14.5.4 Optimum power development sequence

Out of many alternatives regarding share of power generation, plant size and installation timing, the optimum development sequence was selected in each study case on power and energy demand increment. The selection was made in viewpoint of the least present worth of total capital cost, and the operation and maintenance costs. The optimum sequences are proposed in Table 14.2 as well as one each of alternative ones. The alternative sequence was selected as a plan of second least cost one.

The installation programs are presented in Table 14.3 and Fig. 14.1 for each optimum and alternative development sequences, respectively. Computer output of the priority ranking are compiled in APPENDIX C for the optimum and alternative which is corresponding to Table 14.3 and Fig. 14.1.

XV. MASTER ACTION PROGRAM FOR ORDERLY DEVELOPMENT OF HYDROPOWER POTENTIALS

15.1 General

Through the study on priority ranking of promising hydropower project together with other thermal plants, several hydropower projects which will be incorporated into the power expansion program up to the year 2005 were selected. Total installed capacity of power plants to be newly installed during 11 years from 1995 to 2005 is about 4,660 MW. On the other hand, according to the latest power development program by NPC, total installed capacity of power plants which are scheduled to be commissioned by the year 1995 is about 1,000 MW. It means that more than four times of new installation is needed for the latter half of study horizon. NPC's power development program covering 10 years from 1986 to 1995 is well prepared, then no major modification is made in the study.

As was discussed in Chapter XIV, the priority ranking study was made in consideration of an appropriate balance of power generation sources such as hydropower, geothermal, coal-thermal and oil-thermal. It mainly comes from the fact that the domestic energy sources are not infinite and also the confirmation of their field distribution has not completed yet, except hydropower potential sites studied this time. Furthermore energy value of each power generation source will vary in the future from time to time due to fluctuation of fuel price, development cost, etc. In another words, there is no guarantee that the advantage of geothermal in kWh value evaluated at the price level of end-1985 against another power generation sources lasts in the future.

Therefore, the preparation of orderly power development program was made giving an equal chance to hydropower, geothermal and coal-thermal plants, even though the study depth for each source is not same.

15.2 Proposed Orderly Power Development Program

As was discussed in Chapter XIV, the power and energy demand projection was made for four cases, that is A) Original, B) Alternative 1, C) Alternative 2, and D) Alternative 3, changing the annual growth rate of power and energy demand. Among them, case A) is judged to be most practicable at this study stage. Accordingly, the power development program was prepared for this case A).

15.2.1 Required development up to the year 2005

New installation of power generation sources is considered only for the latter eleven years starting 1995. Power generation sources committed in the NPC's Power Development Programs were incorporated without changing. Increment of power and energy demand between the year 1995 and 2005 is roughly 2,600 MW and 16,000 GWh, respectively. Adding to this, decrement of power and energy by ritired hydropower and oil-thermal plants, totalling 1,474 MW and 5,980 GWh, must be substituted by new sources. Then total power and energy to be added are in the order 4,000 MW and 22,000 GWh in net basis. As a result of priority ranking study, the projects to be incorporated to the program are 7 hydro of 1,239 MW, 4 coal-thermal of 2,100 MW and 4 geothermal of 1,320 MW, respectively (Ref.: Fig. 15.1).

Commission Year	Name of Project	Type of Project	Power (MW)	Energy (GWh)
Committed				
1991	Bacon Manito	Geo	110	751
1992	Calaca 2	Coal	300	1,832
1993	Pantay	Hydro	23	154
"	Isabela 1-2	Coal	200	1,220
1994	Isabela 3	"	100	612
1995	Casecnan	Hydro	268	1,379
New Installation				
1995	Binongan	Hydro	175	629
"	Coal 1	Coal	300	1,840
1996	Geo 1	Geo	330	2,110
1997	San Roque	Hydro	390	1,083
1998	Geo 2	Geo	330	2,110
1999	Ibulao	Hydro	17	63
"	Coal 2	Coal	600	3,679
2000	Amburayan	Hydro	64	193
2001	Coal 3	Coal	600	3,679
2002	Tanudan	Hydro	25	99
"	Geo 3	Geo	330	2,110
2003	Geo 4	Geo	330	2,110
2004	Agbulu	Hydro	216	687
"	Coal 4	Coal	600	3,679
2005	Diduyon	Hydro	352	882

15.2.2 Fund requirement

For the projects to be installed after the year 1995, fund of 6,189 x 10^6 US$ in total will be required, breakdown of which is as follows:

Plant Type	Nos. of Project	Total Capacity (MW)	Total Cosnt. Cost (10^6 US$)
Hydropower	7	1,239	1,689
Coal-thermal	4	2,100	2,520
Geothermal	4	1,320	1,980
Total:	15	4,659	6,189

It does not include the cost required for the implementation of investigation, feasibility study and detailed

design works which should be advanced prior to the actual construction works.

Annual disbursement schedule of the above fund is made based on the following annual disbursement ratio:

Plant Type	Const. Cost (10^6 US$)	Const. Period (Years)	Disbursement Ratio (%)
Hydropower	< 100	4	20/30/30/20
	≥ 100	5	15/25/30/20/10
Coal-thermal	-	5	5/25/40/20/10
Geothermal	-	5	5/25/40/20/10

As is seen in the following table, the funds required for the 15 new projects are evenly distributed for 15 years from 1991 to 2005.

Annual Disbursement Schemdule

Year	Annual Disbursement (10^6 US$)			
	Hydro	Coal	Geo	Total
1991	40	18	0	58
1992	67	90	25	182
1993	142	144	124	410
1994	156	72	223	451
1995	150	72	223	445
1996	88	180	247	515
1997	65	324	99	488
1998	32	324	74	430
1999	35	360	149	544
2000	86	180	322	588
2001	181	252	297	730
2002	245	288	148	681
2003	221	144	49	414
2004	134	72	0	206
2005	47	0	0	47
Total:	1,689	2,520	1,980	6,189

15.3 Alternative Power Development Program

As alternative power development programs for the proposed one, three cases were studied taking the different power and energy growth rate into consideration as mentioned in preceding

Section 15.2. The procedure taken was just the same as to that of the proposed power development program.

Plant Type	No. of Project	Total Capacity (MW)	Total Const. Cost (10^6 US$)
Alternative 1			
Hydropower	5	563	731
Coal-thermal	4	1,500	1,800
Geothermal	4	1,320	1,980
Total:	13	3,383	4,511
Alternative 2			
Hydropower	2	532	667
Coal-thermal	4	1,500	1,800
Geothermal	4	1,320	1,980
Total:	10	3,352	4,447
Alternative 3			
Hydropower	4	531	701
Coal-thermal	2	900	1,080
Geothermal	4	1,320	1,980
Total:	10	2,751	3,761

15.4 Updating and Post Activities of the Study

15.4.1 Updating of the information

Numerous information and data have been collected and compiled to accomplish a lot of works to be undertaken in the study. They are such as previous study reports, topographical maps, meteo-hydrologic record, cost data, socio-economic data, geological data, data on power generation, and so forth. Data which have been obtained from the work are also to be treated as necessary information for the study. Most of numeric data used for the analyses and calculations have been systematically stored in the computer files in the computer system of VAX11/750 owned by NPC.

All information and data which the study could obtain through NPC are the latest ones as making public ones, however, some of those have seemed not so accurate since it did not present current and actual condition. Some of topographical maps, for instance, were published in 1950s which have no indication of newly constructed public road. Furthermore, some data have not been compiled yet in the agency in charge.

It is required that the effort shall be made to acquire the latest information occasionally and periodically. After then, compiled data in the computer system shall be updated or renewed. This work requires some study process, such as map study or power demand forecast as well as updating works as described in Chapter XVI.

15.4.2 Topographical survey

As clarified in the preceding Chapters, topographic maps of 1:50,000 scale were basically used for the study while the general layout drawings have been prepared on the enlarged map of 1:10,000 scale which was reproduced from the 1:50,000 one. As far as the project area of proposed schemes concerned, the large scaled map, at least 1:500 scale for dam/weir site and 1:1,000 scale for waterway route, will be required to arrange prior to the next study stage.

Availability of existing public road to be used as an access road is to be also investigated as well as the route of power transmission line.

15.4.3 Hydrologic investigation

Several representative runoff gauges have been selected to estimate discharge at each identified site since reliable gauge is not always located near the identified scheme site. In order to confirm flow condition more precisely at the identified sites proposed for future development, new installation of runoff gauge is required at the proposed site as well as improvement of the existing gauges.

Appropriate number of rainfall stations are also necessary in the drainage area of proposed development site.

Judging from study results obtained by the second screening and the priority ranking study, the following drainage areas seem to be of high priority basins to do hydrologic observation providing for a next study stage:

(1) Binongan,

(2) San Roque,

(3) Amburayan,

(4) Abulog river; upstream reaches of Sisiritan dan,

(5) Diduyon,

(6) Tanudan,

(7) Ibulao, and

(8) Matuno.

Among the above drainage areas, there are one runoff gauge at downstream near from Sisiritan (Atok; ID No. 42005NW203) and several rainfall stations in the catchment of the promising identified schemes along Abulog River. One each runoff gauge is found near from San Roque and Matuno dam sites, respectively. For those gauges and stations, it is required to do further observation and confirmation of data reliability.

As for the other areas, both of runoff and rainfall record are not available in and around the catchment concerned. New installation is required for a runoff gauge near from each site as well as several rainfall stations in each catchment.

15.4.4 Geological investigation

The study was made to obtain basic geological information for the promising schemes, however, some of schemes could not be visited because of difficult access to those schemes. The

accuracy of the information, therefore is rather different among those schemes. Some of schemes are comfirmed their geological condition by field investigation, while previous study report or small scaled geological maps were major source of information for remaining schemes. The requirement of geological investigation for proposed schemes is that geological condition is to be judged on the basis of similar investigation level. It is noted that geological study result presented in the previous study reports are quite different in depth, even though they are in the feasibility study, or pre-feasibility study levels.

XVI. COMPUTER PROGRAM AND DATA BANK SYSTEM

16.1 General

The methodology and criteria applied in this Hydropower Potential Study have been discussed in the preceding chapters. The transaction of numerous works acquires the results or outcrops of each work. Furthermore, the systematic preservation and compilation of numerous collected data are required for the future use and reference as well as the preservation of simulated study result. Thus, the data bank system including simulation computer programs have been established in the computer system VAX11-750 owned by NPC.

16.2 Computer Program

The computer programs required for the study are classified into three groups, that is, the group for the first screening, for the second screening, and that for the priority ranking study. The organization of the programs is systematically depicted on Fig. 16.1.

16.2.1 Programs for first screening

The programs for the first screening are classified into three types: the first is the programs to file and to retrieve the collected data such as monthly rainfall, monthly runoff and hydropower site information, the second is the programs of analysis required for the first screening, and the last is the programs to retrieve the information preserved in the Inventory of Hydropower Site. Those programs are enumerated according to the purpose of program as follows:

(1) Filing and retrieval of collected data

- PRJTFILE : Data filing of site information for respective identified schemes of individual development

- GENEFILE : Filing of common data required for power output calculation and preliminary cost estimate
- RAINFILE : Filing of monthly rainfall data
- RNFFFILE : Filing of monthly runoff data
- COSTFILE : Filing of cost data required for the preliminary cost estimate
- DTTRANS : Retrieval of information on identified scheme of individual development and flow duration/storage draft curves
- RAINSTFL : Retrieval of monthly rainfall data
- RNFFSTSL : Retrieval of monthly runoff data
- RAINLIST : Retrieval of rainfall station outline
- RNFFLIST : Retrieval of runoff gauging station outline
- PRJTLIST : Retrieval of site information for identified scheme of individual development
- PRJTSUM : Retrieval of outline of site infotmation.

(2) Analytical program

- MASSCURV : Preparation of flow duration and storage draft curves
- RESEVAL : Alternative calculation for development scale and power output of identified schemes, exclusively used for individual development
- PRECOST : Preliminary cost estimate of schemes, and filing of power output and cost estimate results into the hydropower site inventory, exclusively used for individual development.

(3) Retrieval of information in the inventory

- INVENT1 : Retrieval of detail feature of respective identified schemes from the inventory

- INVENT2 : Retrieval and totalization of inventoried information
- INVENT3 : Retrieval of outline of respective identified schemes from the inventory.

16.2.2 Programs for second screening

The programs for the second screening are classified into three groups according to those objectives to use. The first one is a group for basin development analysis including power output and preliminary cost estimate. The second one is for meteo-hydrologic data filing on flood and storm record, and the third one is for second cost estimate and catalogue retrieval.

(1) Basin development analysis

- BPRJTFIL : Data filing of site information for respective identified schemes for which flow regulation effect of upstream reservoir were expected, this is a similar program to PRJTFILE
- BDTTRANS : Similar program to DTTRANS, exclusively used for the basin development analysis
- BASNPLAN : Re-preparation of storage draft and flow duration curves taking account of flow regulation effect of upstream reservoir, and alternative calculation for development scale and power output, the second part of this program is similar to RESEVAL
- BPRECOST : Preliminary cost estimation exclusively used for the basin development analysis.

(2) Data filing of meteo-hydrologic data

- DISMXAN : Data filing of annual maximum discharge
- RAIN3D : Data filing of annual maximum three-day rainfall

- RAINHR : Data filing of hourly rainfall during selected storms
- EVAPO : Data filing of pan-evaporation.

(3) Second cost estimate and catalogue

- UTPRICE : Filing of unit price data required for second cost estimate
- CONSCOST : Second cost estimate of identified schemes passed to be examined in the second screening, and filing of scheme feature into the hydropower project catalogue
- CATALOG : Retrieval of detailed feature of respective promising identified scheme.

16.2.3 Programs for priority ranking study

The programs for the priority ranking study contain data filing ones for study condition and one for optimization of development sequence.

(1) Data filing of study condition

- DEMDFILE : Filing of forecasted power and energy demand data
- HYDRFILE : Filing of data related to existing hydroelectric plants and committed hydropower projects for implementaion
- THRMFILE : Filing of data related to existing thermal plants and committed thermal power projects for implementation
- SCENARIO : Data filing of optimizing condition such as discount rate, fuel cost, disbursement schedule and so forth
- PLTOLD : Rearrangement of data on existing and committed power plants

- CANDIDAT : Data filing of candidate projects for development including hydropower and geothermal power projects.

(2) Optimization of development sequence

- HIERACH : Analysis on the optimization of development sequence under given condition.

16.3 Data Bank System

Data bank system established for the study contains data files set up in the computer system and several function of programs. The framing of the system and components are represented in Fig. 16.2. Of those, computer programs related are represented in the preceding section.

The data files and programs required for the system consist of the following six components, which have been established in the computer system VAX11-750 installed in NPC exclusively used for the engineering matter.

16.3.1 Meteo-hydrological sub-system

This sub-system has six data files and several computer programs related. Data files set up are:

(1) Monthly rainfall data file for the 177 rainfall stations,

(2) Monthly streamflow data file for the 152 streamflow gauging stations,

(3) Observation data on pan-evaporation,

(4) Annual maximum discharge data,

(5) Annual maximum three-day rainfall data, and

(6) Hourly rainfall data of several selected storms.

The first two data files consist of just input data and processed ones, while the latter four files include input data. The files of input data are able to be displayed on the screen

of computer terminal. The processed data in the files are retrieved by several programs as occasion calls.

16.3.2 Hydropower scheme sub-system

This sub-system has two data files that have been used for the power output calculation, preliminary cost estimate, and for the second cost estimate, respectively as follows:

(1) Data file of input data on identified hydropower scheme extracted from the map study or previous study reports (145 schemes). Those data processed through a filing program are retrieved by the two retrieval programs.

(2) Data file of scheme features which contains 41 promising identified schemes including series development alternatives examined in the second screening. Those data were used for the second cost estimate as input data of program CONSCOST.

16.3.3 Cost information sub-system

Two sets of filing program and data file were designed in accordance with the two steps of construction cost estimate, respectively:

(1) Cost data file for the preliminary cost estimate containing coefficient of formulae, and

(2) Cost data file for the second cost estimate containing the unit prices as well as the coefficient of work quantity formulae.

The filing programs related have a function of data retrieval.

16.3.4 Existing and committed plants sub-system

The priority ranking study to optimize a development sequence requires several data regarding load forecasting, existing and committed power plants, candidate projects for

construction and calculation condition. Those data have been compiled in respective data file, each of which has a data filing program. The sub-system contains:

(1) Data file of existing hydroelectric plants as well as committed ones for implementation,

(2) Data file of existing and committed thermal plants,

(3) Data file of forecasted power and energy demands up to the year 2005,

(4) Data file of calculation condition such as discount rate, base year, study horizon, construction period, disbursement schedule, and

(5) Data file of candidate projects for ranking study which includes hydropower and geo-thermal projects.

16.3.5 Hydropower site inventory

For the identified 145 schemes, the information of each scheme derived from map study has been preserved in the inventory data files named INVTDT and INVTID. The information includes the results of power output calculation and preliminary cost estimate, such as development scale, power and energy output, construction cost and so forth, made by the computer programs RESEVAL and PRECOST, respectively. Output of basin development analysis is preserved in the inventory files as required.

The inventory contains the following information, of which detail is described in Section 11.2:

(1) Scheme identification information,

(2) Hydrological and topographical information,

(3) Scheme development scale information,

(4) Power and energy information,

(5) Preliminary cost information, and

(6) Technical and reference informations.

Several computer programs to retrieve the inventoried information have been prepared as listed in (3) of Paragraph 16.2.1. The output from the hydropower site inventory by running the program INVENT1 is obtained as compiled in APPENDIX C besides an outline output obtained by INVENT3 as shown in Table 11.1.

The computer program INVENT2 has several optional functions besides the retrieval of the inventory. Those are to calculate hydropower potential by region, by basin, by cost/kWh index class, and to arrange all identified schemes in least cost (US$/kWh) order and order of installed capacity of the maximum development scale.

16.3.6 Promising hydropower project catalogue

For the 41 promising identified schemes including series development alternatives which proceeded to the second screening, the information of each scheme obtained through basic layout drawing and second cost estimate have been preserved in the catalogue data files, CTLGID and CTLGDT.

Information for the catalogue files have been stored or will be renewed by processing of the computer program for the second cost estimate, CONSCOST. The content of Catalogue is retrieved by the program CATALOG, as compiled in APPENDIX C.

16.4 Updating System

The data bank system established in the study will be maintained by a division of NPC in charge. The most important task of maintenance is to make updating of data given to the study. In each component of the data bank system, basic information data and data to be given to the analytical computer programs require periodical and/or timely renewal and modification.

The Inventory and Catalogue will be updated with data modification and processing of some programs as required. Updating system to be adopted is recommended hereinafter.

16.4.1 Data to be updated

Most of data applied in the study have been preserved in data files as source data image. Data renewal and modification will be made by addition and/or replacement of data in computer files directly on the display of computer terminal. Data and name of data files related are summarized in Table 16.1 as well as a name of program concerned.

16.4.2 Programs to be used for updating

Among the programs related to data updating, some of those have a function of data renewal in addition to data filing. In case that a program is used for filing of huge amount of data, such as monthly rainfall, monthly runoff and identified scheme data, the program is designed to enable data addition and/or modification without a processing of other data not to be modified.

16.4.3 Updating flow

To have an updated result of analysis or calculation, and to update information registered in the Inventory or Catalogue, several programs are required to run in a series following a processing flow shown in Fig. 16.3. Updating of runoff data at the selected gauge, for instance, requires a series processing of several programs: MASSCURV, DTTRANS, RESEVAL, PRECOST, in order to keep the latest Inventory.

