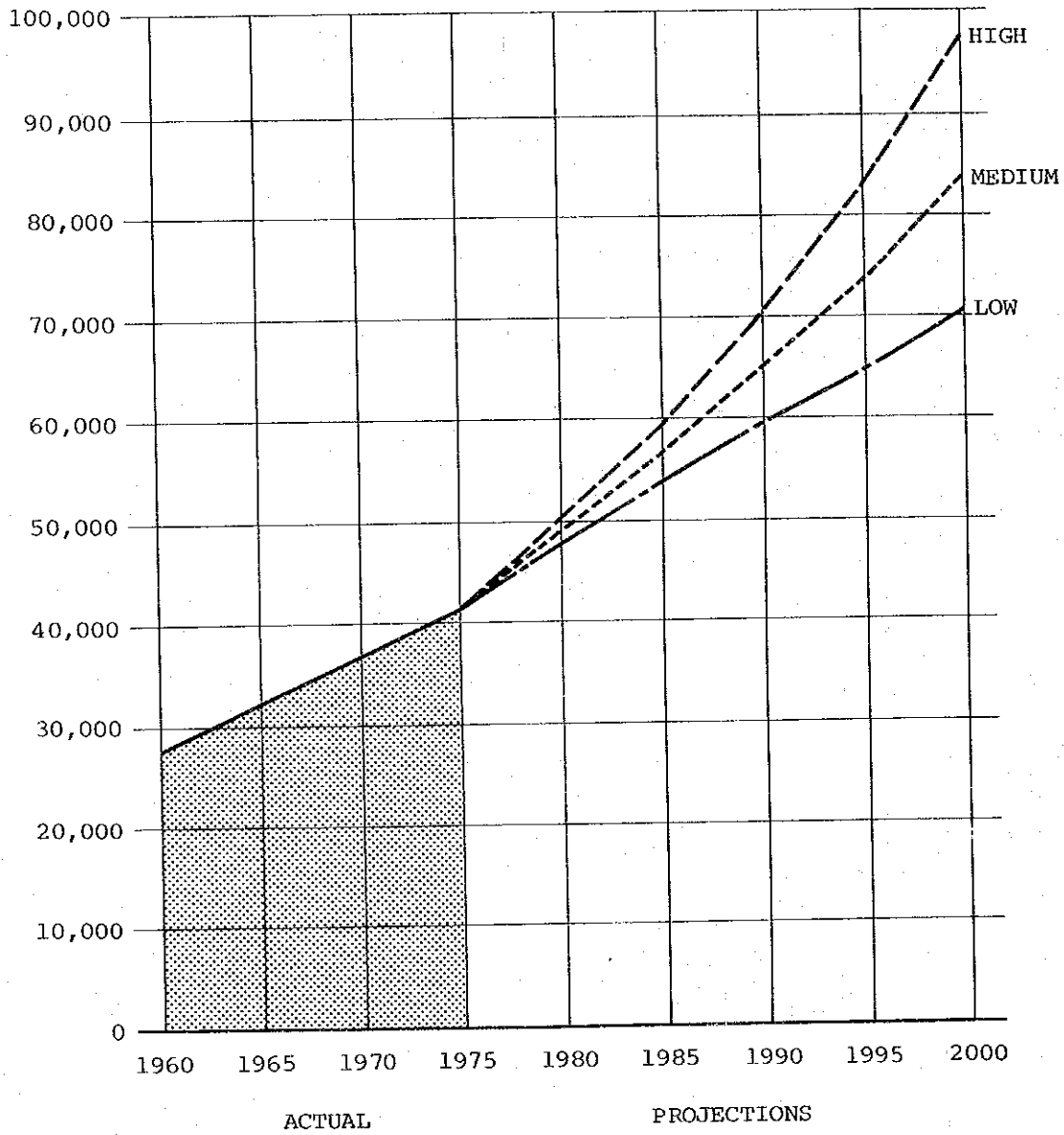
Name Location	Station No. #	Drainage Area km <sup>2</sup>	Mean Discharge m <sup>3</sup> /s	Name Location	Station No. #	Drainage Area km <sup>2</sup>	Mean Discharge m <sup>3</sup> /s
Abra - Banaoang	120	4813	391.5	Angat - Angat	175	552	70.2
Abra - Atoc	118	2575	136.0	Angat - Angat	375	552	69.6
Abulog - Atoc	107	2066	231.7	Arangilan - Calamias	188	84	0.5
Abulog - Putdol	108	1883	148.3	Aringay - Masalep	151	273	19.9
Addalam - Guinalbin	154	721	58.6	Balanac - Bukal	184	116	8.8
Agno - Adaoay	161	246	27.8	Banurbor - Bukal	103	112	4.9
Agno - Ambuklao	163	660	40.6	Banurbor - Maddalero	103	112	4.9
Agno - Binga	166	910	57.4	Baua - Baua	102	103	12.9
Agno - Binga	366	910	81.7	Baroro - Cabaruan	149	129	10.5
Agno - Loakan	162	413	28.2	Inflow Binga Reservoir	266	-	74.5
Agno - San Roque	168	1225	90.4	Bokod - Bokod	164	48	5.0
Agno - San Roque	268	1225	90.6	Buaya - Palali Sur	128	195	13.4
Agno - San Roque	368	1225	105.0	Bucong - Salvador	127	49	2.12
Agno - Tabu	267	1130	97.3	Bued - Dungon	159	141	13.4
Agno - Tabu	367	1130	88.8	Cadaclan - Omambong	146	261	19.7
Agus - Banugao	189	879	120.4	Cagayan - Dippaddiw	158	2323	82.9
Agus - Bayokan	191	811	119.9	Cagayan - Palattao	140	6266	427.6
Ambayoan - Sta. Maria	169	281	25.0	Cagayan - Panang	157	2335	144.1
Inflow Ambuklao Reservoir	263	-	56.2				