REFERENCES

No.	Title of Report	Issued by:	Issued on:
1.	Long Term Philippine Development Plan up to the year 2000	GOP	Sept 1977
2.	Updated Philippine Development Plan 1984-1987	NEDA	Sept 1984
3.	Philippine Development Report 1981	NEDA	1982
4.	The 1982 Development Cooperation for the Philippines	UNDP	Sept 1983
5.	Statistical Yearbook 1983	NEDA	June 1983
6.	Statistical Yearbook 1984	NEDA	Aug 1984
7.	Statistical Yearbook 1985	NEDA	Aug 1985
8.	Statistical Yearbook 1986	NEDA	Aug 1986
9.	Philippine Energy Sector Survey	ADB	Feb 1982
10.	Power Development Program (1985-1995)	NPC	May 1985
11.	The Philippine Energy Development Program 1982-1987	MOE	Apr 1982
12.	1984 Annual Report	NPC	1985
13.	1985 Annual Report	NPC	1986
14.	Summary of the Five-year Philippine Development Plan 1778-1982 mdd. Ten-year Development Program 1978-1987	GOP	Sept 1977
15.	Survey/Inventory on Water Impounding Reservoirs	NWRC	Apr 1978
16.	Power Inventory 1977	NWRC	Jan 1978
17.	Philippines Water Data 1970	NWRC	1970
18.	Philippines Water Resources Survey Data	NWRC	Jan 1980
19.	Power System Luzon Generation Expansion Study	NPC	Dec 1977
20.	Luzon Power Planning Study, Development Potential II of Luzon Hydropower Resources	NPC	Aug 1983

No.	Title of Report	Issued by:	Issued on:
21.	Preliminary Feasibility Report on the Leyte Power Transmission Project	NPC	Apr 1980
22.	Preliminary Survey Report on Water Resources Development of Cagayan River Basin	GOJ	Feb 1983
23.	Cagayan Valley, Five-year Development Plan 1978-1982	GOJ	Sept 1977
24.	Preliminary Survey Report on Water Resources Development of Agno River Basin and Pangasinan Plain	GOJ	Sept 1984
25.	Reconnaissance Report on the Camiling Reservoir Project	ADCA	Aug 1982
26.	Feasibility Study on Diduyon Hydroelectric Development Project	JICA	Mar 1979
27.	Feasibility Study on the Matuno River Development Project	JICA	Feb 1984
28.	Lower Agno Development Plan Multipurpose Project	ELC	July 1976
29.	San Roque Multipurpose Project	JICA	Sept 1985
30.	Magat River Project, Feasibility Report	NIA	June 1973
31.	Feasibility Study on Casecnan Transbasin Diversion Project	NIA	Jan 1983
32.	Water Resources Optimization Study on Balog-Balog Project	NIA	-
33.	Abra River Basin in House Training I Hydroelectric Development, Pre-Feasibility Report	NPC	Aug 1982
34.	Project Report on Mini Hydro Power Development Project in Bicol Region	NEA	Oct 1980
35.	Bicol River Basin Flood Control and Irrigation Development Projects	NCIAD	May 1983
36.	Irrigation Development Plan for Central Luzon	NIA	July 1977

No.	Title of Report	Issued by:	Issued on:
37.	Feasibility Report on Binongan Hydroelectric Project	NPC	Apr 1985
38.	Framework Plan for Each Basin (16 vol.)	NWRC	1981-1983
39.	River Dredging Project II National Flood Control Plan and River Dredging Program	MPWH	Nov 1982
40.	Study of the EHVN-1 Project relative to other Transmission	JICA	-
41.	Development Potential of Luzon Hydropower Resources	IECO	Aug 1973
42.	Assessment of the Magnitude and Frequency of Flood Flows, Water Resources Series No. 30	ECAFE	-
43.	Spillway Design Flood for Potential Dam & Reservoir Sites in Central Luzon Basin	BPW	July 1964
44.	Philippine Yearbook 1985	NCSO, NEDA	1985
45.	1985 Foreign Trade Statistics of Philippines	NCSO, NEDA	1986
46.	Population Dimension Planning I, II, & III 1970-2000	NCSO, NEDA	1975
47.	Labor Force Projections by Age and Sex for the Philippines by Region and Provice 1970-2000	NCSO, NEDA	1977
48.	Updated Philippine Development Plan	NEDA	1986
49.	Philippine Development Report 1984	NEDA	1985
50.	The Philippine energy Development Program 1982-1987	NEDA	1982
51.	Energy Balance Forecasts in Developing Countreis, The Case of the Philippines	AIE	1982
52.	Long-term Trands in Economic Economic Development Development and International Economic Co-operation	UN	1982

No.	Title of Report	Issued by:	Issued on:
53.	International Development Strategy for the Third United Nations Development Decade	UN	1981
54.	World Development Report 1985	IBRD	1985
55.	World Development Report	IBRD	1986
56.	Price Prospects for Major Primary Commodities and its Half-Yearly Revisions and Quarterly Reviews	IBRD	1982-1986
57.	The Outlook for Primary Commodities, 1984 to 1995	IBRD	1984
58.	The Outlook for Thermal Coal	IBRD	1985
59.	Electricity Pricing, Theory and Case Studies	IBRD	1979
60.	Costing and Pricing, Electricity in Developing Countries	ADB	1984
61.	Key Indicators of Developing Member Countries	ADB	1986
62.	Country Report, EIU No. 3-1986 Philippines	EIU	1986
63.	International Financial Statistics	IMF	Aug 1986

TABLES

Table 3.1 NAMED POWER PROJECT SITES (1/9)

River Basin		D.A.	Site		River	C.A.	Study Category			Previous Study
Nos.	River	(km²)		NWRC Code #		(km²)	3	4	5	
WATER RESOURCES REGION I (ILOCOS)										
A05	Cavacanan	146	Cavacanan	4	Cavacanan	11.49			x	
031	Bulu	231	Bulu	1	Bulu	165			x	
032	Banban	134	Dadaur	12	Banban	39.62			x	
			Aload-Ao	20	Unnamed Cr.	22.19			x	
A07			Namilidan	13	Diriqui Cr.	13.46			x	
033	Vintar	772	Vintar	11	Unnamed Cr.	55.80			x	
			Vintar	19	Vintar	139			x	
			Tamdagan	26	Tamdagan	248			x	
034	Laoag	1,319	Cura (Solsona # 1)	27	Cura	67			x	F/S
			Tina (Solsona # 2)	28	Labugoan	93.5		x		F/S
			Gasgas (Solsona # 3)	29	Solsona	71.4		x		F/S
			Dingras	30	Madongan	154		x		
			Sto. Nino	61	Papa	51		x		
			Nueva Era	62	Banga	52		x		F/S
035	Quiaoit	188	Maypalig	60	Quiaoit	14		x		
A12	Tibangran		Nagrebcan	63	Tibangran	72		x		
A15	Cabugao		Sulbec	104	Cabugao	14			x	
036	Abra	5,125	Banoang	109	Abra	4,742.1			x	
			Omagit	152	Malapaao	42			x	
			Langiden	167	"	93.45			x	
			Bangued	164	"	60.51			x	
			Bandi	166	Saquet-soot	117.94			x	
			Abut	165	Unnamed R.	9.67			x	

Study Category: 3 - Committed
4 - Scaled
5 - Unscaled

Table 3.1 NAMED POWER PROJECT SITES (2/9)

River Basin Nos.	River	D.A. (km²)	Site NWRC Code #		River	C.A. (km²)	Study Category 3	4	5	Previous Study
			Alip	168	Palsiguan	172			x	
			Palsiguan	66	Palsiguan	153		x		F/S
			Tineg # 3	172	Tineg	992			x	Pre F/S
			Tineg # 2	171	Tineg	506.00			x	Pre F/S
			Tineg # 1	169	Tineg	203			x	Pre F/S
			Naglibacan	174	Anayan	130.00			x	Pre F/S
			Binongan # 2 (Alaoa)	170	Binongan	377 + 366		x		F/S
			Abualan	173	Unnamed Cr.	77.06			x	
			Paganao	146	Malanas	200.38			x	
036	Abra		Malanas Licuan	147	Kawayan	117.08			x	Pre F/S
			Binongan # 1 (Kapualan)	149	Kawayan	321.39			x	Pre F/S
			Taping	148	Lingas	68.23			x	Pre F/S
			Subusog	145	Abas	46.09			x	
			Taping	144	Baay	147.41			x	
			Mabungtat	137	Manikbel	40.51			x	
			Caliaban	138	Manikbel	66.28			x	Pre F/S
			Daguiaman	143	Bucloc	97.76			x	
			Bucloc	140	Sulden Cr.	147.39		x		
			Upper Maguyepyep	139	Bucloc	216.79			x	Pre F/S
			Danac	142	Ikmin	117.78			x	
			Toqueng	141	Ikmin	185.40			x	Pre F/S
			Boyan	136	Ikmin	256.52			x	Pre F/S
			Amluagan	116	Damanit	148.71			x	Pre F/S
			Gayaman	119	Tiagan	48.56		x		
			Supo	71	Abra # 2	1,235		x		Pre F/S

Study Category: 3 - Committed
4 - Scaled
5 - Unscaled

Table 3.1 NAMED POWER PROJECT SITES (3/9)

River Basin		D.A.	Site		River	C.A.	Study Category			Previous Study
Nos.	River	(km²)		NWRC Code #		(km²)	3	4	5	
			Eteb	70	Abra # 3	864		x		Pre F/s
			Naina	120	Utip	258.09			x	Pre F/S
			Matibuay	121	Maputic	21.35			x	
			Kumanga	122	Ditong	99.39			x	
			Namitpit	82	Namitpit	74.49			x	
			Suysuyan	83	Balasian	164.43			x	Pre F/S
			Bucnit	77	Abra	563			x	Pre F/S
			Upper Bucnit	76	Abra # 1	525		x		Pre F/S
			Dayapan	90	Malaya	214.83			x	Pre F/S
039	Sta. Maria	294	Agagrao	99	Agagrao	75			x	
			Banucal	67	Lancuas	55			x	
			Suagayan	80	Dagman	27.94			x	
			Bugui	68	Sta. Maria	34			x	
A23	Candon		San Vicente	69	Candon	15			x	
040	Buaya	169	Buaya	74	Buaya	110			x	
A26	Padaoil		Padaoil	75	Padaoil	25			x	
A28	Chico		Labong	86	Chico # 1	24			x	Pre F/S
A28	Chico		Uso	87	Chico # 2	150.74			x	
041	Amburayan	1,386	Tibunec	88	Baklin	244 w/ Dayapan			x	Pre F/S
			Luya	92	Amburayan	610			x	Pre F/S
			Duplas	175	Duplas	30.39			x	
A32			Bungol	177	Malagayap	22.44			x	
042	Baroro	191	Bumbuneg	182	Baroro	14.21			x	
			Drissoor	184	Cabasitan	31.26			x	
043	Bauang	353	Bagulin	186	Naguilian	319.08			x	
			Sacyud	187	Unnamed Cr.	13.90			x	
			Burgos	188	Ribusan # 1	9.04			x	

Study Category: 3 - Committed
4 - Scaled
5 - Unscaled

Table 3.1 NAMED POWER PROJECT SITES (4/9)

River Basin		D.A.	Site		River	C.A.	Study Category			Previous Study
Nos.	River	(km²)		NWRC Code #		(km²)	3	4	5	
044	Aringay	469	Rizal	185	Galiano	126.37			x	
WATER RESOURCES REGION - II (CAGAYAN)										
029	Pamplona	706	Luna	16	Ziuanan	257			x	
			Zimiqui	40	Zimiqui	317.85			x	
028	Abulug	3,362	Sisiritan	1	Abulug	1,951		x		Pre F/S
			Bubulayan	2	Abulug	1,679		x		
			Gened	3	Abulug	1,661		x		F/S
			Bulu	4	Abulug	1,609		x		
			Nababalayan	5	Apayao	1,050		x		Pre F/S
			Dibagat	6	Apayao	832		x		
			Agbulu	7	Apayao	769		x		Pre F/S
			Aoan	8	Apayao	147		x		Pre F/S
			Sta. Filomena	42	Nagabaran	65.74			x	
B07			Adawen	43	Luga	24.91			x	
047	Palawig	101	Sta. Ana	41	Palawig	100.03			x	
051	Palanan-Pinacanaoan	806	Palanan	61	Pinacanaoan	365			x	
001	Cagayan	25,558								
(002)	Zinundungan	(405)	Zinundungan	32	Zinundungan	152		x		
(003)	Dummon	(456)	Capisayan	31	Dummon	195.2		x		
(004)	Chico	(7,230)								
(005)	Matalag	(719)	Matalag	33	Matalag	642.9		x		
(006)	Saltan	(794)	Pinukpuk	9	Saltan # 1	817.4		x		
			Adaga	10	Saltan # 2	353.8		x		
			Saltan # 4	11	Saltan # 4	204.4		x		
			Saltan # 5	12	Saltan # 5	145.8		x		

Study Category: 3 - Committed
4 - Scaled
5 - Unscaled

Table 3.1 NAMED POWER PROJECT SITES (5/9)

River Basin		D.A.	Site		River	C.A.	Study Category			Previous Study
Nos.	River	(km²)		NWRC Code #		(km²)	3	4	5	
(007)	Tanudan	(388)	Mt. Bolantot	17	Pasil	250			x	
			Naneng	13	Tanudan	385		x		Pre F/S
	Chico		Basao	19	Chico # 3	920		x		Pre F/S
			Tomiangan	20	Chico # 4	1,408	x			F/S
			Bontoc	21	Chico # 1	371		x		
			Sadanga	22	Chico # 2	720		x		Pre F/S
(008)	Paret	(1,031)	Bantay	34	Paret	735		x		Pre F/S
(009)	Pinacanaoan de Tuguegarao	(658)	Dabba	35	Pinacanaoan de Tuguegarao	452		x		Pre F/S
			Dalaya	45	"	210.73		x		
(010)	Pinacanaoan	(328)	San Pablo	46	Pinacanaoan	209.8		x		
(012)	Tumauini	(190)	Tumauini # 1	47	Tumauini	165		x		Pre F/S
(013)	Siffu-Malig	(2,400)	Banatao	18	Mallig # 2	345.1			x	
			Tabuk	24	Mallig # 1	563		x		Pre F/S
			Natonin	26	Siffu # 1	414		x		
			Pastor	27	Siffu # 2	359		x		Pre F/S
(014)	Ilagan	(8,085)								
(015)	Abuan	(616)	Ballasang	53	Abuan	493		x		Pre F/S
(016)	Disabungan	(677)	Catalangan	49	Catalangan	286.1	x			
			Mariano	50	Disabungan	180.6		x		
			Divisoria	54	Calumangan	77.99			x	
			Disusuan	62	Disabungan	220.78			x	
	Ilagan		Maliano	48	Pinacanaoan de Ilagan	1,226.1		x		Pre F/S
(017)	Magat	(7,820)								
(019)	Alimit	(600)	Alimit # 1	28	Alimit	513		x		
			Alimit # 2	29	Alimit	426		x		

Study Category: 3 - Committed
4 - Scaled
5 - Unscaled

Table 3.1 NAMED POWER PROJECT SITES (6/9)

River Basin		D.A.	Site		River	C.A.	Study Category			Previous Study
Nos.	River	(km²)		NWRC Code #		(km²)	3	4	5	
(020)	Ibulao	(353)	Huoab	30	Ibulao	526.4		x		
(022)	Matsuno	(738)	Barat	73	Matsuno	583		x		F/S
			Sta. Cruz	74	Sta. Cruz	269		x		
(025)	Addalam	(1,014)	Pinaripad	65	Addalam	849.1		x		
			Maddela	67	Diduyon	485		x		F/S
(026)	Dibaluan	(366)	Maddela	63	Dibaluan	192.8		x		
	Cagayan		Maddela	64	Cagayan # 1	2,316.8		x		
			Cabingatan	70	Conwap	1,473		x		Pre F/S
			Dakgan	69	Casecnan	820		x		
			Gadeng	71	Casecnan	565		x		F/S
			Kagipsipan	75	Casecnan	609.9		x		
			Maddela	66	Tabayong	128.1		x		
			Maddela	51	Dabubu	138.5		x		
WATER RESOURCES REGION - III (CENTRAL LUZON)										
075	Patalan	347	Labayug	30	Arodagat	11.60			x	
074	Dagupan	897	Kalipkip	27	Toboy	74		x		Pre F/S
			Lubas	28	Toboy	89		x		Pre F/S
			San Manuel	29	Arbored	75.5			x	
070	Agno	5,952	Bayaoas	33	Bayaoas	63		x		
			Pila	34	Pila	156.47		x		
(071)	Camiling	(764)	Camiling # 2	79	Camiling	228.7		x		Pre F/S
			Camiling # 1	89	Camiling	250.7		x		
(072)	O.D. Moriones	(830)	Balog-Balog	81	Bulsa	282		x		F/S
	Agno		Tebbo	62	Agno	1,070		x		Pre F/S
			Tayum	63	Agno	1,148		x		Pre F/S
			San Roque	26	Agno	1,250		x		F/S

Study Category: 3 - Committed
4 - Scaled
5 - Unscaled

Table 3.1 NAMED POWER PROJECT SITES (7/9)

River Basin		D.A.	Site		River	C.A.	Study Category			Previous Study
Nos.	River	(km²)		NWRC Code #		(km²)	3	4	5	
			San Nicolas	32	Ambayaoan	324.5			x	
			Sapinit	31	Ambayaoan	280			x	
			Sta. Rosa	95	Ambayaoan	256.4		x		Pre F/S
068	Balincaguin	406	Somangan	16	Bani	8.05			x	
			Cabanaetan	21	Remon Iloco	6.50			x	
067	Nayam	213	Mt. Mangradian	22	San Felipe	41.22			x	
			Mt. Maliang	23	Bayambang	13.0			x	
C31			Agopop	78	Masinloc	67.43			x	Pre F/S
064	Bucao	734	Bucao	64	Bucao	34.0		x		
			Villa Botolan	74	Marunot	30.14			x	Pre F/S
			Villa Botolan	75	Naguisguis	30.16			x	Pre F/S
			Botolan	73	Moraga	22.50			x	Pre F/S
C35			Cabangan	77	Tonguey	34.24			x	Pre F/S
063	Sto. Tomas	263	Marella	65	Marella	75		x		
			Mapanuepe	66	Mapanuepe	32		x		
			Sta. Fe	76	Sto. Tomas	17.96			x	
C42			Tabung	110	Matain	-				
C43			Olongapo	109	Sta. Rita	-				
C59			Subic	111	Canlaman	-				
C60	Gumain		Gumain	91	Gumain	103		x		
059	Pampanga	9,759	Dolores	88	Bamban	35		x		
			Dolores	93	Sapang Cauayan	20.45		x		
			Carlang	11	Gonlong	25.8		x		
			Mt. Biscal	15	Bulu	45		x		
			Madlum	16	Madlum	76		x		
			Biac Na Bato	113	Biac Na Bato	-			x	
			Catanapacan Hill	114	Unnamed	-			x	

Study Category: 3 - Committed
4 - Scaled
5 - Unscaled

Table 3.1 NAMED POWER PROJECT SITES (8/9)

River Basin		D.A.	Site		River	C.A.	Study Category			Previous Study
Nos.	River	(km²)		NWRC Code #		(km²)	3	4	5	
(056)	Penaranda	(512)	Balintingon	38	Sumacbao	236.9		x		Pre F/S
			Papaya # 2	48	Penaranda * 1	143.9		x		
			Papaya # 1	49	Chico	124		x		
			Cabu	46	Talictic	71		x		
(057)	Coronel	(740)	Marinat	50	Marinat	44		x		
			Lubingan	41	Lubingan	134		x		Pre F/S
			Ligaya	45	Coronel	477		x		
			Kalaanan	51	Digmala	89		x		
	Talavera		Puncan Mt.	54	Talavera	-		x		Pre F/S
053	Aguang	647	Diayo	94	Diayo	-		x		
			Malupa	103	Malupa	202			x	
			Baler	104	Cabatangan # 1	45			x	Pre F/S
			Baler	105	Cabatangan # 2	79			x	Pre F/S
			Baler	106	Cabatangan # 3	195			x	Pre F/S
054	Umiray	553	Umiray	107	Umiray	352		x		Pre F/S
WATER RESOURCES REGION -IV (SOUTHERN TAGALOG)										
077	Marikina	600	Wawa	3	Marikina	280		x		Pre F/S
			Montalban # 1	79	Mango	18.35			x	
			Montalban # 2	80	Puray		33.01		x	
087	Kapimpong	406	Rosario	75	Malaking Ilog	234.67			x	Pre F/S
091	Iyam	269	Pagbilao	13	Gumacaa	-				Pre F/S
044			Gen. Luna	76	Hingoso	30.47			x	
098	Ginhalinan	149	Picsaan	18	Ginhalinan	54.75			x	
103	Lugan	91	Mauban	76	Balay Balay	65			x	
108	Agos	672	Lower Agos	12	Agos	873		x		F/S
			Daraitan	15	Kaliwa	340		x		Pre F/S
			Kanan	16	Kanan	357		x		Pre F/S
			Mt. Bangbang	7	Lenatin	70			x	

Study Category: 3 - Committed
4 - Scaled
5 - Unscaled

Table 3.1 NAMED POWER PROJECT SITES (9/9)

River Basin Nos.	River Basin River	D.A. (km²)	Site	NWRC Code #	River	C.A. (km²)	Study Category 3	4	5	Previous Study
WATER RESOURCES REGION - V (BICOL)										
110	Labo	913	Labo	12	Labo	62.58			x	
114	Bicol	3,771	Pulantuna	5	Pulantuna	288		x		
			Culaling	6	Culaling	101		x		
			Telisay	1	Albay	146		x		
E31			Salvacion	11	Manapot	35.98			x	
117	Lagonoy	228	Cagaygay	7	Cagaygay	93.34		x		
118	Quinale	103	Quinale	2	Quinale	50.58		x		
E64			Sn. Francisco	31	Bayugin	7.00			x	
			Buyugin	34	Bulusan	6.18			x	
122	Cadacan	197	Patag	24	Cadacan	15			x	
			Tiris	30	Tiris	2.08			x	
			Patag	32	Matacla	11.59			x	
			Irosin	33	Malungoy Lungoy	8.85			x	

Study Category: 3 - Committed
4 - Scaled
5 - Unscaled

Table 3.2 LIST OF AVAILABLE GEOLOGICAL MAPS (1/5)

Series No.	Map Name, Number, Issued	Scale	Year	Remark
	Geological Map of the Philippines (PLATE - I)	1:2,500,000	1982	Attachment of Geology and Mineral Resources of the Philippines Vol. 1
	Geological Map of the Philippines, NE-51 & ND 51, Bureau of Mines, Philippines	1:1,000,000	1962	Color copy
	Geology and Mineral Resources Map Series, Bureau of Mines and Geo-Sciences, Manila	1:250,000	1	Monochromatic with explanation
	Kalinga and Apayao (RI 73)		1974	
	Nueva Vizcaya (RI 74)		1974	
	Pangasinan (RI 75)		1974	
	Sorsogon (RI 76)		1974	
	Benguet (RI 77)		1974	
	Isabela (RI 79)		1974	
	Nueva Ecija (RI 80)		1976	
	La Union (RI 82)		1976	
	Laguna (RI 84)		1976	
	Abra (RI 85)		1976	
	Caranan, Peninsula, Camarines Sur (RI 86)		1977	
	Bataan (RI 90)		1977	
	Camarines Norte and part of Quezon Province (RI 94)		1979	
	Zambales (RI 95)		1979	
	Pampanga (RI 99)		1980	
	Rizal (RI 104)		1981	
	Camarines Sur (RI 105)		1981	
	Ilocos Sur (RI 107)		1981	
	Geologic Map of Luzon Central Cordillera Based from Landsat Imagery Interpretation and Geologic Survey (RI 114), Breau of Mines and Geo-Sciences.	1:250,000	1983	Monochromatic with explanation

Table 3.2 LIST OF AVAILABLE GEOLOGICAL MAPS (2/5)

Series No.	Map Name, Number, Issued	Scale	Year	Remark
	Geological Map of Quadrangle Series, Philippine Breau of Mines and Geo-Sciences	1:50,000	1982	Color original
	Sta. Juliana (3065 I) Botolan (3065 IV) Prensa (3066 III) Benguet Mines (3066 IV) San Fernando (3069 I) Batac (3175 III) Umiray (3264 I) Marikina (3264 III) Norzagaray (3264 IV) Umpacan (3265 III) Pasaking (3271 II) Natonin (3271 III) Roxas (3371 III) Mallig (3371 IV) Bayabas (3262 III) Jose Panganiban (3562 IV)			
	Photogeological map of Ilocos Norte Complete from partial aerial photo-interpretation.	1:50,000	1962	Monochromatic with explanation
	Geologic interpretation of multi-level remote sensing data of Ilocos Norte. BMG November 1979			
	Seismotectonic map of the Philippines : Southeast Asia Association of Seismology and Earthquake Engineering	1:3,000,000		Color original

Table 3.2 LIST OF AVAILABLE GEOLOGICAL MAPS (3/5)

Series No.	Map Name, Number, Issued	Scale	Year	Remark
	Geological Map Series of Geological Survey of Northeastern Luzon Philippines, MMAJ & JICA		1977	Monochromatic
	Geological Map (PL.D)	1:250,000		
	Geological Map (PL.I-7-1)	1:100,000		
	Geological Map (PL.I-7-2)	1:100,000		
	Geological Map & Geological Profile of Baguio Area (PL. I-5-1)	1:100,000		
	Geological Map of Geological Survey of Northeastern Luzon Philippines, MMAJ & JICA		1981	Monochromatic
	Geological Map and Geological Profile (PL.1)	1:250,000		
	Regional Geological Map, Cagayan River Flood Control Basin-Wide Study, Ministry of Public Works, Philtech	1:600,000	1981	Color Map
	Geological Maps of Abra River Project, National Power Corporation, Shawinigan		1982	Color Map
	Regional Geology Map	1:500,000		
	Tineg-Binongan-Malanas System	1:143,000		
	Abra Trans Basin Scheme Northern End	1:143,000		
	Upper Abra/Upper Agno/Amburayan Sub Basins Southern End	1:143,000		

Table 3.2 LIST OF AVAILABLE GEOLOGICAL MAPS (4/5)

Series No.	Map Name, Number, Issued	Scale	Year	Remark
	General Geological Map of Technical Pre-Feasibility Study of the Hydroelectric Development in the Chico River, National Power Corporation, Lahmeyer International	1:250,000	1973	Color Map
	Regional Geological Map of Agos River Hydropower Project, National Power Corporation, JICA	1:115,000	1980	Monochromatic
	Geological Map of Gened Dam Site and Reservoir Area, National Power Corporation, Newjec	1:60,000	1979	Monochromatic
	Geologic Map of Diduyon Hydroelectric Project Upper Cagayan River, National Power Corporation, JICA	1:100,000	1980	Color Map
	Geologic Map of Matuno River Development Project, National Power Corporation, NIA, JICA	1:50,000	1984	Color
	Damsite Geology, Construction Materials & Access Roads Map Series, Cagayan River Flood Control Basin-Wide Study, Ministry of Public Works, Philtech	1:50,000	1981	Monochromatic
	Abuan No. 1, Abuan No. 2, Addalam , Alimit No. 1, Alimit No. 2, Babaca , Cagayan, Catalangan, Chico-Mallig, Dibuluan, Diduyon, Dummon, Ilagan No. 1, Ilagan No. 3, Mallig No. 1, Mallig No. 2, Marang, Matuno No. 2,			

Table 3.2 LIST OF AVAILABLE GEOLOGICAL MAPS (5/5)

Series No.	Map Name, Number, Issued	Scale	Year	Remark
	Nabuangan, Natutud, Paranan, Paret, Pasil, Pinacanauan, Saltan, Siffu No. 1, Siffu No. 2, Sta. Cruz No. 1, Tanudan, Tao-Tao No. 1, Tao-Tao No. 2, Tumauini			
	Project Area Geologic Map of Ilagan River No. 2 Multipurpose Project Feasibility Study, Cagayan River Flood Control Basin-Wide Study, Ministry of Public Works, Philtech	1:121,000	1981	Color
	Project Area Geologic Map of Tuguegarao River Multi-purpose Project Feasibility Study, Cagayan River Flood Control Basin-Wide Study, Ministry of Public Works, Philtech	1:118,000	1981	Color
	Balog-Balog Multipurpose Project Feasibility Study, NIA, Electro-consult		1980	Color
	Gelogic Map of Central East Tarlac Region	1:250,000		
	Geologic Map of Reservoir Area	1:40,000		
	Geologic Map of the Tineg/Binongan Drainage Basins, Binongan Hydro-electric Project Feasi-bility Study, National Power Corporation	1:150,000		Monochromatic

Table 3.3 LIST OF AVAILABLE AERIAL PHOTOGRAPHS

No.	Project Name	Year	Photo Scale
1	NPC Agos Kaliwa & Kanan River, Quezon Province	(1966)	

Map Sheet No.	Photo No.	Map Sheet No.	Photo No.	Map Sheet No.	Photo No.
FL-18	232-235	FL-22	183-189	FL-26	083-087
FL-19	154-162	FL-23	112-119	FL-27	080-082
FL-20	011-020	FL-24	187-193		
FL-21	113-122	FL-25	181-186		

2	NPC Abulog	(1979)	

Map Sheet No.	Photo No.	Map Sheet No.	Photo No.	Map Sheet No.	Photo No.
FL-1	592-595	FL-6	642-651	FL-10	113-118
FL-2	599-607	FL-7	177-188	FL-11	088-094
FL-3		FL-8	194-202	FL-12	728-733
FL-4	250-273	FL-8A	155-164	FL-13	716-721
FL-5	230-240	FL-9	124-138	FL-14	690-697

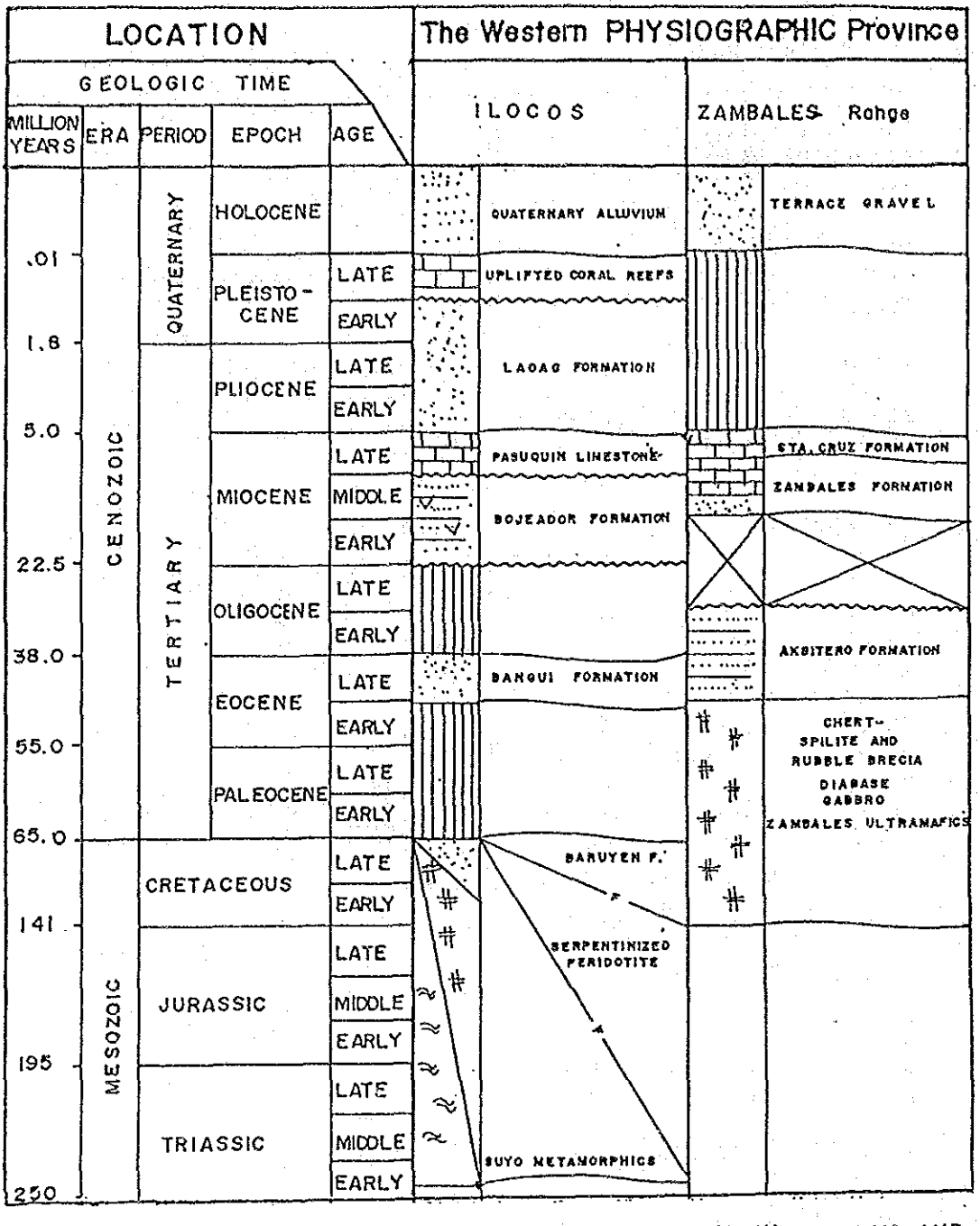
3	Abra River Hydro Electrical Project	(1980)	1:20,000

Map Sheet No.	Photo No.	Map Sheet No.	Photo No.
FL-1	9542-9551	FL-2	9559-9570

4	NIA Casecnan Project		1:8,000

Map Sheet No.	Photo No.	Map Sheet No.	Photo No.	Map Sheet No.	Photo No.
FL-1	9708-9712	FL-6	1476-1491	FL-9	735-737
FL-2	9716-9719	FL-7	1431-1435	FL-10	804-806
FL-3	1377-1381		1439-1448		883-889
FL-4	1400-1408, 1415-1419	FL-8	744-746, 751-767	FL-12	874-876
FL-5	1455-1469	FL-9	713-729		

Table 3.4 SUMMARY of STRATIGRAPHY in LUZON ISLAND (1/3)

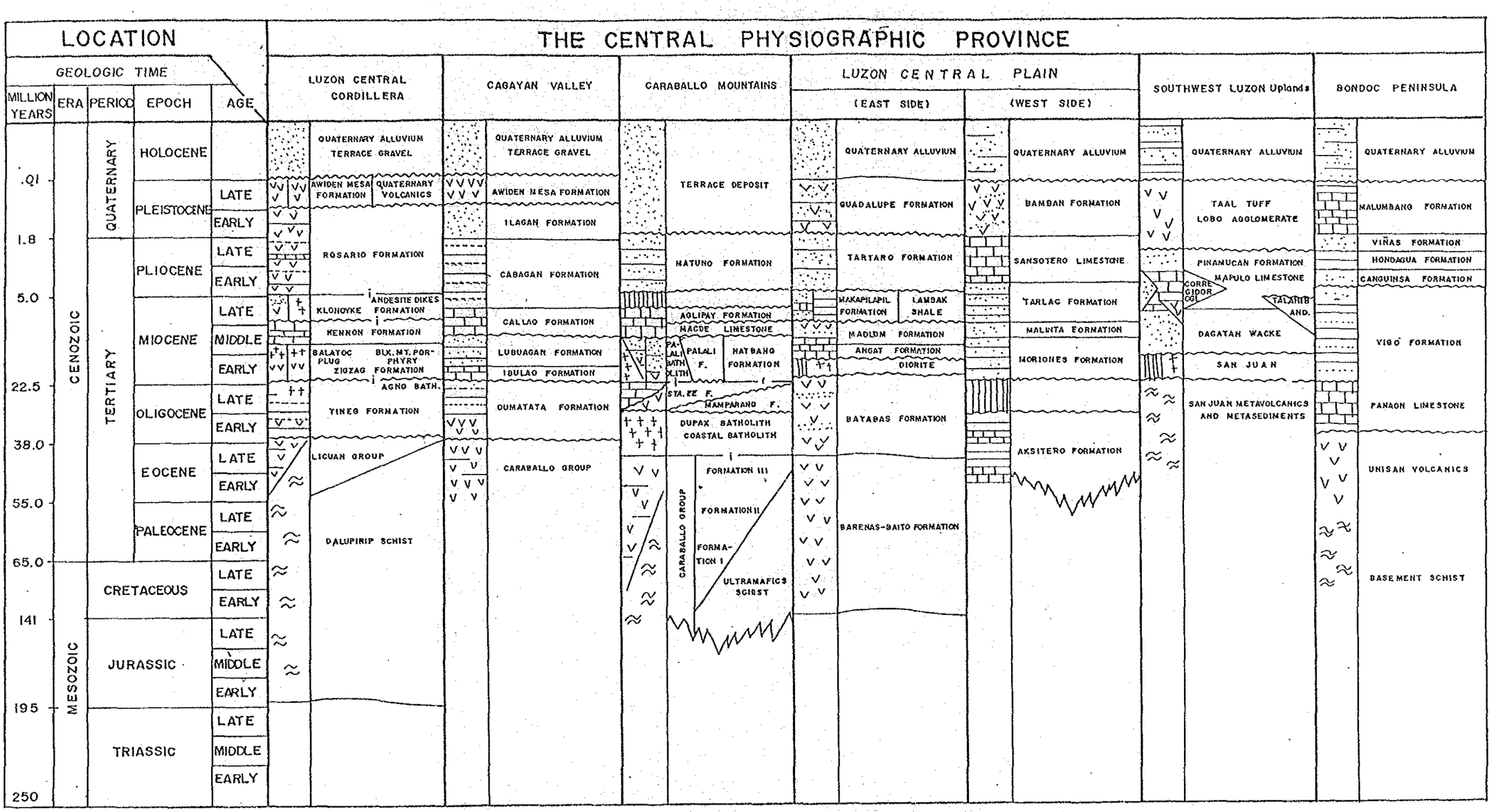


Modified from: Bureau of Mines (1981) GEOLOGY AND MINERAL RESOURCES OF THE PHILIPPINES

LEGEND

- Sandy and gravely facies Sedimentary rock
- Clay and silty facies Sedimentary rock
- Limestone
- Volcanic rock
- Intrusive rock
- Basic to ultra basic rock
- Metamorphic rock
- Lack of the formation
- Unknown

Table 3.4 SUMMARY of STRATIGRAPHY in LUZON ISLAND (2/3)

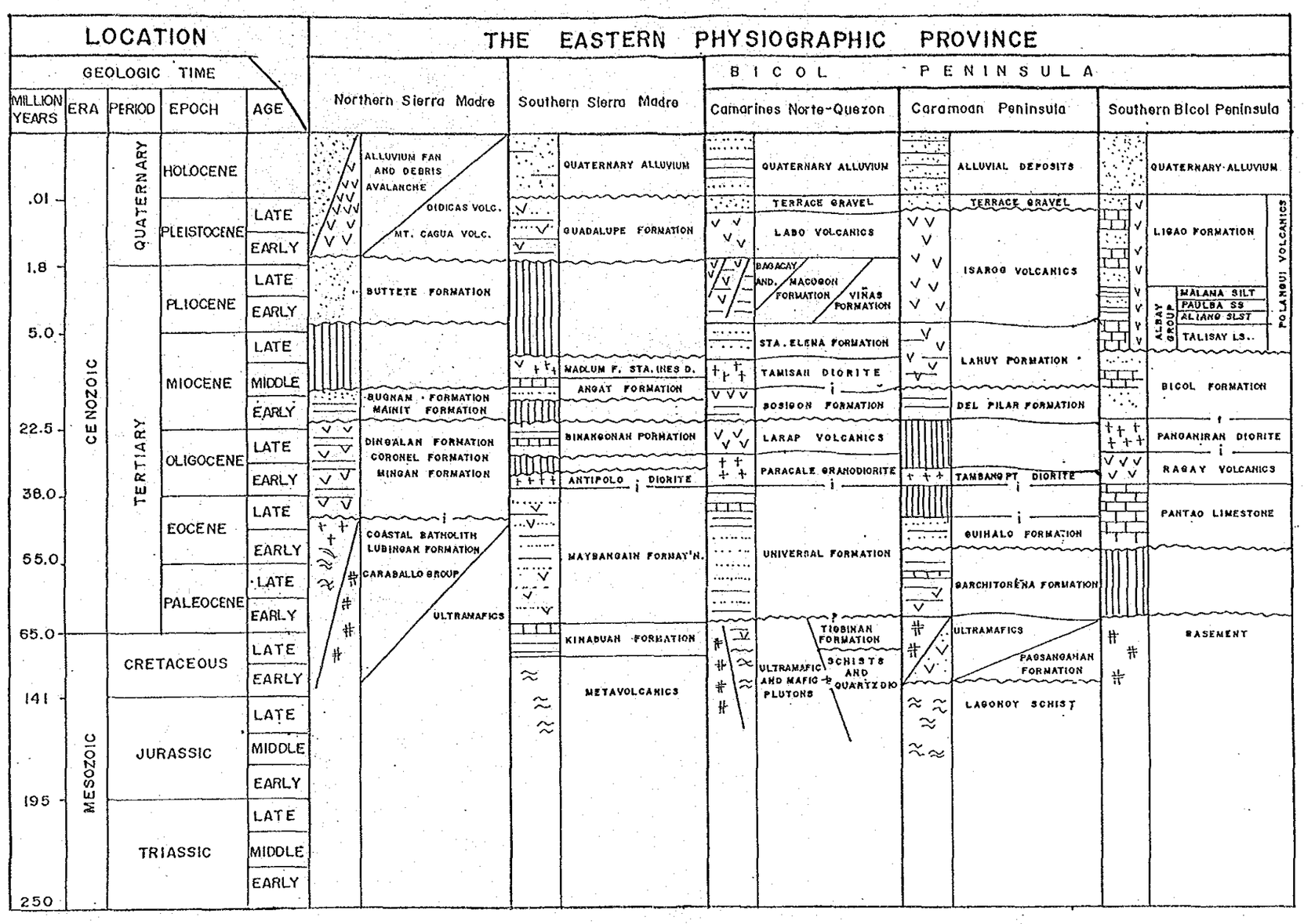


Modified from: Bureau of Mines (1981) GEOLOGY AND MINERAL RESOURCES OF THE PHILIPPINES