Name Location	Station No. #	Drainage Area km <sup>2</sup>	Mean Discharge m <sup>3</sup> /s	Name Location	Station No. #	Drainage Area km <sup>2</sup>	Mean Discharge m <sup>3</sup> /s
Cagayan - Pangal	147	4244	292.9	Gatu Creek - Gatu	101	14	2.6
Caliraya - Lumban	182	92	7.9	Ibulao - Hapid	144	606	45.9
Caliraya and - Lumot	383	129	9.7	Kaliwa - Daraitan	190	440	32.7
Carranglan - Baluarte	170	258	8.3	Laoag - Laoag	104	1355	221.0
Casile Creek - Mallig	136	195	2.7	Mabacan - Calauan	187	46	1.1
Chico - Abbot	113	3349	203.5	Magat - Bato	153	1784	70.6
Chico - Ambato	129	1087	-	Magat - Oscariz	142	4150	191.8
Chico - Ampawilen	131	751.7	64.5	Magat - Talictic	143	4062	264.9
Chico - Anabel	132	605.4	28.2	Mallig - Muñoz	137	563	18.1
Chico - Basao	130	891.4	47.2	Maragayap - Bitalag	148	36	2.9
Chico - Pasonglao	123	1987	174.0	Marikina - Montalban	176	282	18.8
Chico - Taed	133	391.9	34.8	Marikina - Sto. Niño	177	499	27.0
Chico - Tomiangan	122	1409.5	95.8	Mata - Coralan	180	85	0.70
Dabubu - Dabubu- Pequinno	156	162	8.3	Matalag - Escolta	112	655	34.3
Diadi - Cabulay	145	196	2.3	Matuno - Bante	152	558	35.7
Dibuluan - Minuri	155	272	20.4	Mayor - Bagumbayan	181	45	1.68
Digmala - Labi	174	52	4.9	Mayor - Bagumbayan	178	45	1.7
Dumnon - Calaoagan	110	308	12.1	Naguilan - Namat-ing	150	304	30.2
Gasgas - Manalpac	106	73	6.2				

Name Location	Station No. #	Drainage Area km <sup>2</sup>	Mean Discharge m <sup>3</sup> /s	Name Location	Station No. #	Drainage Area km <sup>2</sup>	Mean Discharge m <sup>3</sup> /s
Pampanga - Pialuan	173	838	42.9	Sinundagan - Simay	109	189	16.2
Pnagul - Pangul	114	312	8.0	Tagamusing - San Felipe	160	53	3.81
Pantabangan - Poblacion	172	253	14.6	Talavera - Lomboy	171	261	15.3
Paputok - Mabacan	186	9	0.9	Tanudan - Baba-alan	124	365	-
Paret - Calantac	111	907	58.8	Taotao - Caipilan	139	430	5.2
Pinacanauan - Larion	115	655	49.7	Tineg - Pang-ot	117	664	76.0
Pin. de Ilagan - Minanga	141	1565	87.3	Twin - Baloy	165	87	3.1
Pin. de Tumauini - Antagan	135	170	28.1				
Sabangan - Sipang	134	57	4.7				
Saltan - Liglig	121	255	-				
Saltan - Pinukpuk	116	846	42.8				
Santa Cruz - Calumpang	185	103	4.6				
Santa Maria No. 1 - Sabangan	125	67	1.9				
Santa Maria No. 2 - Sabangan	126	123	2.3				
Santa Maria - Makasipak	179	25	0.73				
Siffu - Muñoz	138	686	28.4				
Sinalang - Lingsad	119	120	10.0				

### POPULATION PROJECTIONS, 1960-2000

In Thousands



Source: Commission on Population and National Census and Statistics Office

POPULATION 10 YEARS AND OVER BY EMPLOYMENT STATUS,  
BY SEX, BY REGION: AUGUST 1976  
(In thousands, except percent)

Region and Sex	Total Persons 10 years old and over	In the Labor Force		Employed (Fully and Partially)				Totally Unemployed		Not in the Labor Force			
		Number	Percent of total persons 10 years old and over	Total	Agriculture		Nonagricultural Industries		Number	Percent of Labor Force	Number	Percent of total persons 10 years old and over	
					Number of Labor Force	Percent of total employed	Number of total employed	Percent of total employed					
Philippines	31,276	16,244	51.8	15,427	95.0	8,126	52.7	7,301	47.3	818	5.0	15,131	48.2
Male	15,433	10,509	68.1	10,022	95.4	6,188	61.7	3,834	38.4	487	4.6	4,924	31.9
Female	15,943	5,736	36.0	5,405	94.2	1,938	35.9	3,467	64.1	331	5.8	10,207	64.0

注) In the labor force: { 労働力を有し現に就労している者  
就労はしていないが就労を求めている者  
Not in the labor force: 労働力を有しているが就労を求めているもの

Source: National Census and Statistics Office

GROSS NATIONAL PRODUCT, NATIONAL INCOME AND GROSS DOMESTIC PRODUCT BY INDUSTRIAL ORIGIN, CY 1967-78  
(In thousands, except percent)

Industry	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
1. AGRICULTURE, FISHERY AND FORESTRY	13,052	13,981	14,432	14,734	15,457	16,040	17,026	17,465	18,218	19,671	20,646	21,541
2. INDUSTRIAL SECTOR	12,766	13,397	14,117	15,048	16,222	17,442	19,586	20,710	22,690	24,904	26,821	28,559
a. Mining and Quarrying	664	802	926	1,093	1,282	1,346	1,400	1,403	1,445	1,491	1,742	1,829
b. Manufacturing	9,846	10,478	10,897	11,823	12,611	13,388	15,252	15,981	16,537	17,481	18,793	20,025
c. Construction	1,978	1,797	1,942	1,738	1,889	2,240	2,433	2,745	4,101	5,254	5,575	5,930
d. Electricity, Gas and Water	278	320	352	394	440	468	501	581	607	678	711	775
3. SERVICE SECTOR	18,275	19,166	20,250	21,232	21,847	22,593	24,319	25,964	27,453	29,010	30,696	32,581
a. Transport, Communication and Storage	1,684	1,785	1,946	2,056	2,184	2,418	2,657	2,933	3,277	3,559	3,779	3,990
b. Commerce	10,858	11,246	11,828	12,295	12,484	12,688	13,589	14,351	15,056	15,938	16,903	17,963
c. Services	5,733	6,135	6,476	6,881	7,179	7,487	8,073	8,680	9,120	9,513	10,014	10,628
GROSS DOMESTIC PRODUCT at market prices	44,093	46,544	48,779	51,014	53,526	56,075	60,931	64,139	68,361	73,585	78,163	82,681
Net Factor Income from the Best of the World	(869)	(1,004)	(812)	(979)	(605)	(549)	(50)	600	169	(244)	(205)	(204)
GROSS NATIONAL PRODUCT at market prices	43,224	45,540	47,967	50,035	52,931	55,526	60,881	64,739	68,530	73,341	77,958	82,477
Indirect taxes net of subsidies	2,987	3,117	3,400	3,666	4,225	4,382	5,482	6,627	7,143	7,036	7,402	8,243
Capital Consumption Allowance	3,584	3,853	4,162	4,712	5,019	5,353	5,535	5,849	6,324	6,847	7,276	8,105
NET NATIONAL PRODUCT OR NATIONAL INCOME	36,653	38,570	40,405	41,657	43,677	45,791	49,864	52,263	55,063	59,458	63,280	66,129
	(24,530)	(27,196)	(29,958)	(34,848)	(40,960)	(45,791)	(58,732)	(81,038)	(90,972)	(106,330)	(123,182)	(137,819)