LEGEND

- Sandy and gravely facies Sedimentary rock
- Clay and silty facies Sedimentary rock
- Limestone
- Volcanic rock
- Intrusive rock
- Basic to ultra basic rock
- Metamorphic rock
- Lack of the formation
- Unknown

Table 3.4 SUMMARY of STRATIGRAPHY in LUZON ISLAND (3/3)



Modified from: Bureau of Mines (1981) GEOLOGY AND MINERAL RESOURCES OF THE PHILIPPINES

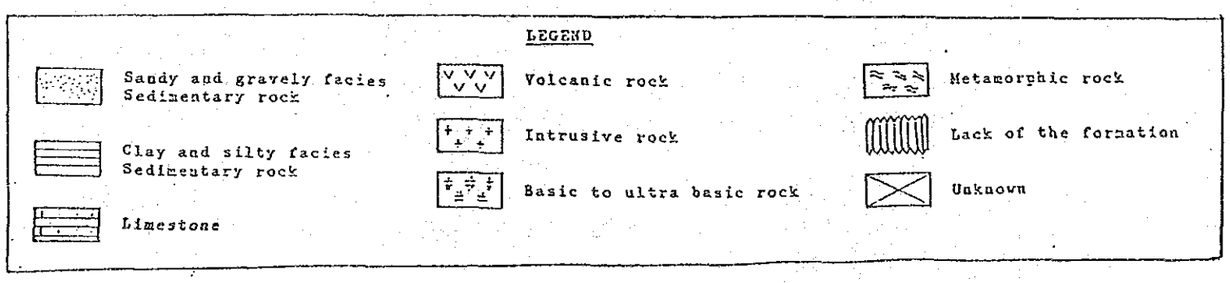


Table 3.5 LIST OF AVAILABLE EARTHQUAKE DATA FILE

No.	Project File Title Issued	Number of Data	Period of Data	M:Magnitude
1	Catalogue of Philippine Earthquakes 1589-1899, Bulletin of the Seismological Society of America Vol. 36, No.5 July 1940	1784 + α	1589-1899 (1599-1860) (1860-1899)	 (M ≧ 5.5) (M > 4)
2	NOAA Earthquake Magnet Tape Data File Boundaries Top Left 23°00N 115°00E Bottom Right 3°00N 130°00E		1807-1978	M > 4
3	NAPOCOR (NPC) Earthquake Data File	4543	1980-1983	M > 4
4	Catalogue of Philippine Earthquakes, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)		1915-1982	M ≧ 3
5	Series on Seismology Volume IV Philippines Southeast Asia Association of Seismology and Earthquake Engineering			
	Part A Catalogue of Philippine Earthquakes		1589-1864	1/
	Part B Catalogue of Philippine Earthquakes		1865-1899	1/
	Part C Catalogue of Philippine Earthquakes		1901-1942	2/
	Part D Catalogue of Philippine Earthquakes		1948-1983	2/
	Part E Catalogue of Destructive Earthquakes in the Philippines		1589-1983	1/

Remarks : 1/ : The same as mentioned No.1
2/ : The same as mentioned No.4, from 1915 to 1982

Table 3.6 LIST OF HISTRICAL EARTHQUAKES (1/2)

SOURCE	DATE	LATITUDE N°	LONGITUDE E°	FOCAL DEPTH(KM)	MAGNITUDES
CFR	May 13, 1897	12.00	124.00	-	(7.90) 1/
CFR	Jun 15, 1897	18.00	120.00	-	(7.90)
CFR	Sep 20, 1897	6.00	122.00	-	(8.60)
CFR	Sep 21, 1897	6.00	122.00	-	(8.70)
CFR	Oct 18, 1897	12.00	126.00	-	(8.10)
CFR	Oct 20, 1897	12.00	126.00	-	(7.90)
CFR	Dec 14, 1901	14.00	122.00	25A	(7.80)
CFR	Dec 28, 1903	7.00	127.00	25A	(7.80)
G-R	Mar 29, 1907	3.00	122.00	500	(7.25)
G-R	Apr 25, 1909	4.00	127.00	100	(7.00)
G-R	Jul 12, 1911	9.00	126.00	-	(7.75)
G-R	Mar 14, 1913	4.50	126.50	25A	(8.30)
G-R	Feb 7, 1918	6.50	126.50	120	(7.50)
G-R	Aug 15, 1918	5.50	123.00	25A	(8.3)
G-R	Aug 15, 1918	5.50	126.00	-	(7.00)
G-R	Jan 1, 1919	8.00	126.00	-	(7.40)
G-R	Dec 20, 1919	22.00	122.00	-	(7.00)
LEE	Dec 21, 1919	22.00	122.00	-	(7.00)
G-R	Nov 11, 1921	8.00	127.00	-	(7.50)
G-R	Mar 2, 1923	6.50	124.00	-	(7.20)
G-R	Mar 16, 1923	6.00	127.00	-	(7.00)
G-R	Apr 14, 1924	6.50	126.00	-	(8.30)
G-R	Aug 30, 1924	8.50	126.50	-	(7.30)
G-R	Apr 16, 1925	22.00	121.00	-	(7.10)
G-R	Apr 17, 1925	22.10	120.70	-	(7.00)
G-R	Nov 13, 1925	13.00	125.00	-	(7.30)
G-R	Nov 16, 1927	6.50	126.00	-	(7.00)
G-R	Jun 15, 1928	12.50	121.50	-	(7.00)
G-R	Dec 19, 1928	7.00	124.00	-	(7.30)
G-R	Jan 4, 1929	6.50	124.50	380	(7.00)
G-R	Jan 13, 1929	8.50	127.00	-	(7.20)
LEE	Sep 4, 1935	22.00	121.30	-	(7.30)
G-R	Jan 20, 1936	6.00	127.00	80	(7.10)
G-R	Aug 22, 1936	22.25	120.75	-	(7.20)
G-R	Aug 22, 1936	22.30	120.80	-	(7.30)
G-R	Aug 20, 1937	14.50	121.50	-	(7.50)
G-R	Dec 8, 1937	22.90	121.20	-	(7.00)
G-R	Dec 8, 1937	22.90	121.50	-	(7.00)
G-R	May 23, 1938	18.00	119.50	80	(7.00)
G-R	Dec 6, 1938	22.75	120.75	-	(7.00)
LEE	Dec 7, 1938	22.90	120.50	-	(7.00)
G-R	Oct 7, 1940	5.00	126.00	100	(7.00)
G-R	Dec 16, 1941	21.50	120.50	-	(7.10)
G-R	Apr 8, 1942	13.50	121.00	25A	(7.80)
LEE	Nov 24, 1943	22.50	122.00	-	(7.00)
G-R	Nov 15, 1964	4.50	127.50	-	(7.20)
G-R	May 3, 1948	18.50	119.00	-	(7.20)

Table 3.6 LIST OF HISTORICAL EARTHQUAKES (2/2)

SOURCE	DATE	LATITUDE N°	LONGITUDE E°	FOCAL DEPTH(KM)	MAGNITUDES
G-R	May 3, 1948	18.80	119.00	-	(7.30)
G-R	Sep 2, 1948	10.00	125.50	-	(7.00)
G-R	May 27, 1949	3.50	127.50	-	(7.00)
G-R	Apr 30,1949	6.50	125.00	-	(7.40)
G-R	Dec 29, 1949	18.00	121.00	-	(7.20)
G-R	Nov 24, 1951	23.00	122.50	-	(7.25)
G-R	Mar 22, 1952	9.50	126.70	-	(7.90)
CGS	Mar 31, 1955	8.10	123.2	96	(7.30)
JMA	Feb 23, 1957	23.00	122.00	-	(7.13)
CGS	Sep 24, 1957	5.50	127.50	-	(7.60)
CGS	Aug 1, 1968	16.52	122.50	37	5.9 (7.3)
CGS	Jan 30, 1969	4.80	127.43	70G	5.9 (7.2)
CGS	Mar 27, 1969	4.77	127.51	32	6.1 (7.0)
CGS	Jan 10, 1970	6.82	126.73	73	6.1 (7.3)
CGS	Apr 7, 1970	15.76	121.71	37	6.4 (7.5)
CGS	Apr 12, 1970	15.06	122.52	24	5.9 (7.0)
ERL	Jan 25, 1972	22.45	122.26	33N	6.3 (7.5)
ERL	Apr 25, 1972	13.37	120.52	50	6.2 (7.3)
ERL	Jun 11, 1972	3.94	124.31	325G	5.8 (7.5)
ERL	Dec 2, 1972	6.47	126.00	33N	6.3 (7.4)
ERL	Mar 17, 1973	13.37	122.78	33N	5.6 (7.5)
GS	Jul 10, 1975	6.50	126.64	86	6.2 (7.0)
GS	Oct 31, 1975	12.54	125.99	50G	6.4 (7.6)
GS	Aug 16, 1976	6.26	124.02	33N	6.4 (7.9)
GS	Mar 18, 1977	16.77	122.32	37	6.2 (7.0)
GS	Jul 23, 1978	22.28	121.51	17	6.5 (7.4)
GS	Jul 24, 1978	22.13	121.43	18D	5.0 (8.0)

From: NOAA Earthquake Magnet Tape Data File (1655-1978)

Remarks:

Source: Data Source

CFR : Charles F. Richter
G-R : Gutenberg-Richter
LEE : Unknown
CGS : Coast and Geodetic Survey
JMA : Japan Meteorological Agency
ERL : Environmental Research Laboratories
GS : U. S. Geological Survey

Depth: A, G, D, or N following value designates depth control factor.

Magnitudes : Body wave values as determined by PDE (Preliminary Determination of Epicenters) programs.

1/ : Authority for other magnitudes and local magnitudes.

Table 3.7 Epicentral Parametres of Destructive Earthquake 1589 - 1983 *

	Date	Time (LST)	Location Lat ° N	Location Long ° E	Magnitude Ms	I ₀ (MMI)
1.	1599 June 21	10:00 a.m.	14.60	121.00		VIII
2.	1619 Nov 30	noon	18.17	121.60		X
3.	1743 Jan 12	5-6:00 p.m.	14:00	121.60		X
4.	1787 July 13	6:45 a.m.	10.70	122.55		X
5.	1796 Nov 05	2:00 p.m	16.05	120.30		X
6.	1852 Sept 16	6:30 p.m.	13.95	120.40		IX
7.	1863 June 03	7:20 p.m.	14.63	121.40		X
8.	1869 Aug 16	3:00 p.m.	12.17	123.69		IX
9.	1869 Oct 01	11:15 a.m.	14.82	120.82		IX
10.	1873 Nov 14	5:30 p.m.	13.11	122.98		VIII
11.	1880 July 18	12:40 p.m.	16.00	121.85		X
12.	1885 July 23	10:45 a.m.	8.43	123.60		X
13.	1889 May 26	2:23 a.m.	13.59	121.19		VIII
14.	1892 Mar 16	9:01 p.m.	16.06	120.42		IX
15.	1893 June 21	3:30 p.m.	6.88	125.83		X
16.	1897 Sept 21	1:15 p.m.	7.11	122.11	8.7 *	IX
17.	1897 Oct 19	7:52 p.m.	12.40	125.00	8.1 *	IX
18.	1902 Aug 21	7:17 p.m.	8.10	124.25		X
19.	1907 Nov 24	9:59 p.m.	13.30	123.40		X
20.	1911 July 12	12:09 p.m.	9.00	126.00	7.7 *	X
21.	1913 Mar 14	4:47 p.m.	4.50	126.50	7.9 (PAS)	IX
22.	1917 Jan 31	12:02 p.m.	5.60	124.80		IX
23.	1918 Aug 15	8:20 p.m.	5.50	123.00	8.3 *	X
24.	1924 Apr 15	12:22 a.m.	6.50	126.50	8.3 *	IX
25.	1924 Aug 30	11:07 a.m.	8 1/2	126 1/2	7.3 (PAS)	IX
26.	1925 Nov 13	8:16 a.m.	13.00	125.00	7.3 (PAS)	VIII
27.	1929 June 13	5:26 p.m.	8 1/2	127.00	7.2 (PAS)	X
28.	1931 Mar 19	2:26 p.m.	18.30	120.20	6.9 (PAS)	VIII
29.	1937 Aug 20	7:59 p.m.	14.20	122.10	7.5 *	VIII
30.	1948 Jan 25	1:46 a.m.	10.90	122.10	8.3 *	IX
31.	1954 July 02	10:46 a.m.	13.00	124.00	6 3/4(PAS)	IX
32.	1955 Apr 01	2:17 a.m.	8.00	124.00	7.5 (PAS)	X
33.	1968 Aug 02	4:19 a.m.	16.50	122.30	7.3 *	IX
34.	1970 Apr 07	1:34 p.m.	15.80	121.70	7.3 (NEIS)	IX
35.	1973 Mar 17	4:31 p.m.	13.41	122.87	7.0 (NEIS)	XI
36.	1976 Aug 17	12:11 a.m.	7.30	123.60	7.9 (NEIS)	X
37.	1977 Mar 19	5:43 a.m.	16.70	122.31	7.0 (NEIS)	VIII
38.	1981 Nov 22	11:06 p.m.	18.71	120.65	6.7 (NEIS)	VIII
39.	1982 Jan 11	2:11 p.m.	14.00	124.50	7.1 (NEIS)	VIII
40.	1983 Aug 17	8:18 p.m.	18.33	120.87	6.5 (NEIS)	VIII

Source : Lomnitz,C. (1974), "Global Tectonics and Earthquake Lisk" P 231

Remarks : * : After SEASEE,Catalogue of Destructive Earthquakes in the Philippines 1589-1983 by Lolita C. Garcia, Rolando G. Valenzuela Nancy T. Lance

PAS : Pasadena
NEIS : National Earthquake Information Service

Table 3.8 SOCIO-ECONOMIC INDICES (1/4)

BASIC DATA (as of August 1986)

Area	Population	Density
300,000 sq km	54.67 million (1985 estimates)	182 persons/sq km
Cropped land per capita (ha): 0.22 (1983)	Annual Growth Rate: 2.5% (1985)	

GNP per Capita (US$)	660 (1984)
Social /Development Indicators	
Life expectancy at birth (years)	63 (1984)
Infant mortality (per 1,000 live births)	58 (1984)
Calories intake per day per capita (Cal)	2,430 (1983)
Protein intake per day per capita (Gram)	55 (1983)
Persons per physician	6,667 (1984)
Gross Primary school enrollment (%)	106 (1981-1983)
Adult literacy rate (%)	83 (1980)
Energy consumption per capita (kg coal equivalent)	313 (1983)

Income distribution

% of Households	% of Income (1970)	% of Income (1983)
Highest 10%	39	40
Highest 20%	53	58
Lowest 20%	6	3
Lowest 10%	2	1

	1982	1983	1984	1985
Labor Force (10^3)	19,980	20,521	20,277	19,986
Employed	19,100	19,671	19,046	18,825
Agriculture, forestry & fishery	9,933	10,250	9,569	9,293
Mining & manufacturing			1,925	2,044
Others	9,167	9,421	7,552	7,488
Unemployed and/or underemployed	880	850	1,231	1,161
Unemployment/underemployment rate (%)	4.4	4.1	6.1	6.8
Gross Domestic Product (GDP) (10^9 Pesos)				
GDP (current market prices)	340.6	384.7	539.4	610.1
GDP (constant 1972 market prices)	99.0	99.9	94.2	90.5
Growth rate (%)	2.9	0.9	-5.7	-4.0

Table 3.8 SOCIO-ECONOMIC INDICES (2/4)

	1982	1983	1984	1985
GDP (at constant 1972 market prices) by industry (%)				
Agriculture, forestry & fishery	25.7	24.8	27.0	28.7
Mining & manufacturing	26.8	27.1	26.6	25.9
Construction	8.2	7.7	6.3	4.7
Electricity & water	1.1	1.2	1.3	1.4
Transport & communications	5.3	5.3	5.3	5.5
Trade	13.2	13.9	15.0	15.6
Others	19.8	19.9	18.6	18.3
GDP (at constant market prices) growth rate by industry (%)				
Agriculture, forestry and fishery	3.3	-2.4	2.4	2.4
Mining and manufacturing	1.1	2.3	-7.4	-6.8
Others	3.7	1.9	-9.0	-5.9
GDP (at constant 1972 market prices) by expenditure (%)				
private consumption	64.1	65.4	70.1	73.1
Government consumption	9.2	8.7	8.1	9.1
Gross fixed capital formation	23.9	23.0	17.5	14.0
Increase in stocks	2.6	1.9	-0.7	-0.1
Exports of goods and services	17.7	19.3	22.1	21.4
Less imports of goods & services	19.7	21.7	19.3	15.5
Statistical discrepancy	2.1	3.4	1.5	-2.0
Resource Gap (at current market prices) (%)				
Gross Domestic saving/GDP	22.6	22.5	18.4	13.4
Gross domestic investment/GDP	28.3	26.7	18.7	15.8
Savings-investment gap	-5.8	-4.2	-0.3	-2.4
Price Indexes				
Wholesale (Metro Manila, 1978 = 100)	179.0	208.0	346.5	409.4
Annual change (%)	12.4	16.2	66.6	18.2
Consumer (Metro Manila, 1978 = 100)	176.2	195.3	291.5	351.9
Annual change (%)	11.0	10.8	49.3	20.7
Money and Credit				
Commercial banks				
Time & savings deposits	81,943	97,842	120,023	128,945
Domestic credits outstanding	130,309	159,002	158,477	142,547
Money supply (M1)	23,495	32,490	33,629	35,826
Annual change (%)	-0.1	38.3	3.5	6.5

Table 3.8 SOCIO-ECONOMIC INDICES (3/4)

	1982	1983	1984	1985
Central Government Finance (10^6 US$)				
Current revenue	38,205	45,632	56,861	68,961
Current expenditure	31,746	34,522	42,873	55,275
Current surplus/deficit (-)	6,459	11,110	13,988	13,686
Capital receipts	-	-	-	-
Capital expenditure	18,646	16,148	13,730	12,139
Capital account surplus/ deficit (-)	-18,646	-16,148	-13,730	-12,139
Net lending	2,218	2,393	10,086	12,734
Overall surplus/deficit (-)	-14,405	-7,431	-9,828	-11,187
Financing				
Domestic borrowings, net	6,602	6,591	15,220	13,298
Foreign borrowing, net	4,597	5,437	1,890	-340
Foreign grants	-	-	-	-
Use of cash balances	3,206	-4,597	-7,282	-1,771
Local Govt. revenues/Central Govt. revenues (%)	16.9	15.3	13.3	..
Local Govt. expenditure/ Central Govt. expenditure (%)	11.1	12.6	13.9	..
Balance of Payments (10^6 US$)				
Exports (fob)	5,021	5,005	5,391	4,629
Imports (fob)	-7,667	-7,487	-6,070	-5,111
Trade balance	-2,646	-2,482	-679	-482
Services (net)	-1,040	-740	-823	26
Transfer (net)	486	472	386	379
Current balance	-3,200	-2,750	-1,116	-77
Capital flow	1,673	886	1,044	1,047
Direct investment	16	105	20	-14
Portfolio investment	1	7	-3	5
Other long-term capital	1,548	1,392	478	2,787
Other short-term capital	108	-618	549	-1,731
Net errors & omissions	-371	-387	161	638
Monetization of gold	277	183	169	221
Allocation of SDRs	-	-	-	560
Overall Balance	-1,621	-2,068	258	2,389
Monetary movements	1,621	2,068	-258	-2,389

Table 3.8 SOCIO-ECONOMIC INDICES (4/4)

	1982	1983	1984	1985
Leading Export Commodities (%)				
Coconut oil	8.0	0.3	10.8	7.5
Copper concentrates	6.2	5.0	2.1	1.8
Logs and lumber	4.0	4.5	3.6	2.8
Centrifugal and refined sugar	8.3	6.0	5.7	3.7
Copra	1.0	0.1	0.0	..
Lending Import Commodities (%)				
Petroleum and petroleum products	27.0	28.2	25.7	26.4
Machinery other than electric	12.9	12.1	6.9	7.1
Transport equipment	3.8	4.0	3.8	1.3
Base metals	7.2	6.4	4.1	3.5
Electric machinery	5.0	5.4	6.9	5.5
Terms of Trade (1982 = 100) (period average)	59	61	60	56
Exchange Rate (Pesos/US$) (end of period)	9.171	14.002	19.760	19.032
International Reserves (10^6 US$)				
Total (end of year)	1,711	864	890	1,116
Gold, national valuation	823	117	288	501
Foreign exchange	885	746	574	550
Reserve position in the fund	-	-	9	26
SDRs	3	1	39	6
other bank's assets	..	..	..	..
Ratio to merchandise imports (months)	2.7	1.4	1.8	2.6
External Debt (10^6 US$)				
Publicly guaranteed, outstanding Including undisbursed (end of period)	13,855.2	14,922.7	15,726.8	..
Disbursed only (end of period)	8,851.7	10,400.5	11,175.7	..
Private non-guaranteed, outstanding disbursed only (end of period)	3,156.4	3,125.0	2,959.0	..
Disbursements (total for period)	2,432.4	2,545.3	1,333.9	
Principal repayments (total for period)	989.1	901.9	528.4	..
Interest payments (total for period)	925.0	936.1	912.0	..
Debt service ratio (%)	23.9	22.6	17.9	..