Note: ( ) is at current price

Source of data: Statistical Coordination Office, National Economic and Development Authority

QUANTITY AND VALUE OF PRODUCTION BY KIND OF CROP, PHILIPPINES CROP YEAR 1929-77  
(Quantity in thousand metric tons; value in million pesos)

	CROPS																	
	Total		Food		Commercial		Palay		Corn		Banana		Mango		Pineapple		Other Fruits and Nuts	
	Quan- tity	Value	Quan- tity	Value	Quan- tity	Value	Quan- tity	Value	Quan- tity	Value	Quan- tity	Value	Quan- tity	Value	Quan- tity	Value	Quan- tity	Value
1929	4,728.0	509.0	3,120.2	255.3	1,607.8	253.7	2,190.6	193.4	350.1	24.4	186.7	18.9	23.5	3.4	11.9	0.4	54.0	2.7
1970	15,200.6	8,099.7	10,670.0	4,750.2	4,530.6	3,349.6	5,233.4	2,073.6	2,008.2	525.9	896.0	656.9	151.7	142.9	233.4	109.5	288.4	212.5
1971	15,621.4	9,143.8	10,773.8	5,559.3	4,847.6	3,584.5	5,342.9	2,490.2	2,050.0	720.9	1,034.8	811.8	137.5	127.0	234.3	121.4	256.6	198.5
1972	15,191.1	10,285.7	10,629.4	6,749.3	4,561.7	3,536.3	5,100.1	3,190.1	2,012.6	1,043.5	980.1	781.2	143.4	132.3	282.1	146.6	337.3	287.5
1973	15,092.1	10,752.5	9,860.2	6,258.3	5,201.9	4,484.4	4,414.6	2,650.0	1,831.1	828.2	1,012.6	814.7	187.7	180.0	293.4	166.4	309.8	284.6
1974	17,546.3	17,763.5	12,072.6	10,370.0	5,473.7	7,393.5	5,594.1	4,960.4	2,288.7	1,537.1	1,235.5	1,038.1	191.5	297.8	338.3	285.7	326.8	427.0
1975	19,807.3	20,147.5	13,549.0	13,421.2	6,258.3	6,726.3	5,660.1	5,345.5	2,568.4	2,153.2	1,686.0	1,542.6	239.3	254.8	424.4	504.1	337.4	569.2
1976	22,934.6	20,279.3	15,679.2	14,440.1	7,255.4	5,839.2	6,159.5	5,918.5	2,766.8	2,450.3	3,067.9	1,093.6	330.9	644.7	419.9	521.5	344.8	550.5
1977	24,388.6	27,521.2	16,775.9	16,716.8	7,612.7	10,804.4	6,456.1	6,617.4	2,843.4	2,684.3	2,394.7	921.3	307.1	682.8	427.3	573.4	465.2	739.5

Source: The Bureau of Agricultural Economics



SUMMARY OF MAJOR PRODUCTS

Statistical Series	Latest Data		Compared to		Per Cent Change
	Reference Period	Value	Reference Period	Value	
<b>PRODUCTION</b>					
a. Production of agricultural crops (1,000 MT)	Crop Year 1977	24,388.6	Crop Year 1976	22,934.6	6.34
Food crops		16,775.9		15,679.2	6.99
Palay		6,456.1		6,159.5	4.82
Corn		2,843.4		2,766.8	2.77
Fruits and vegetables		4,261.6		4,784.5	(10.93)
Other food crops		3,214.8		1,968.4	63.32
Commercial crops		7,612.7		7,255.4	4.92
Coconut		3,816.5		3,415.0	11.76
Sugarcane		3,531.0		3,576.8	(1.28)
Abaca and other crops		154.9		144.9	6.90
Tobacco		52.1		59.9	(13.02)
Rubber		58.2		58.8	(1.02)
b. Value of production of agricultural crops (P million)	Crop Year	27,521.2	Crop Year 1976	20,279.3	35.71
Food crops		16,716.8		14,440.1	15.77
Palay		6,617.4		5,918.5	11.81
Corn		2,684.3		2,450.3	9.55
Fruits and vegetables		4,109.8		4,098.9	0.27
Other food crops		3,305.3		1,972.4	67.58
Commercial crops		10,804.4		5,839.2	85.03
Coconut		3,980.3		1,916.7	107.66
Sugarcane		6,169.2		3,209.9	92.19
Abaca and other crops		311.4		320.7	(2.90)
Tobacco		190.5		251.0	(24.10)
Rubber		153.0		140.9	8.59
c. Fish production (1,000 MT)	CY 1976	1,393.5	CY 1975	1,336.8	4.24
Commercial fishing		508.2	CY 1973	498.6	1.93
Fishponds		112.8		106.5	5.92
Municipal fisheries and sustenance fishing		772.5		731.7	5.58
d. Value of fish production (P million)	CY 1976	7,298.0	CY 1975	5,919.1	23.30
Commercial fishing		2,697.8		2,549.0	5.84
Fishponds		845.7		809.1	4.52
Municipal fisheries and sustenance fishing		3,754.5		2,561.0	46.60
e. Production of logs, lumber, plywood and veneer (1,000 cu.m.)	CY 1977		CY 1976		
Logs		7,874		8,646	(8.93)
Lumber		1,567		1,610	(2.67)
Plywood		489		417	17.27
Veneer		496		807	(38.54)
f. Value of mining production (P million)	CY 1977	4,085.7	CY 1976	3,429.1	19.15
Precious metals		636.0		489.9	29.82
Base metals		2,999.1		2,568.9	16.75
Non-metallics		450.6		370.3	21.69
g. Value of manufacturing output (P million)	CY 1974	47,553	CY 1973	31,248	52.18
Food		14,516		9,210	57.61
Beverages		1,762		1,249	41.07
Tobacco		2,149		1,506	42.70
Textiles		3,490		2,619	33.26
Footwear and Wearing Apparel		431		345	24.93
Wood and crok		1,281		1,227	4.40
Furniture and fixtures		193		141	36.88
Paper		1,578		1,064	48.31
Printing		67		505	(86.73)
Leather		60		56	7.14
Rubber		806		563	43.16
Chemicals		4,669		3,249	43.71
Petroleum and coal		6,315		2,519	150.69
Non-metallic mineral products		1,657		1,102	50.36
Basic metal		2,276		1,923	18.36
Metal products		1,290		1,137	13.46
Machinery except electrical		628		333	88.59
Electrical machinery		1,215		818	48.53
Transport equipment		1,879		1,178	59.51
Miscellaneous		690		452	52.65

Source: National Economic and Development Authority

NATIONAL POWER CORPORATION  
DEMAND AND ENERGY FORECAST  
TOTAL NPC LUZON  
JUNE, 1979

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CALENDAR YEAR	S A L E S ( G W H )				PEAKLOAD				
	PROVINCIAL CUSTOMER	GROWTH RATE %	MECO*	GROWTH RATE %	TOTAL SALES	GROWTH RATE %	ENERGE (GWH) GENERATION	MW	I.F.%
<u>ACTUAL</u>									
1969	852	-	4787	-	5639	-	6087	1020**	68.1
1970	1030	20.9	5016	4.8	6046	7.2	6386	1111	65.6
1971	1307	26.9	5289	5.4	6596	9.1	7048	1205	66.8
1972	1485	13.6	5645	6.7	7131	8.1	7555	1331	64.8
1973	1461	10.5	6082	7.7	7723	8.3	8212	1335	73.2
1969-1973		17.8%		6.2%		8.2%	7.8%	7.0%	
1974	1835	11.8	5969	(1.9%)	7804	1.0	8240	1379	68.1
1975	2142	16.7	6443	7.9	8585	10.0	9014	1513	68.3
1976	2268	5.9	7185	11.5	9453	10.1	9626	1659	66.1
1977	2182	(3.8)	7631	6.2	9813	3.8	10357	1709	69.2
1978	2353	7.8	8061	5.6	10414	6.1	11223	1780	71.9
1974-1978		6.4%		7.8%		7.5%	8.0%	6.6%	
1969-1978		11.9%		6.0%		7.1%	7.0%	6.4%	

Note: \*\* Estimated using coincidence factor of 97%.  
\* Includes company use and system losses.

LUZON GRID LOAD FORECAST  
(GENERATION LEVEL)

YEAR	DEMAND (MW)	ENERGY (GWh)
<u>ACTUAL</u>		
1968	903	5387
1969	1020	6087
70	1111	6386
71	1205	7048
72	1331	7555
73	1335	8212
1969 - 1973	8.1%	8.8%
1974	1379	8240
75	1513	9014
76	1659	9676
77	1709	10357
78	1780	11223
1974 - 1978	5.9%	6.4%
1969 - 1978	7.0%	7.6%
<u>FORECAST</u>		
1979	1905	11765
80	2038	12497
81	2180	13368
82	2333	14306
83	2496	15305
1979 - 1983	7.0%	6.4%
1984	2671	16379
85	2858	17525
86	3058	18752
87	3272	20064
88	3502	21474
1984 - 1988	7.0%	7.0%
1989	3747	22977
90	4009	24593
1989 - 1990	7.0%	7.0%
1979 - 1990	7.0%	6.8%

NPC GENERATION PLANT DATA  
AS OF DEC. 1979

	MW CAPACITY	DATE OF COMMISSIONING	FUEL USED	PRODUCTION GWH (1979)	LOCATION	REASONS FOR CHOICE OF LOCATION
<b>LUZON</b>						
<b>HYDRO:</b>						
	2,992.8					
Ambuklao	75	12-23-56	-	311.986	Bokod, Benguet	Near load center; for irrigation
Binga	100	May 1960	-	394.817	Itogon, Benguit	- do -
Argat	218	9-9-67	-	465.230	Norzagaray, Bulacan	Water supply, irrigation power; near load center.
Pantabangan	100	1st unit (Feb. 1977) 2nd unit (May 1977)	-	300.698	Pantabangan, Nueva Ecija	- do -
Caliraya	32	1st unit - Oct. 1975	-	129.878	Lumban, Laguna	Near load center and hydro sour
Botocan	16	1948	-	48.766	Majayjay, Laguna	Hydro source available at that time; for power.
Buhi-Barit	1.8	9-1-57	-	10.035	Buhi, Camarines Sur	Develop provincial load
<b>THERMAL (oil-fired)</b>						
Bataan 1	75	Sept. 1972	Hi-Vis oil	470.157	Lamay, Bataan	Fuel is by product of Bataan Refining Co., power supply for industrial area
Bataan 2	150	2-9-77	- do -	898.495	- do -	Fuel is by product of Phil. Petroleum Corp.
Malaya 1	300	July 1974	Bunker C/Special	1764.760	Pililia, Rizal	- do -
Malaya 2	350	January 1979	fuel oil	1562.158	- do -	- do -
Snyder 1	200	July 1971	Bunker C	565.591	Muntinlupa, Metro.Mla.	Near load center of Metro Mla.
Snyder 2	300	July 1972	- do -	1089.529	- do -	- do -
Gardner 1	150	Aug. 1968	- do -	437.296	- do -	- do -
Gardner 2	200	Jan. 1970	- do -	1187.076	- do -	- do -
Tegen 1	100	Sept. 1965	- do -	518.695	Isla de Previsor, Mla.	- do -
Tegen 2	100	- do -	- do -	689.679	- do -	- do -
Rockwell 1-5	125	Sept. 1955	- do -	227.422	Makati, Metro Manila	- do -
Rockwell 6-7	180	Oct. 1963	- do -	686.043	- do -	- do -
<b>GEOTHERMAL:</b>						
Titwi 1&2	110	Unit 1 - Jan. 1979 Unit 2 - May 1979	Geothermal Steam	441.310		Geothermal source; generation at end of long T/L for reliability and regulation.
Mak-Ban 1&2	110	Unit 1 - May 1979 Unit 2 - Aug. 1979	- do -	192.100		Geothermal source and near load center; for pumping power for Kalayaan Pumped Storage Plt.

	MW CAPACITY	DATE OF COMMISSIONING	FUEL USED	PRODUCTION GWH (1979)	LOCATION	REASONS FOR CHOICE OF LOCATION
<b>VISAYAS</b>						
<b>CEBU GRID:</b>						
Naga Diesel	85.4	1-Unit July 1977 3-Unit 1978	Heavy/Light fuel	190.804	Naga, Cebu	Load Center
<b>NEGROS GRID:</b>						
Amlan Hydro	0.8	5-17-61	-	3.204	Amlan, Negros Cr.	Hydro source and developing provincial load center
Amlan Diesel	11.0	- do -	Heavy/Light fuel	27.506	- do -	
<b>BOHOL GRID:</b>						
Loboc Hydro	1.2	4-6-57	Light/Heavy fuel	5.305	Loboc, Bohol	Hydro source and developing provincial load center
Tagbilaran Diesel	11.1	- do -	Light/Heavy fuel	9.589	Tagbilaran City	
<b>LEYTE-SAMAR GRID:</b>						
Tongonan Geo.	3.0	July 1977	Geothermal Steam	4.163	Tongonan, Leyte	Geothermal Source
<b>PANAY:</b>						
Dingle Diesel	7.3	November 1979	Heavy/Light fuel	2.747	Iroiro, Panay	Load Center and developing provincial load.
<b>MINDANAO</b>						
<b>MINDANAO</b>						
<b>HYDRO:</b>						
Agus VI	200.0	1 Unit -5-26-53 2 Unit 11-9 -56 3rd Unit - 1968 4th Unit -6-30-71 5th Unit - April 1977		851.142	Baloi, Lanao del Norte	Near load center and source of power for industries
Agus II	60.0	June 1979		259.912	Saguiran, Lanao Del Sur	Hydro Source
Agusan	1.6	12-19-57		11.283	Sur Philips, Bukidnon	- do -
<b>DIESEL:</b>						
Aplaya 1	11.0	Unit 1 - Sept. 1979	Light/Heavy fuel	16.372	Aplaya, Miamis Or.	Generation located at end of long T/L reliability & regulations.
General Santos	14.6	- do -	- do -	(Although completed no generation for 1979)	Gen. Santos City, South Cotabato	- do - Develop provincial load
<b>Total</b>	<b>3365.4MW</b>					