Table 4.1 MONTHLY MEAN AIR TEMPERATURE

(Unit: °C)

Station Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
Ambulong	25.5	26.1	27.3	28.5	28.7	27.8	27.1	27.0	26.8	26.5	26.4	25.6	26.9
Aparri	23.2	23.8	25.3	27.1	28.1	28.5	28.1	27.9	27.5	26.5	25.2	23.9	26.3
Aurora	25.4	25.7	26.3	27.3	27.9	27.8	27.3	27.3	27.1	26.8	26.5	25.7	26.8
Baquio	16.9	17.4	18.3	18.9	19.2	18.9	18.4	18.0	18.2	18.3	18.1	17.5	18.2
Baler	24.5	24.7	25.6	26.9	27.9	28.2	28.0	28.1	27.7	27.0	26.1	25.2	26.7
Basco	22.3	22.7	23.9	25.1	27.6	28.3	28.3	27.9	27.5	26.3	24.8	23.1	25.7
Cabanatuan	25.9	26.6	27.8	29.3	29.8	28.7	28.1	27.6	27.7	27.6	26.7	26.0	27.7
Casiguran	23.7	24.0	24.9	26.4	27.2	27.6	27.4	27.2	27.0	26.5	25.5	24.3	26.0
Daet	25.1	25.2	25.9	26.9	27.7	27.9	27.4	27.4	27.1	26.6	26.3	25.5	26.6
Dagupan	25.8	25.4	27.7	29.0	29.0	28.2	27.4	27.3	27.4	27.5	26.8	26.1	27.4
Iba	25.4	25.7	26.8	28.1	28.4	27.7	27.0	26.7	26.8	27.0	26.6	25.9	26.8
Infanta	24.6	25.0	25.9	27.1	27.9	28.4	28.0	28.0	27.6	26.9	26.3	25.3	26.8
Laoag	24.7	25.3	26.9	28.3	28.6	27.9	27.3	27.0	27.2	26.9	26.2	25.2	26.8
Legaspi	25.7	25.9	26.7	27.7	28.2	28.1	27.4	27.4	27.3	27.1	26.7	26.2	27.0
Lucena	25.3	25.8	26.7	28.0	28.7	28.3	27.8	27.7	27.6	27.0	26.5	25.5	27.1
Manila CO	25.0	25.5	26.8	28.3	28.6	27.9	27.1	27.0	26.9	26.7	25.9	25.2	26.7
Tuguegarao	23.4	24.4	26.4	28.2	29.0	28.9	28.2	27.9	27.5	26.4	25.1	24.0	26.6
Vigan	25.4	25.7	27.0	28.3	28.7	28.0	27.3	26.9	27.1	27.3	26.7	26.0	27.0
Virac	25.9	25.9	26.4	27.2	27.8	28.1	27.8	28.1	27.8	27.3	26.9	26.4	27.1
Manila MMO	25.4	26.1	27.2	28.9	29.4	28.5	27.7	27.3	27.4	27.1	26.2	25.5	27.2
Mean	24.9	25.3	26.4	27.7	28.4	28.1	27.6	27.5	27.3	26.9	26.2	25.3	26.4

Table 4.2 MONTHLY MEAN RELATIVE HUMIDI

(Unit: %)

Station Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
Ambulong	78	75	71	71	75	81	84	84	86	84	81	81	79
Aparri	83	82	81	78	79	79	79	81	83	84	84	85	81
Aurora	82	81	78	76	74	74	77	77	77	77	79	81	78
Baquio	80	80	80	83	87	89	91	93	92	88	83	80	85
Baler	83	83	84	84	83	82	81	80	82	83	84	83	83
Basco	80	80	80	82	83	83	85	84	81	80	81	81	82
Cabanatuan	72	70	65	66	70	80	83	85	86	81	79	74	76
Casiguran	89	87	87	86	86	86	86	87	88	89	87	90	87
Daet	84	83	82	82	82	82	79	83	85	86	85	85	83
Dagupan	75	74	72	72	75	80	84	85	85	81	78	77	78
Iba	78	77	75	75	77	83	86	87	87	83	81	79	81
Infanta	81	78	76	73	78	81	83	83	84	84	84	83	81
Laoag	72	71	69	71	75	81	85	85	85	78	76	74	77
Legaspi	83	82	81	80	81	82	83	83	85	84	84	84	83
Lucena	84	84	80	79	78	81	81	82	83	84	83	84	82
Manila CO	77	73	70	69	74	80	83	84	84	83	81	80	78
Tuguegarao	81	77	74	70	70	75	78	79	81	83	85	85	78
Vigan	72	74	74	74	76	81	84	86	85	79	75	73	78
Virac	80	81	79	79	79	79	81	79	82	83	82	82	80
Manila MMO	78	73	68	66	70	79	82	85	86	84	82	81	78
Mean	80	78	76	76	78	81	83	80	84	83	82	81	80

Table 4.3 PAN EVAPORATION RATE

Location	Approximate Elevation (m)	Pan Evaporation (mm/day)
Existing Plant/ Named Project Sites		
Ambuklao	896	4.0
Binga	586	5.6
Angat	200	4.5
Caliraya	266	3.5
San Roque	97	5.1
Pantabangan	125	4.5
Binongan	275	5.1
Agos	-	5.2
Diduyon	542	4.0
Matuno	382	5.2
Casecnan	235	5.5
Palsiguan	195	6.3
Meteorological Stations		
Tuguegarao	62	4.1
Alimanao	30	5.9
Isu, Echague	66	4.1
Baligatan	200	5.5
Baretbet	230	4.8
Wacal	225	4.9
Cohsuelo	600	4.5
Malasin	110	5.1
San Isidro	100	5.0
Bontoc	855	3.5
Lagawe	400	4.9
Tabuk	170	5.0
Sto. Domingo	320	5.6
MSAC, Baguio City	1,500	3.1
HOA, Luisita	30	4.6
CLSU, Munoz	60	5.4
BPI, Cuyambay	172	3.6
Central Hydromet	43	4.2
NAS, UPLB	20	4.4
CSAC, Pili	25	5.0
Parapoto	20	3.6
Naga City	80	4.7
Ambulong	5	3.9
Talictic	200	4.9
Vintar	60	5.8
Laoag	5	5.1

Table 4.4 DENUDATION RATE

River System	Stream	D.A. (km²)	Denudation Rate (mm/year)
Existing Damsites			
Magat	Cagayan	Magat	4,150	1.6
Ambuklao	Agno	Agno	690	2.2
Binga	Agno	Agno	936	6.5
Pantabangan	Pampanga	Pampanga	853	1.5
Angat	Pampanga	Angat	568	4.5
Caliraya	Caliraya	Caliraya	91.5	0.8
Named Project Sites			
Tina	Laoag	Labugaon	98.5	0.01
Gasgas	Laoag	Solsona	71.4	0.01
Cura	Laoag	Cura	63.1	0.01
Palsiguan	Ilocos	Palsiguan	153	1.5
Binongan	Abra	Binongan	377	2.0
Chico IV	Cagayan	Chico	1,410	2.0
Matuno	Cagayan	Matuno	593	0.6
Casecnan	Cagayan	Casecnan	1,150	1.8
San Roque	Agno	Agno	1,250	6.5
Balog-Balog	Bulsa	Bulsa	283	2.6
Agus	Agus	Agus	867	0.6

Table 4.5 STREAMFLOW KEY STATIONS

HR	ID No.	Station Name	River System	Location		D.A. (sq. km.)	Areal Rainfall (mm/Year)
				Lat.	Long.		
A	42005NW203	Atok	Abulog	18-12-15	121-21-30	2,066	4,084
B	41003NW102	Bangay	Laoag	18-05	120-42	534	2,513
	41008NW106	Bumagcat	Abra	17-37-40	120-42-40	2,575	2,619
C	42020NW225	Larion	Cagayan	17-37-30	121-46-15	655	2,216
	42044NW244	Pangal	Cagayan	16-36-12	121-40-25	4,244	2,432
	42055NW	Bato	Cagayan	16-25-54	121-07-00	1,784	2,505
	42063NP	Basao	Cagayan	17-14-18	121-07-21	874	3,355
D	41017NW114	Mamat-ing	Bauang	16-35-16	120-25-00	304	3,270
	43017NW325	Guisguis	Nayom	15-48-31	119-58-48	128	2,750
E	43009NW326	Baluarte	Carranglan	15-58-00	121-03-14	258	2,250
	43052NW361	Sta. Ines	Pampanga	15-09-15	121-04-12	204	2,458
	43093NP	Ambuklao H.E. Plant	Agno	16-28-42	120-44-45	690	2,923
F	44001NW3118	Diamman	Cabatangan	15-44-09	121-24-48	242	2,534
	44021NW418	Magdalena	Laguna	14-12-24	121-26-33	116	3,094
G	44025NW417	Calumpang	Laguna Lake	14-11-55	121-26-30	103	2,505
H	44003NW430	Banugao	Agus	14-45-15	121-36-45	879	4,670
	45001NW501	Matogdon	Labo	14-08-53	122-50-18	28	4,268
I	45039NW529	Bibongsuran	Bicol	13-14-00	123-31-30	164	2,585
J	-						

Remark : HR - Hydrological Region

Table 4.6 DESIGN FLOOD CURVES FOR SPILLWAY AND DIVERSION WORKS

Zone	Major River Basins	Design Flood Curve	
		Spillway	Diversion Works
1	Laoag R. Abra R. Sta. Maria R. Buaya R. Amburayan R. Naguilian R. Aringay R.	$qs=160.3\ A^{-0.399}$	$qd=70.0\ A^{-0.425}$
2	Abulog R. Gattu R. Banurbur R. Cagayan R. Baua R. Cabatangan R. Disabit R.	$qs=371.7\ A^{-0.539}$	$qd=85.0\ A^{-0.572}$
3	Balincaguin R. Bucao R. Sto. Tomas R. Caulaman R. Colo R. Pilar R.	$qs=658.0\ A^{-0.640}$	$qd=9.8\ A^{-0.176}$
4	Agno R. Tagamusing R. Sinocalan R.	$qs=310.9\ A^{-0.503}$	$qd=65.5\ A^{-0.563}$
5	Pampanga R. Sta. Maria R. Guagua R.	$qs=1,537.0\ A^{-0.815}$	$qd=71.7\ A^{-0.539}$
6	Laguna Lake Marikina R. Agos R. Maapon R. Ilang-Ilang R. Panaysayan R. Balsahan R. Maragundan R. Lagnas R. Sariaya R.	$qs=147.6\ A^{-0.387}$	$qd=22.8\ A^{-0.280}$
7	Bicol R. Matogdon R. Talisay R. Lagonoy R. San Francisco R. San Ramon R.	$qs=331,0\ A^{-0.496}$	$qd=57.4\ A^{-0.589}$

where qs, qd : Specific discharge ($m^3/s/km^2$)

A : Drainage area (km^2)

Table 4.7 RESERVOIR TYPE SCHEMES PASSED FIRST SCREENING

No.	Scheme ID No.	Scheme Name	Co-ordinate		River Name	D.A. (Km^2)
			N-Lat.	E-Longi.		
1.	1-022-00-01-0-1	Banaoang	17-33-30	120-28-18	Abra	4,766.0
2.	1-022-00-05-0-1	Supo	17-14-42	120-40-36	"	1,293.0
3.	1-022-00-06-0-1	Eteb	17-10-42	120-40-22	"	911.0
4.	2-006-00-01-0-1	Sisiritan	18-09-42	121-21-00	Abulog	1,870.0
5.	2-006-00-02-0-1	Bubulayan	18-06-18	121-18-18	"	1,609.7
6.	2-006-00-03-0-1	Bulu	18-02-30	121-13-00	"	1,540.0
7.	2-006-01-04-0-1	Nababarayan	18-02-00	121-08-00	"	1,007.0
8.	2-006-01-05-0-1	Dibagat	18-05-20	121-07-17	"	798.9
9.	2-006-01-06-0-1	Agbulu	18-08-20	121-05-00	"	706.0
10.	2-008-03-05-0-1	Sadanga	17-08-53	121-03-08	Chico	725.0
11.	2-008-07-24-0-1	Bantay	17-54-52	121-49-39	Paret	742.0
12.	2-008-08-25-0-1	Dabba	17-42-05	121-50-05	Pin. Tuguegarao	439.7
13.	2-008-14-34-0-1	Maliano	16-44-36	122-04-00	Ilagan	880.2
14.	2-008-28-52-0-1	Cabingatan	16-13-32	121-37-31	Cagayan	1,660.3
15.	2-008-29-61-0-1	Upper Casecnan-3	16-08-09	121-14-34	"	172.1
16.	4-007-00-01-0-1	Kanan	14-44-30	121-31-54	Agos	364.3
17.	4-007-00-02-0-1	Daraitan	14-36-00	121-26-10	"	325.0
18.	4-007-00-05-0-1	Upper Agos-2	14-48-40	121-30-42	"	286.4
19.	4-115-01-01-0-1	Wawa	14-43-30	121-11-24	Marikina	283.2
20.	5-014-01-01-0-1	Bosigon	14-10-07	122-38-54	Labo	335.7

Table 4.8 ADJUSTMENT FACTORS FOR STORM TRANSPOSITION

No.	Scheme Name	Rainfall Station	R(mm) 1/	C 2/
1.	Banaoang	Mt. Data	511	0.68
2.	Supo	"	511	0.68
3.	Eteb	"	511	0.68
4.	Sisiritan	Baliwanan	631	0.84
5.	Bubulayan	"	631	0.84
6.	Bulu	"	631	0.84
7.	Nababarayan	"	631	0.84
8.	Dibagat	"	631	0.84
9.	Agbulu	"	631	0.84
10.	Sadanga	Mt. Data	511	0.68
11.	Bantay	Imulong	519 3/	0.69
12.	Dabba	Taan Dupax	633	0.84
13.	Maliano	Taan Dupax	633	0.84
14.	Cabingatan	"	633	0.84
15.	Upper Casecnan-3	"	633	0.84
16.	Kanan	Tuno	771	1.03
17.	Daraitan	Lumutan	632 3/	0.84
18.	Upper Agos-2	Tuno	771	1.03
19.	Wawa	Sta. Ines	589	0.79
20.	Bosigon	Lulay	661	0.88

Notes: 1/ R = seasonal monthly rainfall

2/ C = adjustment factor (R/750 mm)

3/ modified by ratio of highest annual mean rainfall within scheme basin to annual mean rainfall at station.

Table 4.9 DIMENSIONLESS HYDROGRAPH BY RIVER SYSTEM

Abra(Tapayen)		Abulog(Sisiritan)		Cagayan(Magat)		Agos (Banugao)	
T(%)	Ordi.	T(%)	Ordi.	T(%)	Ordi.	T(%)	Ordi.
0.00	0.001	0.00	0.001	0.00	0.001	0.00	0.001
20.00	0.18	10.00	0.11	1.00	0.12	5.00	0.10
30.00	0.90	20.00	0.34	10.00	0.52	10.00	0.15
40.00	3.60	30.00	0.90	20.00	2.20	20.00	0.50
50.00	9.80	40.00	2.00	30.00	6.00	30.00	1.30
60.00	22.00	50.00	4.80	40.00	13.00	40.00	3.00
66.70	28.80	60.00	8.60	50.00	22.00	50.00	7.20
74.10	26.40	70.00	15.00	55.00	23.59	60.00	14.00
81.50	22.56	80.00	32.00	60.00	25.65	70.00	28.00
88.90	19.92	81.84	33.79	65.00	23.91	75.00	34.00
96.30	17.52	84.57	42.12	71.00	21.45	77.00	34.80
100.00	16.50	87.29	45.40	75.00	19.27	80.00	34.00
110.00	14.50	90.02	41.77	81.00	16.77	85.00	29.00
120.00	12.50	92.75	39.43	85.00	15.21	90.00	25.00
130.00	10.50	95.48	35.91	89.00	13.72	100.00	18.00
140.00	9.20	98.21	32.27	95.00	11.57	110.00	14.00
150.00	8.00	100.00	28.00	100.00	10.70	120.00	10.60
160.00	7.00	110.00	20.00	110.00	9.70	130.00	8.40
170.00	6.10	120.00	15.00	120.00	8.80	140.00	7.00
180.00	5.40	130.00	10.50	130.00	8.00	150.00	6.20
190.00	4.80	140.00	7.60	140.00	7.20	160.00	5.50
200.00	4.20	150.00	5.60	150.00	6.60	170.00	5.00
220.00	3.30	160.00	4.49	160.00	6.00	180.00	4.60
240.00	2.70	170.00	3.80	170.00	5.40	190.00	4.20
260.00	2.25	180.00	3.60	180.00	4.90	200.00	3.80
280.00	1.85	185.00	3.40	190.00	4.50	220.00	3.20
300.00	1.55	190.00	3.20	200.00	4.10	240.00	2.60
350.00	0.94	200.00	2.90	220.00	3.30	260.00	2.20
400.00	0.58	220.00	2.40	240.00	2.75	280.00	1.80
450.00	0.36	240.00	1.95	250.00	2.50	300.00	1.50
500.00	0.23	260.00	1.60	260.00	2.25	340.00	1.05
550.00	0.14	280.00	1.32	280.00	1.85	380.00	0.72
585.00	0.10	300.00	1.10	300.00	1.55	420.00	0.50
		340.00	0.76	350.00	0.94	460.00	0.36
		380.00	0.51	400.00	0.58	500.00	0.24
		420.00	0.34	450.00	0.36	540.00	0.17
		460.00	0.23	500.00	0.22	580.00	0.12
		500.00	0.16	550.00	0.13	600.00	0.10
		540.00	0.11	580.00	0.10		
		545.00	0.10				

Table 4.10 BASIN FACTORS FOR FLOOD HYDROGRAPH SYNTHESIS

No.	Scheme Name	River Name	D.A. (Sq. km)	Lag Time (hrs) 1/ W/O	Lag Time (hrs) 1/ W	Base Flow q (cms/sq.km)
1.	Banaoang	Abra	4,766.0	30	23 (20) 2/	7.5
2.	Supo	"	1,293.0	16	*	5.0
3.	Eteb	"	911.0	15	*	5.0
4.	Sisiritan	Abulog	1,870	30	*	5.5
5.	Bubulayan	"	1,609.7	24	10	5.5
6.	Bulu	"	1,540.0	23	15	5.5
7.	Nababrayan	"	1,007.0	20	14	5.5
8.	Dibagat	"	798.9	17	12	5.5
9.	Agbulu	"	706.0	13	12	5.5
10.	Sadanga	Chico	725.0	13	*	9.0
11.	Bantay	Paret	742.0	13	10	6.5
12.	Dabba	Tuguegarao	392.0	13	*	7.0
13.	Maliano	Ilagan	880.2	21	10	7.0
14.	Cabingatan	Cagayan	1,660.3	23	15	5.0
15.	Upper Casecnan-3	"	172.1	8	6	5.0
16.	Kanan	Agos	364.3	11	6	7.5
17.	Daraitan	"	325.0	12	*	7.5
18.	Upper Agos-2	"	286.4	9	3	7.5
19.	Wawa	Marikina	283.2	9	*	3.0
20.	Bosigon	Labo	335.7	9	*	3.0

Notes: 1/ : W/O = in without dam case, W = in with dam case
2/ : The lag time in parentheses shows that in the Tineg river basin.
3/ : As for the scheme with *, it is presumed that the basin change is negligible.

Table 4.11 DESIGN FLOODS FOR SPILLWAY AND DIVERSION WORKS

No.	Scheme Name	River Name	D.A. (Sq. km)	Spillway		Diversion
				Without Dam	With Dam	
1.	Banaoang	Abra	4,766.0	24,000	27,600	12,400
2.	Supo	"	1,293.0	11,300	- 2/	5,400
3.	Eteb	"	911.0	8,600	-	4,600
4.	Sisiritan	Abulog	1,870.0	17,600	-	6,400
5.	Bubulayan	"	1,609.7	17,200	24,000	6,000
6.	Bulu	"	1,540.0	17,100	20,000	5,900
7.	Nababarayan	"	1,007.0	12,700	14,700	4,700
8.	Dibagat	"	798.9	11,200	12,600	4,100
9.	* Agbulu 1/	"	706.0	11,600	11,600	1,300
10.	* Sadanga	Chico	725.0	7,100	-	1,100
11.	Bantay	Paret	742.0	7,200	7,500	3,000
12.	Dabba	Pin. Tuguegarao	392.0	4,500	-	1,500
13.	Maliano	Ilagan	880.2	8,200	11,200	2,400
14.	Cabingatan	Cagayan	1,660.3	13,000	15,700	7,000
15.	Upper Casecnan-3	"	172.1	3,100	3,200	1,700
16.	Kanan	Agos	364.3	7,500	9,100	2,800
17.	Daraitan	"	325.0	5,400	-	2,600
18.	* Upper Agos-2	"	286.4	6,500	10,800	800
19.	* Wawa	Marikina	283.2	4,000	-	600
20.	Bosigon	Labo	335.7	5,900	6,900	2,100

Notes: 1/ : Schemes with asterisk are planned as a concrete gravity type dam, and the others are rock-fill type dam.

2/ : It is presumed that the basin change is negligible.

Table 5.1 GDP, GRDP-LUZON 1970-1985 AT 1972 CONSTANT PRICE (1/3)
WITH SECTORAL AND REGIONAL BREAKDOWN

Unit : Mill. Pesos

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
GRDP at 1972 constant price:																
NCR			16,690	19,012	20,184	21,527	22,754	24,436	25,729	27,476	29,224	30,521	31,511	32,231	28,923	27,026
Agriculture			0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry			8,548	10,168	10,624	11,174	11,935	13,085	13,751	14,425	15,251	15,960	16,350	16,645	15,022	13,840
Service			8,142	8,844	9,560	10,353	10,819	11,351	11,978	13,051	13,973	14,561	15,160	15,586	13,901	13,185
Region 1			2,392	2,606	2,654	2,710	2,738	2,934	3,021	3,257	3,433	3,645	3,760	3,883	3,821	3,859
Agriculture			880	962	1,027	967	945	991	1,026	1,173	1,230	1,347	1,436	1,555	1,624	1,694
Industry			565	638	593	662	656	778	747	802	862	917	839	834	765	742
Service			947	1,006	1,034	1,081	1,137	1,165	1,248	1,282	1,341	1,381	1,425	1,493	1,432	1,423
Region 2			1,805	2,062	1,999	1,788	2,060	2,185	2,332	2,589	2,614	2,699	2,640	2,585	2,461	2,472
Agriculture			1,117	1,288	1,178	866	920	977	1,070	1,137	1,154	1,180	1,116	1,170	1,292	1,393
Industry			166	196	224	283	477	514	539	676	672	710	718	571	348	278
Service			522	578	597	639	663	694	723	776	788	809	806	844	821	801
Region 3			4,824	5,180	5,547	5,777	6,344	6,576	6,943	7,355	7,778	8,517	8,795	8,767	8,228	7,996
Agriculture			1,326	1,490	1,636	1,678	1,723	1,795	1,954	2,008	2,179	2,449	2,567	2,477	2,418	2,508
Industry			1,638	1,724	1,854	1,951	2,307	2,394	2,479	2,728	2,827	3,204	3,255	3,247	2,922	2,643
Service			1,860	1,966	2,057	2,148	2,314	2,387	2,510	2,619	2,772	2,864	2,973	3,043	2,888	2,845
Region 4			7,666	7,973	8,348	9,348	10,347	11,022	11,886	12,265	12,954	13,239	13,521	13,903	13,450	12,905
Agriculture			2,231	2,361	2,513	2,869	3,145	3,386	3,620	3,597	3,969	3,839	3,838	3,888	3,941	4,034
Industry			2,763	2,875	3,006	3,473	4,001	4,302	4,659	4,985	5,324	5,368	5,503	5,631	5,121	4,504
Service			2,672	2,737	2,829	3,006	3,201	3,334	3,607	3,683	3,934	4,032	4,180	4,384	4,388	4,367
Region 5			2,040	2,124	2,231	2,354	2,601	2,779	2,773	2,901	3,181	3,257	3,045	3,189	3,137	3,069
Agriculture			1,221	1,269	1,342	1,346	1,399	1,520	1,435	1,497	1,697	1,713	1,475	1,603	1,697	1,723
Industry			173	158	173	226	369	394	414	437	467	494	495	452	346	288
Service			646	697	716	780	833	865	924	967	1,017	1,050	1,076	1,134	1,094	1,059
Luzon total (6 regions)			35,417	38,957	40,963	43,504	46,844	49,932	52,684	55,843	59,184	61,878	63,272	64,458	60,021	57,328
Agriculture			6,775	7,370	7,696	7,728	8,132	8,669	9,105	9,412	9,956	10,528	10,492	10,693	10,973	11,352
Industry			13,853	15,759	16,474	17,769	19,745	21,467	22,589	24,053	25,403	26,653	27,160	27,380	24,524	22,296
Service			14,789	15,828	16,793	18,007	18,967	19,796	20,990	22,378	23,825	24,697	25,620	26,464	24,524	23,680
Population *1			20,868	21,487	22,128	22,790	23,411	24,049	24,708	25,383	26,081	26,901	27,611	28,336	29,078	29,832
Per capita GRDP *2			1,697	1,813	1,851	1,909	2,001	2,076	2,132	2,200	2,269	2,300	2,292	2,275	2,064	1,922
GDP at 1972 constant price:																
Philippine	51,014	53,526	56,075	60,931	64,139	68,361	72,962	77,990	82,797	88,346	92,706	96,207	98,939	99,920	94,214	90,470
Agriculture	14,734	15,457	16,040	17,026	17,465	18,218	19,671	20,645	21,620	22,595	23,732	24,608	25,378	24,845	25,409	26,010
Industry	15,048	16,222	17,442	19,586	20,710	22,690	24,904	27,554	29,598	32,343	33,471	34,963	35,714	35,955	32,159	28,881
Service	21,232	21,847	22,593	24,319	25,964	27,453	28,387	29,790	31,579	33,408	35,503	36,636	37,907	39,120	36,646	35,580
Population *1	36,684	37,862	38,914	39,995	41,106	42,071	43,406	44,584	45,794	47,037	48,098	49,401	50,740	52,055	53,351	54,668
Per capita GDP *2	1,391	1,414	1,441	1,523	1,560	1,625	1,681	1,749	1,808	1,878	1,927	1,947	1,951	1,920	1,776	1,655

Note : *1 Unit: Thousand person *2 Unit: Pesos

Source : Ref. Data No. 1, 2, 3, 4 and 6

Table 5.1 GDP, GRDP-LUZON 1970-1985 AT 1972 CONSTANT PRICE (2/3)
PERCENTAGE DISTRIBUTION BY SECTOR AND REGION

Unit : %

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
GRDP at 1972 constant price:																
NCR			29.8	31.2	31.5	31.5	31.2	31.3	31.1	31.1	31.5	31.7	31.8	32.3	30.7	29.9
Agriculture			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industry			15.2	16.7	16.6	16.3	16.4	16.8	16.6	16.3	16.5	16.6	16.5	16.7	15.9	15.3
Service			14.5	14.5	14.9	15.1	14.8	14.6	14.5	14.8	15.1	15.1	15.3	15.6	14.8	14.6
Region 1			4.3	4.3	4.1	4.0	3.8	3.8	3.6	3.7	3.7	3.8	3.8	3.9	4.1	4.3
Agriculture			1.6	1.6	1.6	1.4	1.3	1.3	1.2	1.3	1.3	1.4	1.5	1.6	1.7	1.9
Industry			1.0	1.0	0.9	1.0	0.9	1.0	0.9	0.9	0.9	1.0	0.8	0.8	0.8	0.8
Service			1.7	1.7	1.6	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.4	1.5	1.5	1.6
Region 2			3.2	3.4	3.1	2.6	2.8	2.8	2.8	2.9	2.8	2.8	2.7	2.6	2.6	2.7
Agriculture			2.0	2.1	1.8	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.1	1.2	1.4	1.5
Industry			0.3	0.3	0.3	0.4	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.6	0.4	0.3
Service			0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.9	0.9
Region 3			8.6	8.5	8.6	8.5	8.7	8.4	8.4	8.3	8.4	8.9	8.9	8.8	8.7	8.8
Agriculture			2.4	2.4	2.6	2.5	2.4	2.3	2.4	2.3	2.4	2.5	2.6	2.5	2.6	2.8
Industry			2.9	2.8	2.9	2.9	3.2	3.1	3.0	3.1	3.0	3.3	3.3	3.2	3.1	2.9
Service			3.3	3.2	3.2	3.1	3.2	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.1	3.1
Region 4			13.7	13.1	13.0	13.7	14.2	14.1	14.4	13.9	14.0	13.8	13.7	13.9	14.3	14.3
Agriculture			4.0	3.9	3.9	4.2	4.3	4.3	4.4	4.1	4.3	4.0	3.9	3.9	4.2	4.5
Industry			4.9	4.7	4.7	5.1	5.5	5.5	5.6	5.6	5.7	5.6	5.6	5.6	5.4	5.0
Service			4.8	4.5	4.4	4.4	4.4	4.3	4.4	4.2	4.2	4.2	4.2	4.4	4.7	4.8
Region 5			3.6	3.5	3.5	3.4	3.6	3.6	3.3	3.3	3.4	3.4	3.1	3.2	3.3	3.4
Agriculture			2.2	2.1	2.1	2.0	1.9	1.9	1.7	1.7	1.8	1.8	1.5	1.6	1.8	1.9
Industry			0.3	0.3	0.3	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.3
Service			1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2
Luzon total (6 regions)			63.2	63.9	63.9	63.6	64.2	64.0	63.6	63.2	63.8	64.3	63.9	64.5	63.7	63.4
Agriculture			12.1	12.1	12.0	11.3	11.1	11.1	11.0	10.7	10.7	10.9	10.6	10.7	11.6	12.5
Industry			24.7	25.9	25.7	26.0	27.1	27.5	27.3	27.2	27.4	27.7	27.4	27.4	26.0	24.6
Service			26.4	26.0	26.2	26.3	26.0	25.4	25.4	25.3	25.7	25.7	25.9	26.5	26.0	26.2
Population																
Per capita GRDP																
GDP at 1972 constant price:																
Philippine	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Agriculture	28.9	28.9	28.6	27.9	27.2	26.6	27.0	26.5	26.1	25.6	25.6	25.6	25.5	24.9	27.0	28.7
Industry	29.5	30.3	31.1	32.1	32.3	33.2	34.1	35.3	35.7	36.6	36.1	36.3	36.1	36.0	34.1	31.9
Service	41.6	40.8	40.3	39.9	40.5	40.2	38.9	38.2	38.1	37.8	38.3	38.1	38.3	39.2	38.9	39.3
Population																
Per capita GDP																

Source : Ref. Data No. 1, 2, 3, 4 and 6

Table 5.1 GDP, GRDP-LUZON 1970-1985 AT 1972 CONSTANT PRICE (3/3)
EXPONENTIAL GROWTH PER ANNUM

Unit : Previous year = 100

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
GRDP at 1972 constant price:																
NCR				113.9	106.2	106.7	105.7	107.4	105.3	106.8	105.4	104.4	103.2	102.3	89.7	93.4
Agriculture																
Industry				119.0	104.5	105.2	105.8	109.6	105.1	104.9	105.7	104.6	102.4	101.8	90.2	92.1
Service				108.6	108.1	108.3	104.5	104.9	105.5	109.0	107.1	104.2	104.1	102.8	89.2	94.8
Region 1				108.9	101.8	102.1	101.0	107.2	103.0	107.8	105.4	106.2	103.2	103.3	98.4	101.0
Agriculture				109.3	106.8	94.2	97.7	104.9	103.5	114.3	104.9	109.5	111.1	103.9	104.4	104.3
Industry				112.9	92.9	111.6	99.1	118.6	96.0	107.4	107.5	106.4	91.5	99.4	91.7	97.0
Service				106.2	102.8	104.5	105.2	102.5	107.1	102.7	104.6	103.0	103.2	104.8	95.9	99.4
Region 2				114.2	96.9	89.4	115.2	106.1	106.7	111.0	101:0	103.3	97.8	97.9	95.2	100.4
Agriculture				115.3	91.5	73.5	106.2	106.2	109.5	106.3	101.5	102.3	94.6	104.8	110.4	107.8
Industry				118.1	114.3	126.3	168.6	107.8	104.9	125.4	99.4	105.7	101.1	79.5	60.9	79.9
Service				110.7	103.3	107.0	103.8	104.7	104.2	107.3	101.5	102.7	99.6	104.7	97.3	97.6
Region 3				107.4	107.1	104.1	109.8	103.7	105.6	105.9	105.8	109.5	103.3	99.7	93.9	97.2
Agriculture				112.4	109.8	102.6	102.7	104.2	108.9	102.8	108.5	112.4	104.8	96.5	97.6	103.7
Industry				105.3	107.5	105.2	118.2	103.8	103.6	110.0	103.6	113.3	101.6	99.8	90.0	90.5
Service				105.7	104.6	104.4	107.7	103.2	105.2	104.3	105.8	103.3	103.8	102.4	94.9	98.5
Region 4				104.0	104.7	112.0	110.7	106.5	107.8	103.2	105.6	102.2	102.1	102.8	96.7	95.9
Agriculture				105.8	106.4	114.2	109.6	107.7	106.9	99.4	110.3	96.7	100.0	101.3	101.4	102.4
Industry				104.1	104.6	115.5	115.2	107.5	108.3	107.0	106.8	100.8	102.5	102.3	90.9	88.0
Service				102.4	103.4	106.3	106.5	104.2	108.2	102.1	106.8	102.5	103.7	104.9	100.1	99.5
Region 5				104.1	105.0	105.5	110.5	106.8	99.8	104.6	109.7	102.4	93.5	104.7	98.4	97.8
Agriculture				103.9	105.8	100.4	103.8	108.6	94.4	104.3	113.4	100.9	86.1	108.7	105.9	101.5
Industry				91.3	109.5	130.6	163.3	106.8	105.1	105.6	106.9	105.8	100.2	91.3	76.5	83.2
Service				107.9	102.7	108.9	106.8	103.8	106.8	104.7	105.2	103.2	102.5	105.4	96.5	96.8
Luzon total (5 regions)				110.0	105.1	106.2	107.7	106.6	105.5	106.0	106.0	104.6	102.3	101.9	93.1	95.5
Agriculture				108.8	104.4	100.4	105.2	106.6	105.0	103.4	105.8	105.7	99.7	101.9	102.6	103.5
Industry				113.8	104.5	107.9	111.1	108.7	105.2	106.5	105.6	104.9	101.9	100.8	89.6	90.9
Service				107.0	106.1	107.2	105.3	104.4	106.0	106.6	106.5	103.7	103.7	103.4	92.6	96.6
Population				103.0	103.0	103.0	102.7	102.7	102.7	102.7	102.7	103.1	102.6	102.6	102.6	102.6
Per capita GRDP				106.8	102.1	103.1	104.8	103.7	102.7	103.2	103.1	101.4	99.7	99.3	90.7	93.1
GDP at 1972 constant price:																
Philippine		104.9	104.8	108.7	105.3	106.6	106.7	106.9	106.2	106.7	104.9	103.8	102.9	100.9	94.3	96.0
Agriculture		104.9	103.8	106.1	102.6	104.3	108.0	105.0	104.7	104.5	105.0	103.7	103.1	97.9	102.3	102.4
Industry		107.8	107.5	112.3	105.7	109.6	109.8	110.6	107.4	109.3	103.5	104.5	102.1	100.7	89.4	89.8
Service		102.9	103.4	107.6	106.8	105.7	103.4	104.9	106.0	105.8	106.3	103.2	103.5	103.2	93.7	97.1
Population		103.2	102.8	102.8	102.8	102.3	103.2	102.7	102.7	102.7	102.3	102.7	102.7	102.6	102.5	102.5
Per capita GDP		101.7	101.9	105.7	102.4	104.2	103.4	104.0	103.4	103.9	102.6	101.0	100.2	98.4	92.5	93.2

Source : Ref. Data No. 1, 2, 3, 4 and 6

Table 5.2 COMPOUND ANNUAL REAL GROWTH RATE OF HISTORICAL GDP, GRDP - LUZON

Unit: % per annum

Year	1972/75	1975/80	1980/85
GRDP at 1972 constant price :			
NCR	8.85	6.30	-1.55
Agriculture			
Industry	9.34	6.42	-1.92
Service	8.34	6.18	-1.15
Region 1	4.25	4.84	2.37
Agriculture	3.19	4.93	6.61
Industry	5.42	5.42	-2.95
Service	4.51	4.40	1.19
Region 2	-0.31	7.89	-1.11
Agriculture	-8.13	5.91	3.84
Industry	19.46	18.88	-16.18
Service	6.97	4.28	0.33
Region 3	6.19	6.13	0.55
Agriculture	8.16	5.36	2.85
Industry	6.00	7.70	-1.34
Service	4.92	5.23	0.52
Region 4	6.84	6.74	-0.08
Agriculture	8.75	6.71	0.33
Industry	7.92	8.92	-3.29
Service	4.00	5.53	2.11
Region 5	4.89	6.21	-0.71
Agriculture	3.35	4.71	0.30
Industry	9.32	15.62	-9.21
Service	6.48	5.45	0.81
Luzon total (6 regions)	7.10	6.35	-0.64
Agriculture	4.48	5.20	2.66
Industry	8.65	7.41	-2.58
Service	6.78	5.76	-0.12
Population	2.98	2.73	2.72
Per capita GRDP	4.00	3.52	-3.26

Year	1970/75	1975/80	1980/85
GDP at 1972 constant price :			
Philippine	6.03	6.28	-0.49
Agriculture	4.34	5.43	1.85
Industry	8.56	8.09	-2.91
Service	5.27	5.28	0.04
Population	2.78	2.71	2.59
Per capita GDP	3.16	3.47	-3.00