LUZON GRID EXPANSION PROGRAM

Plants Under Construction

Year	Name of Plant	Type	Capacity (MW)
1979	Tiwi #1 & 2*	Geo	110
	Mak-Ban #1 & #2*	Geo	110
	Malaya 2*	Oil	350
1980	Tiwi #3 & #4	Geo	110
	Mak-Ban #3 & #4	Geo	110
1981	Masiway	Hydro	12
1982	Tiwi #5 & #6	Geo	110
1983	Kalayaan	Pumped Hydro	300
	Magat #1 & #2	Hydro	180
1984	Magat #3 & #4	Hydro	180
1986	PNPP #1	Nuclear	620

Proposed Additions

Year	Name of Plant	Type	Capacity (MW)
1984	Coal Thermal I	Coal	300
1985	Geo 1-4	Geo	220
1986	Coal Thermal II	Coal	300
	Magat #5 & #6	Hydro	180
1987	San Roque #1 & #2	Hydro	260
1988	Geo #5 & #6	Geo	110
1988/89	Gened	Hydro	600
	Kanan HE	Hydro	280
1990	Chico IV	Hydro	360
	San Roque #3	Hydro	130

\* Tiwi #1 & #2, Mak-Ban #1 and Malaya #2 has been commissioned by the first half of 1979.

石油輸入量 (単位：百万バレル)

年 度	中近東諸国	その他	合 計
1972	35.83	11.84	67.67
1973	65.58	3.10	68.68
1974	57.67	2.67	60.34
1975	54.52	12.93	67.45
1976	51.85	17.65	69.50
1977	51.30	19.55	70.85
1978	51.95	20.97	72.92
1979	46.95	20.10	67.05

(Source : NPC)

EXTERNAL DEBT OUTSTANDING CLASSIFIED

BY INSTITUTIONAL SOURCE: 1974-76

(In million U.S. dollars)

Institutional Source	1974	1975	1976
TOTAL	1,562.6	2,230.4	3,320.6
U.S. Government & U.S. AID	130.4	1172.0	202.3
IBRD	164.1	236.1	304.7
IMF <sup>3</sup>	358.9	469.6	612.6
IDA <sup>4</sup>	9.6	22.6	27.1
ADB <sup>5</sup>	46.3	91.2	129.0
US Eximbank	26.7	70.3	97.4
US commercial banks	299.0	339.2	675.2
European banks	127.3	180.5	170.5
Japaneas banks	80.7	95.8	61.2
Other banks	12.5	190.8	232.6
Other financial & development institutions	7.3	3.8	3.8
U.S.A.	51.9	49.8	49.6
Japan	139.8	13.2	38.8
West Germany	6.2	7.3	6.0
France	0.7	0.2	0.0
Belgium	1.0	2.1	2.1
Italy	0.9	3.9	3.1
British	0.0	7.5	6.4
Hongkong	0.0	14.8	34.8
Canada	14.8	8.5	4.5
Other private creditors	-	-	2.8
Republic of China	6.5	16.0	9.3
Government of Thailand	25.2	23.6	19.9
Government of Belgium	1.0	1.5	4.5
Government of Japan	33.2	178.5	226.9
Government of Denmark	4.9	7.4	8.5
Government of Spain	0.0	2.2	1.7
Others	24.0	22.0	388.1

1. Excludes other institutional sources of credit.

2. International Bank for Reconstruction & Development.

3. International Monetary Fund.

4. International Development Association.

5. Asian Development Bank.

Source: Central Bank of the Philippines.

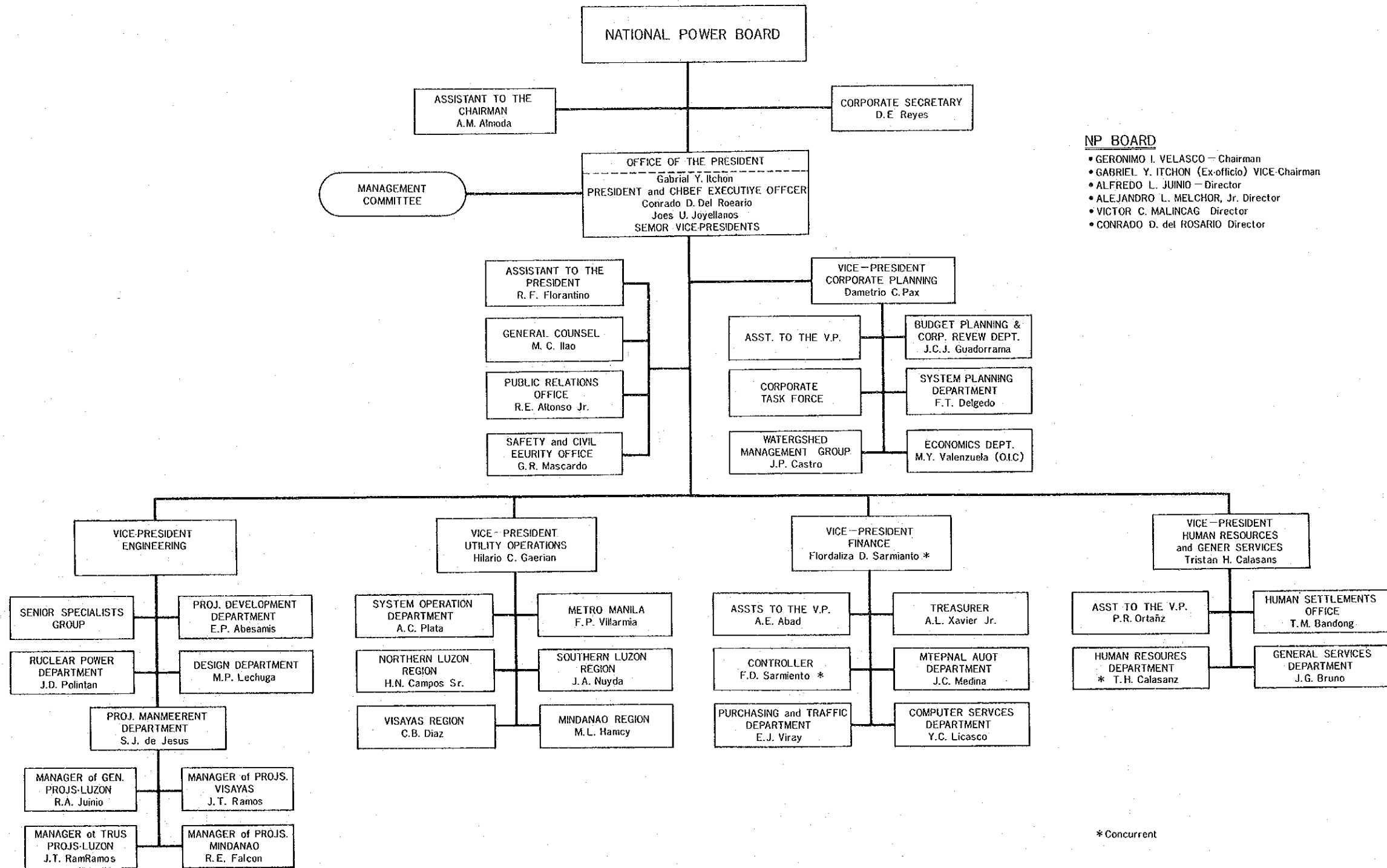


THE ELEVEN PROJECTS IN INDUSTRIAL DEVELOPMENT

1. INTEGRATED STEEL MILL
2. PETROCHEMICAL COMPLEX
3. COPPER SMELTER
4. PHOSPHATE FERTILIZER
5. ALUMINUM SMELTER
6. HEAVY INDUSTRY - FABRICATION OF MACHINERY FOR ALCOGAS, CEMENT,  
REFINERIES, HEAVY EQUIPT, ETC.
7. DEVELOPMENT OF NON-CONVENTIONAL SOURCES OF ENERGY
8. RATIONALIZATION OF COCONUT INDUSTRY
9. EXPANSION OF CEMENT INDUSTRY
10. INTEGRATED PULP AND PAPER INDUSTRY
11. DIESEL ENGINE MANUFACTURING

Source: NPC

# NATIONAL POWER CORPORATION ORGANIZATION CHART



**NP BOARD**

- GERONIMO I. VELASCO – Chairman
- GABRIEL Y. ITCHON (Ex-officio) VICE-Chairman
- ALFREDO L. JUNIO – Director
- ALEJANDRO L. MELCHOR, Jr. Director
- VICTOR C. MALINCAG Director
- CONRADO D. del ROSARIO Director

\* Concurrent



## ルソン島のCoopとその供給需要家数

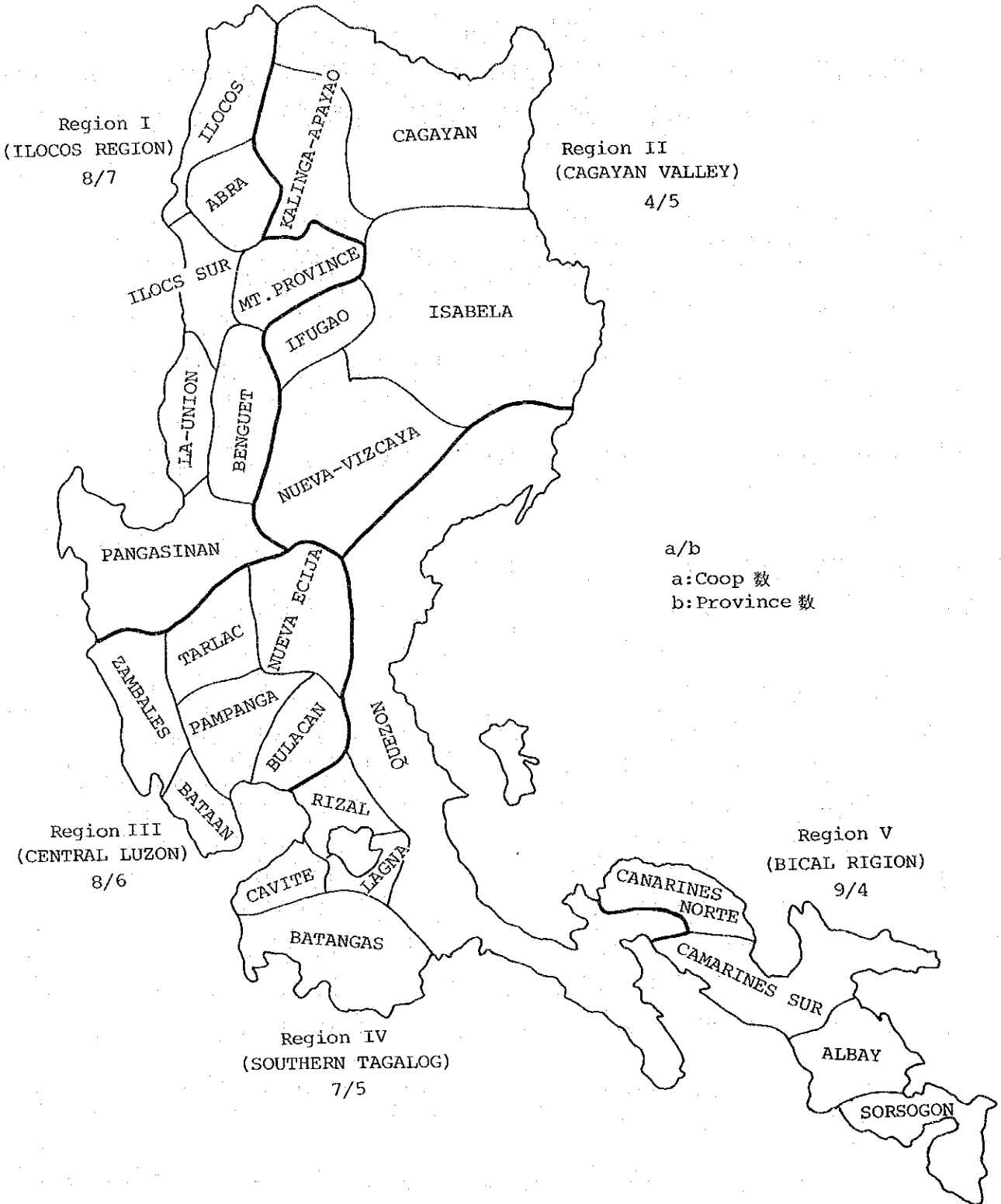
(1978年2月末現在)