Source : Ref. 1, 2, 3, 4 & 6

Table 5.3 ANALYSIS OF GDP AND GRDP-LUZON 1987-1992 AT 1972 CONSTANT PRICE

Year		1986 *1		1987 *2		1988 *2		1989 *2		1990 *2		1991 *2		1992 *2		Compound annual growth rate 1987/1992 (%)
	UNIT															
GRDP:	(Amount) (Share)															
NCR	Mil. Pesos %			28,670	29.7									35,441	27.7	4.91
Reg. I	"			4,280	4.4									5,899	4.5	6.63
" II	"			2,805	2.9									4,076	3.1	7.76
" III	"			8,522	8.8									12,021	9.1	7.12
" IV	"			13,111	13.6									18,329	14.0	6.93
" V	"			3,191	3.3									4,467	3.4	6.96
Luzon (6 regions)	"			60,579	62.8									81,233	61.8	6.04
Population	Thousand			31,376										35,280		2.37
GRDP per capita	Pesos			1,931										2,303		3.59
GDP:	(Amount) (Share)															1986/1992 (%)
	(Growth: Previous year = 100)															
Agriculture, fishery & forestry	Mil. Pesos %	26,800	29.4	28,100	29.1	29,500	28.9	31,200	28.7	32,900	28.5	34,700	28.2	36,700	27.9	5.36
			103.0		104.9		105.0		105.8		105.5		105.5		105.8	
Industry	"	28,100	30.3	30,000	31.1	31,900	31.2	34,100	31.4	36,500	31.6	39,200	31.8	42,100	32.0	7.00
			97.3		106.8		105.3		106.9		107.0		107.4		107.4	
Manufacturing	"	21,700	23.8	23,100	24.0	24,600	24.1	26,200	24.1	28,000	24.2	30,000	24.4	32,200	24.5	6.88
			100.3		106.5		106.5		106.5		106.9		107.1		107.3	
Mining & quarrying	"	1,800	2.0	1,900	2.0	1,900	1.9	2,000	1.8	2,100	1.8	2,200	1.8	2,300	1.8	4.17
			102.0		105.6		100.0		105.3		105.0		104.8		104.5	
Construction	"	3,300	3.6	3,600	3.7	3,900	3.8	4,300	4.0	4,700	4.1	5,100	4.1	5,600	4.3	9.21
			77.7		109.1		108.3		110.3		109.3		108.5		109.8	
Electricity, gas & water	"	1,300	1.4	1,400	1.5	1,500	1.5	1,600	1.5	1,700	1.5	1,900	1.5	2,000	1.5	7.44
			104.6		107.7		107.1		106.7		106.3		111.8		105.3	
Service	"	36,200	39.7	38,300	39.7	40,700	39.9	43,400	39.9	46,200	40.0	49,200	40.0	52,500	40.0	6.39
			101.7		105.8		106.3		106.6		106.5		106.5		106.7	
GDP	"	91,100	100.0	96,402	100.0	102,100	100.0	108,700	100.0	115,600	100.0	123,100	100.0	131,390	100.0	6.29
			100.7		105.8		105.9		106.5		106.3		106.5		106.7	
Population	Thousand	56,004		57,356		58,721		60,097		61,480		62,810		64,169		2.29
			102.4		102.4		102.4		102.3		102.3		102.2		102.2	
GDP per capita	Pesos	1,627		1,681		1,739		1,776		1,880		1,960		2,048		3.91
			98.3		103.3		103.5		102.1		105.9		104.3		104.5	

Note : *1 Estimate by NEDA *2 Projection by NEDA

Source : NEDA information release and Ref. No. 3

Table 5.4 POWER GENERATION AND ECONOMIC GROWTH 1970-2005 IN PHILIPPINE

PHILIPPINE

	Power Generation (Energy)				GDP at 1972 constant price			Population	Per Capit GDP		
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Unit :				GWH			Mil. Pesos	Thous.			Pesos
Year 1970	6,791	6,791	6,791	6,791	51,014	51,014	51,014	36,884	1,391	1,391	1,391
1973	8,718	8,718	8,718	8,718	60,931	60,931	60,931	39,995	1,523	1,523	1,523
1975	9,618	9,618	9,618	9,618	68,361	68,361	68,361	42,701	1,601	1,601	1,601
1980	15,086	15,086	15,086	15,086	92,706	92,706	92,706	48,098	1,927	1,927	1,927
1985	18,757	18,757	18,757	18,757	90,470	90,470	90,470	54,668	1,655	1,655	1,655
1986	19,010	19,230	19,230	19,231	92,926	90,470	91,100	56,004	1,659	1,615	1,627
1987	20,188	20,207	20,207	20,207	93,396	93,184	96,402	57,356	1,628	1,625	1,681
1988	21,586	21,588	21,582	21,540	98,870	96,911	102,100	58,721	1,684	1,650	1,739
1989	22,698	22,748	22,952	22,836	103,933	101,757	108,700	60,097	1,729	1,693	1,809
1990	24,185	24,173	24,739	24,538	110,588	107,862	115,600	61,480	1,800	1,754	1,880
1991	25,773	25,629	26,341	26,059	117,202	113,256	123,100	62,810	1,866	1,803	1,960
1992	27,237	27,220	27,934	27,534	124,234	118,918	131,390	64,169	1,936	1,853	2,048
1993	28,765	28,888	29,579	29,053	131,688	124,864	138,621	65,567	2,008	1,904	2,114
1994	30,684	30,694	31,327	30,674	139,589	131,107	145,251	66,975	2,084	1,958	2,184
1995	32,386	32,489	33,065	32,263	147,965	137,663	154,300	68,424	2,162	2,012	2,255
1996	34,232	34,338	34,893	33,937	156,843	144,546	160,740	69,733	2,249	2,073	2,305
1997	36,134	36,245	36,809	35,677	166,253	151,773	167,448	71,067	2,339	2,136	2,356
1998	38,109	38,228	38,819	37,513	176,228	159,362	174,436	72,426	2,433	2,200	2,408
1999	40,147	40,219	40,933	39,439	186,802	167,330	181,716	73,811	2,531	2,267	2,462
2000	42,253	42,318	43,163	41,492	198,010	175,697	189,300	75,223	2,632	2,336	2,517
2001	44,483	44,531	45,522	43,614		184,482	196,647	76,439		2,413	2,573
2002	46,833	46,855	48,007	45,852		193,706	204,279	77,674		2,494	2,630
2003	49,323	49,308	50,634	48,168		203,391	212,208	78,929		2,577	2,689
2004	51,945	51,883	53,401	50,624		213,561	220,444	80,205		2,663	2,749
2005	54,714	54,598	56,324	53,191		224,239	229,000	81,501		2,751	2,810

Year	Compound Annual Growth Rate									Unit : % per annum	
1970/75	7.21	7.21	7.21	7.21	6.03	6.03	6.03	3.08	2.86	2.86	2.86
1975/80	9.42	9.42	9.42	9.42	6.28	6.28	6.28	2.41	3.78	3.78	3.78
(73/80)	8.15	8.15	8.15	8.15	6.18	6.18	6.18	2.67	3.42	3.42	3.42
1980/85	4.45	4.45	4.45	4.45	-0.49	-0.49	-0.49	2.59	-3.00	-3.00	-3.00
(85/95)	5.61	5.65	5.83	5.57	5.04	4.29	5.48	2.27	2.71	1.97	3.14
1985/90	5.21	5.20	5.69	5.52	4.12	3.58	5.02	2.38	1.70	1.17	2.59
1990/95	6.01	6.09	5.97	5.63	5.98	5.00	5.95	2.16	3.73	2.78	3.70
1995/00	5.46	5.43	5.47	5.16	6.00	5.00	4.17	1.91	4.01	3.03	2.22
2000/05	5.30	5.23	5.47	5.09		5.00	3.86	1.62		3.33	2.23
1970/80	8.31	8.31	8.31	8.31	6.16	6.16	6.16	2.75	3.32	3.32	3.32
1980/90	4.83	4.83	5.07	4.98	1.79	1.53	2.23	2.49	-0.68	-0.94	-0.25
1990/00	5.74	5.76	5.72	5.39	5.99	5.00	5.06	2.04	3.87	2.90	2.96

Note : Projection scenarios effective 1986
(1) NPC estimate in Nov. 1985 (2) NPC estimate in Sep. 1986 (3) NPC revised estimate in Sep. 1986
(4) NPC estimate in Nov. 1986 (5) & (9) NPC estimate in Jun. 1986 (6) & (10) NPC estimate in Sep. 1986
(7) & (11) NEDA projection (1987-1992) with extension under extrapolation
(8) NCSO medium assumption (moderate fertility and moderate mortality decline)

Source : National Power Corp., National Economic & Development Authority and National Census Statistics Office

Table 5.5 POWER GENERATION AND ECONOMIC GROWTH 1970-2005 IN LUZON

LUZON (6 REGIONS)

	Power Generation (Energy)				GRDP at 1972 Constan price			Population	Per Capita GRDP		
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Unit :				GWH			Mil. Pesos	Thous.			Pesos
Year 1970	6,458	6,458	6,458	6,458	31,698	31,698	31,698	19,688	1,610	1,610	1,610
1973	8,227	8,227	8,227	8,227	38,957	38,957	38,957	21,487	1,813	1,813	1,813
1975	9,037	9,037	9,037	9,037	43,504	43,504	43,504	22,790	1,909	1,909	1,909
1980	13,115	13,115	13,115	13,115	59,184	59,184	59,184	26,061	2,269	2,269	2,269
1985	14,449	14,449	14,449	14,449	57,328	57,328	57,328	29,832	1,922	1,922	1,922
1986	14,391	14,704	14,704	14,714	59,296	58,055	57,487	30,598	1,938	1,897	1,879
1987	14,646	15,326	15,326	15,304	60,872	59,805	60,579	31,378	1,940	1,906	1,931
1988	15,211	16,026	16,020	15,975	63,089	62,236	63,951	32,161	1,962	1,935	1,988
1989	15,966	16,748	16,952	16,841	66,320	65,359	67,864	32,950	2,013	1,984	2,060
1990	16,817	17,462	18,028	17,954	70,630	69,355	71,937	33,747	2,093	2,055	2,132
1991	17,947	18,499	19,211	18,947	74,767	72,903	76,356	34,505	2,167	2,113	2,213
1992	19,020	19,618	20,332	19,964	79,274	76,524	81,233	35,280	2,247	2,169	2,303
1993	20,165	20,833	21,524	21,038	84,030	80,337	85,932	36,072	2,330	2,227	2,382
1994	21,396	22,176	22,809	22,185	89,071	84,394	90,903	36,883	2,415	2,288	2,465
1995	22,659	23,544	24,120	23,382	94,417	88,614	96,161	37,711	2,504	2,350	2,550
1996	24,012	24,970	25,525	24,629	100,081	92,986	100,441	38,451	2,603	2,418	2,612
1997	25,452	26,454	27,018	25,931	106,086	97,545	104,912	39,205	2,706	2,488	2,676
1998	26,980	28,007	28,598	27,326	112,451	102,406	109,581	39,974	2,813	2,562	2,741
1999	28,598	29,558	30,272	28,795	119,198	107,510	114,456	40,756	2,925	2,638	2,808
2000	30,314	31,197	32,042	30,375	126,350	112,973	119,552	41,556	3,040	2,718	2,877
2001	32,132	32,926	33,917	32,009		118,603	124,523	42,249		2,807	2,947
2002	34,060	34,749	35,901	33,738		124,534	129,700	42,952		2,899	3,020
2003	36,104	36,675	38,001	35,523		130,638	135,093	43,667		2,992	3,094
2004	38,270	38,706	40,224	37,433		137,149	140,710	44,393		3,089	3,170
2005	40,567	40,851	42,577	39,422		143,894	146,560	45,132		3,188	3,247

Year	Compound Annual Growth Rate									Unit : % per annum	
1970/75	6.95	6.95	6.95	6.95	6.54	6.54	6.54	2.97	3.46	3.46	3.46
1975/80	7.73	7.73	7.73	7.73	6.35	6.35	6.35	2.73	3.52	3.52	3.52
(73/80)	6.89	6.89	6.89	6.89	6.16	6.16	6.16	2.81	3.26	3.26	3.26
1980/85	1.96	1.96	1.96	1.96	-0.64	-0.64	-0.64	2.72	-3.27	-3.27	-3.27
(85/95)	4.60	5.00	5.26	4.93	5.12	4.45	5.31	2.37	2.68	2.03	2.87
1985/90	3.08	3.86	4.57	4.44	4.26	3.88	4.64	2.50	1.72	1.35	2.10
1990/95	6.14	6.16	6.00	5.43	5.98	5.02	5.98	2.25	3.65	2.72	3.65
1995/00	5.99	5.79	5.84	5.37	6.00	4.98	4.45	1.96	3.96	2.96	2.44
2000/05	6.00	5.54	5.85	5.35		4.96	4.16	1.66		3.24	2.45
1970/80	7.34	7.34	7.34	7.34	6.44	6.44	6.44	2.85	3.49	3.49	3.49
1980/90	2.52	2.90	3.23	3.19	1.78	1.60	1.97	2.61	-0.81	-0.99	-0.62
1990/00	6.07	5.97	5.92	5.40	5.99	5.00	5.21	2.10	3.80	2.84	3.04

Note : Projection scenarios effective 1986
(1) NPC estimate in Nov. 1985 (2) NPC estimate in Sep. 1986 (3) NPC revised estimate in Sep. 1986
(4) NPC estimate in Nov. 1986 (5) & (9) NPC estimate in Jun. 1986 (6) & (10) NPC estimate in Sep. 1986
(7) & (11) NEDA projection (1987-1992) with extension under extrapolation
(8) NCSO medium assumption (moderate fertility and moderate mortality decline)

Source : National Power Corp., National Economic & Development Authority and National Census Statistics Office

Table 6.1 EXISTING POWER PLANTS IN LUZON OWNED BY NPC

Power Plant	No. of Unit	Installed Capacity(MW)	Dependable Capacity(MW)	Commissioning Year
Hydropower				
Caliraya	4 x 8	32	24	1945 - 50
Botocan	2 x 8	16.96	8	1948
	1 x 0.96			
Ambuklao	3 x 25	75	36	1956 - 57
Buhi-Barit	1 x 1.8	1.8	1	1957
Cawayan	1 x 0.4	0.4	0.4	1959
Binga	4 x 25	100	75	1960
Angat	4 x 50	228	134	1967 - 68
	3 x 6			
	1 x 10			1987
Pantabangan	2 x 50	100	46	1977
Masiway	1 x 12	12	6	1980
Kalayaan[1/]	2 x 150	300	(300)	1982
Magat	4 x 90	360	72	1983 - 84
Subtotal of Hydro:		1,226.16	702.4	
Oil-fired Thermal				
Manila 1 (Tegen 1)	1 x 100	100	92	1965
Manila 2 (Tegen 2)	1 x 100	100	95	1966
Sucat 1 (Gardner 1)	1 x 150	150	100	1968
Sucat 2 (Gardner 2)	1 x 200	200	120	1970
Sucat 3 (Gardner 3)	1 x 200	200	160	1971
Sucat 4 (Gardner 4)	1 x 300	300	260	1972
Bataan 1	1 x 75	75	68	1972
Malaya 1	1 x 300	300	250	1975
Bataan 2	1 x 150	150	143	1977
Malaya 2	1 x 350	350	310	1979
Subtotal of Oil-fired Thermal:		1,925	1,598	
Coal-fired Thermal				
Batangas	1 x 300	300	285	1984
Geothermal				
Tiwi A	2 x 55	110	91	1979
Mak-Ban A	2 x 55	110	102	1979
Tiwi B	2 x 55	110	92	1980
Mak-Ban B	2 x 55	110	102	1980
Tiwi C	2 x 55	110	92	1981 - 82
Mak-Ban C	2 x 55	110	103	1984
Subtotal of Geothermal:		660	582	
Grand Total:		4,111.16	3,167.4	

Remark: 1/: pumped-storage

Table 6.2 NPC ENERGY PRODUCTIONS AND SALES

Year	Gross Generation (GWh)	NAPOCOR Sales (GWh)			NPC System Peak (MW) 1/	(Reference) Luzon Grid Peak (MW) 3/
		Total	MERALCO	Others		
1970	1,629.4 1/	1,521.2	490.1	1,031.1	268.8	1,086.4
71	2,038.8	1,935.9	628.1	1,307.8	299.4	1,187.5
72	2,287.9	2,154.6	668.0	1,486.6	318.0	1,331.3
73	1,814.3	1,638.7	-4.1	1,642.8	333.0	1,335.1
74	2,118.3	1,971.9	135.4	1,836.5	389.0	1,377.0
75	2,099.1	1,990.3	-152.9	2,143.2	438.0	1,514.0
76	2,360.9	2,210.9	-58.2	2,269.1	441.0	1,648.0
77	2,332.8	2,085.7	-96.7	2,182.4	420.0	1,709.0
78	3,741.0	3,450.0	951.0	2,499.0	350.0	1,780.0
79 2/	12,504.0	11,303.5	8,572.6	2,730.9	1,926.0	1,926.0
1980	13,115.0	12,164.0	9,055.5	3,108.4	2,074.0	2,074.0
81	13,666.0	12,690. 0	9,415.2	3,274.5	2,225.0	2,225.0
82	14,398.0	13,126.0	9,755.4	3,370.2	2,364.0	2,364.0
83	15,294.0	13,908.0	10,484.1	3,423.4	2,478.0	2,478.0
84	14,655.0	13,245.0	9,800.0	3,445.0	2,374.0	2,374.0
85	14,449.0	13,136.0	9,742.4	3,394.0	2,311.0	2,311.0

Note: 1/: Excluded MERALCO plant.

2/: All generation had been taken over by NPC.

3/: Generation level, including MERALCO.

Table 6.3 · STATUS OF ENERGIZATION
(As of December 31, 1984)

	Municipalities[1/]		Barangays[2/]		House Connections		
	Coverage	Energezed	Coverage	Energized	Potential	Actual	%
I	164	150	3,629	2,973	592,000	394,594	67
II	108	92	2,442	1,235	372,000	151,318	41
III	122	122	2,267	1,931	854,000	692,209	81
IV-A	17	17	-	-	1,246,000	1,137,187	91
IV-B	195	182	3,251	1,951	1,093,000	721,652	66
V	108	98	3,296	1,902	551,000	234,916	45
Total	714	661	14,885	9,992	4,708,000	3,331,896	71
Total Phillippine	1,493	1,356	34,161	18,218	8,317,000	4,609,145	55

Source: NEA, Status of Program Implementation, As of December 1984

Remarks: 1/: Covers only franchise area of electric systems, does not include areas outside franchise areas of electric systems.

2/: Covers only barangays in franchise areas of electric cooperatives, does not include barangays in franchise areas of Meralco and other private/ provincial/municipal systems.