	Cooperative Name	Towns	Barangays	House Connections
	(Region I)			
1	Ilocos Norte	20	347	31,748
2	La Union	18	327	22,734
3	Abra	16	128	7,817
4	Benguet	8	132	19,268
5	Ilocos Sur	26	342	26,252
6	Mt. Province	1	2	625
7	W. Pangasian	9	83	7,118
8	C. Pangasian	15	254	26,702
	(Region II)			
9	Isabela	12	135	11,240
10	Cagayan I	9	66	8,541
11	" II	1	-	959
12	Nueva Vizcaya	1	5	1,659
	(Region III)			
13	Bataan	12	285	29,523
14	Bulacan I	6	125	30,965
15	" II	4	50	8,825
16	Nueva Ecija I	12	156	32,656
17	" " II	11	110	15,621
18	Pampanga	18	234	62,590
19	Zambalas	13	174	20,628
20	Tarlac	14	175	19,624
	(Region IV)			
21	Batangas I	10	116	19,972
22	" II	7	71	16,186
23	Carite	6	62	30,504
24	Laguna	11	94	15,663

	Cooperative Name	Towns	Barangays	House Connections
	(Region IV)			
25	Rizal I	1	37	4,821
26	" II	5	41	7,951
27	Quezon	13	130	12,592
	(Region V)			
28	Albay	14	156	24,508
29	Camarines Sur I	10	109	7,575
30	" " II	8	89	12,028
31	" " III	6	69	6,799
32	" " IV	7	87	5,334
33	" Norte	12	74	9,284
34	Camarines	6	81	5,405
35	Sorsogon I	8	112	5,044
36	" II	5	13	5,204

(Source: NEA Annual Report 1978)

ルソン島のRegionとProvince



**Pambansang Korporasyon Sa Elektrisidad  
(NATIONAL POWER CORPORATION)**

AUGUST 13' 1979

**NOTICE TO  
NATIONAL POWER CORPORATION POWER CUSTOMERS  
AND THE GENERAL PUBLIC**

By virtue of the power granted in Section 4, Republic Act No. 6395 (Revised Charter of the National Power Corporation), as amended, the National Power Board has fixed and approved the following revisions in the FUEL COST ADJUSTMENT (FCA) clauses of the Rules and Regulations for the Sale of Electricity to NPC customers, served by the Luzon Grid, Visayas Sub-grids and Mindanao Grid, affective September 1, 1979:

The FCA charge per kilowatt-hour shall be correspondingly increased or decreased by the following adjustment, rounded to the nearest P0.0001.--

**LUZON GRID: Adjustment per KWH = P0.0300 plus  $\frac{A \times B}{C}$**

**VISAYAS AND MINDANAO:  
Adjustment per KWH = P0.0100 plus  $\frac{A \times B}{C}$**

Where A = the weighted average price increase above (or decrease below) the following base prices of fuel oil actually burned during the billing period, net of all taxes, duties fees and all other charges imposed by the Republic of the Philippines and its various instrumentalities to the extent that NPC is able to avail itself of or otherwise benefit from such exemption:

LUZON GRID	—	P21.82/MBTU
CEBU GRID	—	P0.9360/liter
NEGROS SUB-GRID	—	P0.9482/liter
BOHOL SUB-GRID	—	P0.9726/liter
MINDANAO GRID	—	P0.9597/liter

B = Million BTU or liters of fuel oil actually burned in NPC's oil-burning generating plants in the individual grid or sub-grid during the billing period.

C = Kilowatt-hour sales by NPC in the individual grid or sub-grid during the billing period.

(SGD) G.Y. ITCHON  
President

NATIONAL POWER CORPORATION

LUZON GRID RATES SCHEDULE

(Effective April 1, 1979)

(FOR UTILITIES)

Demand Charge:

First 250 KW of Billing Demand	₱5.00 per KW per mo.
Over 250 KW of Billing Demand	5.40 per KW per mo.

Basic Energy Charge:

First 250 KWH/KW of Billing Demand	₱0.1973 per KWH
Next 200 KWH/KW of Billing Demand	0.2123 per KWH
Over 450 KWH/KW of Billing Demand	

(FOR INDUSTRIES/NON-UTILITIES)

Demand Charge:

First 1,000 KW of Billing Demand	₱5.63 per KW per mo.
Next 9,000 KW of Billing Demand	3.38 per KW per mo.
Over 10,000 KW of Billing Demand	1.13 per KW per mo.

Energy Charge:

First 300 KWH/KW of Billing Demand	₱0.2193 per KWH
Next 150 KWH/KW of Billing Demand	0.2083 per KWH
Excess KWH/KW of Billing Demand	0.2033 per KWH

3/27/79



NATIONAL POWER CORPORATION

CEBU POWER GRID RATES SCHEDULE

(Effective April 1, 1979)

SCHEDULE I - FOR UTILITIES

a) Applicability

Applicable to electric power and energy supplied to electric utilities in Cebu served by CORPORATION.

b) Rates

<u>Demand Charge:</u>	<u>Per Meter</u> <u>Per Month</u>
First 100 KW of Billing Demand	P 11.00 per KW
Next 900 KW of Billing Demand	14.00 per KW
Over 1000 KW of Billing Demand	17.00 per KW
 <u>Energy Charge:</u>	
First 100 KWH/KW of Billing Demand	P 0.2475 per KWH
Next 150 KWH/KW of Billing Demand	0.2795 per KWH
Over 250 KWH/KW	0.2885 per KWH
 <u>Minimum Charge:</u>	

The monthly minimum charge shall be based on the KW of Billing Demand and Contract Energy.

SCHEDULE II - FOR INDUSTRIES

a) Applicability

Applicable to electric power and energy supplied to industries and non-utilities in Cebu served by CORPORATION.

b) Rates

	<u>Per Meter</u> <u>Per Month</u>
<u>Demand Charge:</u>	
First 1000 KW of Billing Demand	£ 20.00 per KW
Next 9000 KW of Billing Demand	18.00 per KW
Over 10,000 KW of Billing Demand	17.00 per KW
 <u>Energy Charge:</u>	
First 300 KWH/KW of Billing Demand	£ 0.3455 per KWH
Next 200 KWH/KW of Billing Demand	0.3305 per KWH
Over 300 KWH/KW of Billing Demand	0.3005 per KWH
 <u>Minimum Charge:</u>	

The monthly minimum charge shall be based on the KW of Billing Demand and Contract Energy.

REPUBLIKA NO FILIPINAS  
Pambansang Korporasyon Sa Elektrisidad  
(NATIONAL POWER CORPORATION)

SEPTEMBER 5, 1979

NOTICE TO

NATIONAL POWER CORPORATION POWER CUSTOMERS  
AND THE GENERAL PUBLIC

PANAY POWER GRID

By virtue of the power granted in Section 4, Republic Act No. 6395 (Revised Charter of the National Power Corporation), as amended, the National Power Board has fixed and approved under Resolution No. 79-136 dated September 8, 1979, the interim power rate for the Panay Power Grid as a straight energy charge of ₱0.40 per kilowatt-hour plus fuel cost adjustment (FCA).

The effectivity period of said authorized power rate shall be from the commissioning date of NPC's diesel plants in Panay until December 31, 1979, unless otherwise extended.

Fuel Cost Adjustment (FCA) Clause

The FCA charge per kilowatt-hour shall be correspondingly increased or decreased by the following adjustment rounded to the nearest ₱0.0001:

$$\text{Adjustment per KWH} = \frac{A \times B}{C}$$

Where A = weighted average price increase above (or decrease below) ₱0.9670 per liter base price of fuel oil actually burned during the Billing period, net of all taxes, duties, fees, and all other charges imposed by the Republic of the Philippines and its various instrumentalities to the extent that NPC is able to avail of or otherwise benefit from such exemption.

B = Liters of fuel oil actually burned in the Panay Grid's oil-burning generating plants during the billing period.

C = Kilowatthour sales of NPC in the Panay grid during the billing period.

G. Y. ITCHON  
President

NATIONAL POWER CORPORATION

BOHOL RATES SCHEDULE

(Effective April 1, 1979)

a) Applicability

Applicable to electric power and energy supplied to electric utilities and non-utilities in Bohol served by CORPORATION.

b) Rates

<u>Demand Charge:</u>	<u>Per Meter</u> <u>Per Month</u>
All Kilowatts of Billing Demand	₱10.00 per KW

Basic Energy Charge:

First 300 KWH per KW of Billing Demand	₱0.2300 per KWH
Next 150 KWH per KW of Billing Demand	0.2100 per KWH
Excess KWH's	0.1900 per KWH

Minimum Charge:

The monthly minimum charge shall be based on the KW of Billing Demand and Contract Energy.

NATIONAL POWER CORPORATION  
NEGROS ORIENTAL RATES SCHEDULE

(Effective April 1, 1979)

a) Applicability

Applicable to electric power and energy supplied to electric utilities and non-utilities in Negros Oriental served by CORPORATION.

b) Rates

	Per Meter
	Per Month
<u>Demand Charge:</u>	
All Kilowatts of Billing Demand	₱10.00 per KW
<u>Basic Energy Charge:</u>	
First 300 KWH per KW of Billing Demand	₱0.2290 per KWH
Next 150 KWH per KW of Billing Demand	0.2090 per KWH
Excess KWH's	0.1890 per KWH
<u>Minimum Charge:</u>	

The monthly minimum charge shall be based on the KW of Billing Demand and Contract Energy.

REPUBLIKA NO FILIPINAS  
Rambansang Korporasyon Sa Elektrisidad  
(NATIONAL POWER CORPORATION)

SEPTEMBER 5, 1979

NOTICE TO

NATIONAL POWER CORPORATION POWER CUSTOMERS  
AND THE GENERAL PUBLIC

GENERAL SANTOS POWER GRID

By virtue of the power granted in Section 4, Republic Act No. 6395 (Revised Charter of the National Power Corporation), as amended, the National Power Board has fixed and approved under Resolution No. 79-133 dated September 3, 1979, the interim power rate for the General Santos Power Grid as a straight energy charge of P0.40 per kilowatthour plus fuel cost adjustment (FCA).

The effectivity period of said authorized power rate shall be from the commissioning date of NPC's diesel plants in General Santos until December 31, 1979, unless otherwise extended.

Fuel Cost Adjustment (FCA) Clause

The FCA charge per kilowatthour shall be correspondingly increased or decreased by the following adjustment, rounded to the nearest P0.0001:

$$\text{Adjustment per KWH} = \frac{A \times B}{C}$$

Where A = weighted average price increase above (or decrease below) P0.9597 per liter base price of fuel oil actually burned during the billing period, net of all taxes, duties, fees and all other charges imposed by the Republic of the Philippines and its various instrumentalities to the extent that NPC is able to avail of or otherwise benefit from such exemption.

E = Liters of fuel oil actually burned in the General Santos Grid's oil-burning generating plants during the billing period.

C = Kilowatthour sales of NPC in the General Santos Grid during the billing period.

G. Y. ITCHON  
President



NATIONAL POWER CORPORATION  
MINDANAO GRID RATES SCHEDULE

(Effective April 1, 1979)

SCHEDULE I - FOR UTILITIES

a) Applicability

Applicable to electric power and energy supplied to electric utilities in Mindanao served by Agost Grid of Corporation.

b) Rates

<u>Demand Charge</u>	<u>Per Meter</u> <u>Per Month</u>
1st 100 KW of Billing Demand	P 2.00 per KW
Next 900 KW of Billing Demand	4.00 per KW
Next 4,000 KW of Billing Demand	10.00 per KW
Over 5,000 KW of Billing Demand	14.00 per KW
 <u>Basic Energy Charge</u>	
1st 100 KWH/KW of Billing Demand	P 0.0702 per KWH
Next 100 KWH/KW of Billing Demand	0.1002 per KWH
Next 200 KWH/KW of Billing Demand	0.1102 per KWH
Over 400 KWH/KW of Billing Demand	0.1252 per KWH

SCHEDULE II - FOR INDUSTRIES/NON-UTILITIES

a) Applicability

Applicable to electric power and energy supplied to industries and non-utilities in Mindanao served by Agus Grid of CORPORATION

b) Rates

	<u>Per Meter</u> <u>Per Month</u>
1st 1,000 KW of Billing Demand	P14.00 per KW
Next 4,000 KW of Billing Demand	16.00 per KW
Next 10,000 KW of Billing Demand	18.00 per KW
Over 15,000 KW of Billing Demand	19.00 per KW

Basic Energy Charge

1st 150 KWH/KW of Billing Demand	0.1152 per KWH
Next 250 KWH/KW of Billing Demand	0.1802 per KWH
Next 150 KWH/KW of Billing Demand	0.1352 per KWH
Over 550 KWH/KW of Billing Demand	0.1402 per KWH

Minimum Charge

The monthly minimum charge shall be based on the KW of Contract Demand and Contract Energy.

FUEL COST ADJUSTMENT CLAUSE









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