Table 6.4 PEAK POWER DEMAND OF DAY AND NIGHT TIME OF LUZON GRID (Jan. to Dec., 1986)

(Day)	(JAN) Day Time	(JAN) Night Time	(FEB) Day Time	(FEB) Night Time	(MAR) Day Time	(MAR) Night Time	(APR) Day Time	(APR) Night Time	(MAY) Day Time	(MAY) Night Time	(JUN) Day Time	(JUN) Night Time	(JUL) Day Time	(JUL) Night Time	(AUG) Day Time	(AUG) Night Time	(SEP) Day Time	(SEP) Night Time	(OCT) Day Time	(OCT) Night Time	(NOV) Day Time	(NOV) Night Time	(DEC) Day Time	(DEC) Night Time
1	1168	1826	2002	2097	1846	2000	2192	2242	1817	1972	1618	1852	2248	2218	2095	2159	2125	2155	2227	2283	1422	1745	1795	2004
2	1262	1955	1561	1862	1614	1827	2193	2318	2221	2203	2241	2284	2112	2148	1898	2041	1801	1856	2221	2317	1456	1934	2238	2355
3	1923	2052	2099	2227	2001	2127	2244	2309	1978	2204	2323	2294	2112	2128	1688	1853	2003	2012	2126	2233	2193	2345	2245	2361
4	1778	1938	2116	2179	1998	2005	2242	2282	1821	1908	2308	2227	2103	2093	2183	2221	2046	2125	1948	2088	2239	2359	2213	2325
5	1442	1795	2142	2114	1987	2003	1943	2035	2309	2242	2286	2226	2064	2125	2103	2244	2118	2128	1264	1762	2271	2304	2154	2343
6	1946	2012	1708	1982	2012	2145	1673	1894	2081	2113	2243	2248	1984	1997	2126	2143	1921	2078	1680	1851	2252	2412	1581	2100
7	1932	1995	1472	1730	2012	2000	2169	2096	2338	2345	2075	2162	2125	2078	2249	2122	1703	1939	1912	2100	2275	2358	1531	1973
8	1846	2002	1646	1929	1878	2041	2002	2105	2361	2341	1676	1554	2018	1977	2221	2133	2183	2288	2123	2218	2041	2251	2141	2304
9	1846	1965	1453	1810	1485	1513	2238	2242	2346	2314	2333	2335	1748	1636	1891	2055	2283	2242	2288	2228	1657	1973	2054	2310
10	1888	2012	2048	2138	2089	2245	2193	2241	2123	2108	2356	2356	1238	1616	1628	1984	2171	2262	2136	2198	2243	2402	2097	2317
11	1758	1944	2062	2100	2151	2252	2204	2328	1973	1907	2343	2364	1951	2011	2198	2274	2196	2172	1903	2154	2256	2326	2106	2318
12	1638	1823	2052	2129	2171	2198	2043	2171	2295	2325	1985	2044	1947	2037	2258	2196	2248	2246	1565	1796	2173	2258	2129	2319
13	2034	2159	2091	2098	2195	2249	1542	1933	2345	2331	2319	2300	1584	1814	2218	2192	2018	2181	2058	2188	2128	2273	1851	2192
14	2042	2103	1632	2053	2408	2342	2225	2258	2331	2157	2102	2216	2083	1975	2238	2134	1731	1939	2128	2293	2128	2269	1754	1995
15	2044	2212	1699	1865	1931	2264	2262	2313	2148	2211	1819	1839	2152	2166	2195	2182	2141	2217	2284	2388	1986	2148	2188	2315
16	2034	2124	2091	2077	1815	2005	2283	2281	2295	2206	2258	2158	2115	2218	1901	1992	2218	2225	2185	2352	1523	1968	2159	2335
17	2022	2056	2083	2176	2237	2302	2258	2342	2048	2006	2284	2238	2122	2194	1493	1885	2155	2164	2224	2262	2136	2249	2172	2302
18	1908	2008	2021	2156	2222	2266	2279	2318	1882	1909	2256	2270	2134	2152	2188	2263	2161	2198	2025	2155	2184	2332	2204	2351
19	1429	1752	2168	2248	2165	2318	2068	2222	2212	2273	2256	2122	1981	2018	2147	2278	2144	2116	1568	1831	2237	2352	2141	2352
20	1956	2143	2146	2228	2288	2248	1965	2082	2254	2248	2281	2221	1573	1852	2212	2218	1885	2032	2088	2225	2154	2287	1918	2188
21	2085	2102	2126	2182	2223	2272	2315	2328	2308	2291	2055	2218	2283	2186	2018	2148	1735	1833	2229	2331	2241	2485	1625	1926
22	2089	2146	1883	2041	1981	2157	2318	2352	2313	2244	1832	1981	2152	2134	1811	2156	2154	2219	2051	2223	2272	2292	2012	2128
23	1983	2116	1216	1858	1796	1922	2332	2074	2257	2268	2086	2038	2157	2202	1995	2184	2232	2293	2198	2292	1845	2074	1978	2154
24	1938	2081	1838	1941	2148	2222	2388	2433	1874	2065	2141	2153	2172	2284	1986	1862	2138	2252	2172	2272	2295	2387	1838	1928
25	1841	1982	1842	1762	2158	2232	2288	2254	1853	1813	2069	2028	2154	2246	2121	2021	2242	2256	1543	2161	2168	2481	1902	1729
26	1455	1738	1858	1888	2128	2138	1998	2235	2153	2265	2183	2023	1819	2053	2151	2128	2242	2247	1823	2008	2102	2413	1508	1963
27	2088	2102	1998	2118	1581	1758	1923	1926	2113	2184	1822	1988	1855	1842	2128	2285	1998	2187	2188	2385	2146	2323	1722	2011
28	2053	2122	1987	2188	1375	1618	2278	2288	2278	2156	1781	1958	2158	2261	2095	2168	1998	2043	2245	2343	2145	2324	1525	1899
29	2056	2088			1647	1834	2324	2333	2238	2261	1813	2018	2158	2203	2162	2145	2225	2258	2236	2363	2081	2227	1869	2038
30	2184	2173			1618	1848	2288	2264	2302	2258	2052	2078	2174	2163	1954	2048	2256	2256	2183	2263	1758	1943	1551	1864
31	2159	2192			2087	2235			2017	2191			2186	2153	1689	1858			1736	2023			1488	1848
Mean:	1871	2025	1912	2041	1957	2102	2153	2284	2158	2192	2102	2142	2034	2066	2036	2116	2072	2145	2038	2172	2068	2248	1920	2158

Remark: Figure with underline shows to exceed its night time peak.

Table 6.5 GDP, GRDP LUZON & NCR AND THEIR PER CAPITA, AT 1972 CONSTANT PRICE

Year	Philippines			Luzon Grid			NCR		
	GDP	Population	Per capita	GRDP	Population	Per capita	GRDP	Population	Per capita
(Unit:	Peso 10^6	10^3	Peso	Peso 10^6	10^3	Peso	Peso 10^6	10^3	Peso)
1970	51,014	36,684	1,391		19,688			3,967	
1971	53,526	37,862	1,414	32,686	20,269	1,613	14,094	4,150	3,396
1972	56,075	38,914	1,441	35,417	20,868	1,697	16,690	4,341	3,845
1973	60,931	39,995	1,523	38,957	21,487	1,813	19,012	4,541	4,187
1974	64,139	41,106	1,560	40,963	22,128	1,851	20,184	4,751	4,248
1975	68,361	42,071	1,625	43,504	22,790	1,909	21,527	4,970	4,331
1976	72,962	43,406	1,681	46,844	23,411	2,001	22,754	5,148	4,420
1977	77,990	44,584	1,749	49,932	24,049	2,076	24,436	5,332	4,583
1978	82,797	45,794	1,808	52,684	24,708	2,132	25,729	5,523	4,658
1979	88,346	47,037	1,878	55,843	25,383	2,200	27,476	5,721	4,803
1980	92,706	48,098	1,927	59,184	26,081	2,269	29,224	5,926	4,931
1981	96,207	49,401	1,947	61,878	26,901	2,300	30,521	6,155	4,959
1982	98,999	50,740	1,951	63,272	27,611	2,292	31,511	6,345	4,966
1983	100,120	52,055	1,923	64,458	28,336	2,275	32,383	6,540	4,952
1984	95,619	53,351	1,792	60,025	29,078	2,064	28,895	6,739	4,288
1985	97,967	54,668	1,792	61,280	29,832	2,054	29,185	6,942	4,204
1986	100,828	56,004	1,800	62,705	30,598	2,049	29,505	7,147	4,128
1987	104,362	57,356	1,820	64,358	31,376	2,051	29,874	7,354	4,062
Compound Annual Growth Rate (Unit: %)									
70/75	6.03	2.78	3.16	7.41 1/	2.97	4.30 1/	11.17 1/	4.61	6.27 1/
75/80	6.28	2.71	3.47	6.35	2.73	3.52	6.30	3.58	2.63
80/83	2.60	2.67	-0.07	2.89	2.80	0.09	3.48	3.34	0.14
70/83	5.32	2.73	2.52	5.82 2/	2.84	2.91 2/	7.18 2/	3.92	3.19 2/
83/84	-4.50	2.49	-6.81	-6.88	2.62	-9.27	-10.77	3.04	-13.41
84/87	2.96	2.44	0.52	2.35	2.57	-0.21	1.12	2.95	-1.79

Remark: 1/: 71/75 2/: 71/83

Source: Philippine Statistical Yearbook 1984, NEDA, August 1984 and Updated Philippine Development Plan, 1984-1987, NEDA, Sept. 1984

Table 6.6 ANNUAL POWER SALES FOR LUZON AND NCR

(Unit: GWH)

Year	POWER SALES by National Power Corporation					
	Luzon					
	Total	Utility	Industry	Misc.	MERALCO	Provincial
1970	6,047	3,301	2,451	295	5,016	1,031
1971	6,597	3,466	2,694	437	5,289	1,308
1972	7,133	3,736	2,831	566	5,646	1,487
1973	7,725	4,015	3,078	632	6,082	1,643
1974	7,805	3,862	3,256	687	5,969	1,836
1975	8,586	4,328	3,495	763	6,443	2,143
1976	9,200	4,590	3,788	822	6,931	2,269
1977	9,813	5,130	3,925	758	7,631	2,182
1978	10,595	5,674	4,193	728	8,096	2,499
1979	11,304	6,136	4,529	639	8,573	2,731
1980	12,163	6,754	4,766	643	9,055	3,108
1981	12,690	7,371	4,710	609	9,415	3,275
1982	13,125	7,990	4,637	498	9,755	3,370
1983	13,908	8,722	4,813	373	10,484	3,424
1984	13,245				9,800	3,445
1985	13,136				9,742	3,394
Total:	163,092				123,927	39,145
Share (%)	100.0				76.0	24.0

Compound Annual Growth Rate (Unit: %)

70/75	7.26	5.57	7.35	20.93	5.13	15.76
75/80	7.21	9.31	6.40	- 3.36	7.04	7.72
80/85	1.55				1.47	1.78
70/85	5.30				4.52	8.27

Table 6.7 POWER TARIFF OF MERALCO (as of Feb. 1986)

No.	Type of Consumers & Tariff Code	Generation Charge 1/ (Demand Charge + Energy Charge)		Distribution Charge 2/ 4/ (Demand Charge + Energy Charge)	
1.	Residential Service				
		1st 10 kWh	₱2.60	1st 130 kWh	0.00/kWh
		Next 40 kWh	0.26/kWh	Next 70 kWh	0.12/kWh
		Next 80 kWh	0.25/kWh	Next	0.53/kWh
		Next	1.9850/kWh 3/		
2.	General Service (Small Scale, Commercial and Industries and Social) 5/				
	X-1 (Up to 5,000 W)	1st 10 kWh	₱3.40	1st 70 kWh	0.00/kWh
		Next 40 kWh	0.34/kWh	Next 20 kWh	0.12/kWh
		Next 20 kWh	0.28/kWh	Next	0.52/kWh
		Next	1.9850/kWh		
	X-MD (Over 5,000 W)	1.9850/kWh		₱12.60/kW/mo. 6/	1st 100H 0.51/kWh
					Next 100H 0.41/kWh
					Next 100H 0.37/kWh
					Next 0.33/kWh
3.	General Power (Large Scale, Commercial & Industries)				
	40 kW or more	1.9850/kWh		₱12.60/kWh/mo. 7/	1st 200H 0.42/kWh
		Minimum ₱900/mo.			Next 200H 0.39/kWh
					Next 100H 0.37/kWh
					Next 100H 0.36/kWh
					Next 0.35/kWh
4.	Government, Hospital & Metered Street-lightings				
	X-1 (Up to 5,000 W)	1st 10 kWh	₱2.60	(No Distribution Charge)	
		Next 40 kWh	0.29/kWh		
		Next 40 kWh	0.28/kWh		
		Next	0.27/kWh		
	X-MD (Over 5,000 W)	₱5.10/kW/mo.	1st 100H 0.29/kWh	(No Distribution Charge)	
			Next 100H 0.24/kWh		
			Next 0.23/kWh		
	40 kW or more	₱6.65/kW/mo.	1st 200H 0.23/kWh	(No Distribution Charge)	
		Minimum ₱450/mo.	Next 200H 0.21/kWh		
			Next 100H 0.20/kWh		
			Next 0.19/kWh		
5.	Flat Street-lighting Service				
	4,000 lm. open-type	₱20/lamp/mo.		(No Distribution Charge)	
	4,000 lm. enclosed-type	₱34/lamp/mo.			
	9,000 lm. open-type	₱32/lamp/mo.			
	9,000 lm. enclosed-type	₱46/lamp/mo.			
	16,000 lm. enclosed-type	₱56/lamp/mo.			

Note: 1/: Total cost of electricity purchased during a supply month + Franchise Tax.
2/: Income of MERALCO, shall be added 21.82% of currency exchange rate adjustment.
3/: Refer to "Generation Charge Clause"
4/: Refer to "Currency Exchange Rate Adjustment Clause"
5/: 22% discount on the distribution charge for school, culture and sports center, private hospital.
6/: Refer to "Billing Demand".
7/: Special discount on the distribution charge

a) Power factor adjustment: e.g. power factor = 0.9, multiple 0.981
b) Primary metering discount: 2.2% discount for measuring at the primary side of receiving substation.
c) Bulk service discount: in excess of 200 hours per month and demand exceeding 200 kW per month.

Source: MERALCO Utility Economic Division

Table 6.8 POWER DEMAND PROJECTION FOR LUZON ISLAND

Year	Energy Sales (GWH)	Generation Level 1/	
		Energy (GWH)	Demand (MW)
1986	13,372	14,714	2,400
87	13,908	15,304	2,496
88	14,518	15,975	2,605
89	15,305	16,841	2,746
90	16,317	17,954	2,928
91	17,219	18,947	3,090
92	18,143	19,964	3,256
93	19,119	21,038	3,431
94	20,162	22,185	3,618
95	21,250	23,382	3,813
96	22,382	24,628	4,016
97	23,566	25,931	4,229
98	24,834	27,326	4,456
99	26,169	28,795	4,696
2000	27,605	30,375	4,954
1	29,090	32,009	5,220
2	30,661	33,738	5,502
3	32,283	35,523	5,793
4	34,019	37,433	6,105
5	35,827	39,422	6,429

1/: Derived from the sales figures assuming a load factor of 70% and total system loss of 9.12%.

Table 6.9 CRITERIA FOR GENERATION AND TRANSMISSION PLANNING

The National Power Corporation aims to provide an acceptable level of electricity service to the community at minimum cost to the consumer.

To attain this level of service, SPD has adopted the following planning criteria which have evolved through the years:

(1) Generation Planning:

- The chance of not being able to meet the load, determined by reliability studies, is one day in one year.
- Reserve margin equal to the largest unit on line must be provided. Maintenance schedule of generating units should be considered.

(2) Transmission Planning:

- No element of the system must be overloaded under normal system condition.
- Voltage at all busses must be within ±5% of its nominal value.
- An outage of any single transmission system component should not overload any element by more than 110%.
- The system must remain in synchronism (stable) after the occurence of a three-phase fault which is assumed to be cleared in 100 milliseconds.
- Frequency deviation of ±1% is to be maintained.

Table 6.10 POWER EXPANSION PROGRAM OF LUZON GRID

Year	Project	Construction	
		Start	Commissioning
1986	-	-	-
1987	Rehabilitation of Malaya 1 & 2 (300 & 350 MW)	1986	1987
	Extra High Voltage - South I Naga-Kalayaan (230 KM, 500 KV)	1984	3/1987
1988	Bauang-Labrador (113 KM, 230 KV)	1985	1988
1989	Extra High Voltage - South II Kalayaan-San Jose (97 KM, 500 KV)	1986	1989
1989	Stage 1 - Rehabilitation Luzon Transmission Lines	1987	1989
1990	Rehabilitation of Sucat 1 (150 MW)	1989	1990
	Rehabilitation of Sucat 4 (300 MW)	1989	1990
1991	Bac-Man (2 x 55 MW)	1988	1991
	Bac-Man - Daraga (43 KM, 230 KV)	1990	1991
1992	Calaca II (300 MW)	1989	1992
	Calaca 230 KV Lines	1990	1992
1993	Isabela-Santiago (40 KM, 230 KV)	1991	1993
	Extra High Voltage - North 1 San Jose-Munoz-Santiago (247 KM, 500 KV)	1990	1993
	Isabela 1 & 2 (200 MW)	1989	1993
	Pantay (23 MW)	1988	1993
	Pantay-Dolores (14 KM, 115 KV)	1992	1993
1994	Isabela 3 (100 MW)	1991	1994
1995	Casecnan (268 MW)	1988	1995
	Casecnan 230 KV Lines	1993	1995

Source: Power Development Program (30 May, 1986) by SPD of NPC

Remark: Projects above dotted lines are on-going projects.

Table 6.11 GENERATION EXPANSION PROGRAM OF LUZON GRID

Comm. Year	Plant Addition	Plant Cap (MW)	Installed Capacity (MW)						Dep. Cap. (MW)	Peak Demand (MW)	O.S.[1] (MW)	Lolp[2] Days/ Year	System Dispatch (GWH)						System[4] Reqt. (GWH)	Unserved Energy GWH
			Hydro	Geo	Coal Ther	Nuc	Oil Ther	Total					Hydro[5]	Geo	Coal Ther	Nuc	Oil Ther	Total[6]		
1985	Existing Hydro	1226[7]	1216	660	300	-	1925	4111	3105	2311	794	-	2869	4284	1471	-	5825	14449	-	-
	Existing Geo	660																		
	Existing Oil	1925																		
	Existing Coal	300																		
1986	-		1226	660	300	-	1925	4111	3105	2335	778	0.05	2559	4597	1678	-	5557	14391	14319	-
1987	Rehab Mal 1-2	658	1226	660	300	-	1925	4111	3195	2382	813	0.04	2751	4223	1836	-	5836	14646	14685	0.1
1988	-	-	1226	660	300	-	1925	4111	3195	2477	718	0.10	2751	4223	1836	-	6401	15211	15198	0.2
1989	-	-	1226	660	300	-	1925	4111	2985	2601	384	0.40	2751	4223	1836	-	7156	15966	15949	0.9
1990	Rehab Sucat 1	150[8]	1226	660	300	-	1925	4111	3285	2757	520	0.80	2751	4223	1836	-	8007	16817	16907	2.0
	Rehab Sucat 4	300																		
1991	Bacon Manito	110	1226	770	300	-	1925	4221	3387	2923	464	0.76	2751	4974	1836	-	8386	17947	17921	2.0
1992	Calaca II	300	1226	770	600	-	1925	4521	3672	3098	574	0.66	2751	4974	3668	-	7627	19020	18996	1.8
1993	Isabela 1-2	200	1249	770	800	-	1925	4744	3882	3284	598	0.74	2905	4974	4888	-	7486	20165	20135	2.0
	Pantay H.E	23																		
1994	Isabela 3	100	1249	770	900	-	1925	4844	3977	3481	496	1.68	2905	4974	5500	-	8017	21396	21343	5.0
1995	Casecnan	268	1517	770	900	-	1925	5112	4164	3689	475	1.46	4284	4974	5500	-	7901	22659	22623	4.4

Source: Power Development Program (30 May, 1986) by NPC

Remarks:
1/: Refers to Outage Space reserve for Scheduled Maintenance and Unscheduled Outages of Generating Units
2/: Based on water inflow values measured one standard deviation from the mean of a normally distributed inflow record.
3/: 1985 are actual figures. 1986 are budget figures. Figures for 1987 and beyond are results of computer simulation by SPD.
4/: Excludes pumping requirement for Kalayaan 1 and 2.
5/: Excludes generatin of pumped storage stations. Figures for 1987 and beyond are based on the average inflow values of the last five years.
6/: Energy difference between total dispatch and system requirement is chargeable against losses for operation of pumped storage facilities.
7/: Includes Kalayaan 1 and 2 (2 x 150 MW).
8/: Scat 1 rehabilitation starts in July 1989; recommissioning in Jan. 1998.
Scat 4 rehabilitation starts in Nov. 1989; recommissioning in July 1998.

Table 6.12 RETIREMENT SCHEDULE OF OIL-FIRED THERMAL PLANTS OF LUZON GRID

Plant	(MW)	Year
Manila 1	100	1995
Manila 2	100	1995
Sucat 1	150	1998
Sucat 2	200	2000
Sucat 3	200	2001
Sucat 4	300	2002
Bataan 1	75	2002
Bataan 2	150	2007
Malaya 1	300	2005
Malaya 2	350	2009

Table 7.1 MAP STUDY - CRITERIA FOR GENERAL DEVELOPMENT PLAN (1/2)

Item	Guideline/Criteria for Planning
Maximum dam crest	- Max. dam height assumed by highest high water level and free board or at a height where the ridge thickness is 500 m, whichever is the lower.
Saddle dam	- Not considered in this study, except for schemes already proposed.
River width	- If river width not shown on map: Catchment less than 200 km² : 10 m Catchment less than 500 km² : 20 m Catchment larger than 500 km² : 30 m - To measure the width on map if the river is shown in double lines.
Dam Type	- In initial planning, rockfill dam to be considered.
Damsite Valley	- Damsite topography in terms of crest length to be preferably in the following ranges : Dam Height (m) — Crest Length (m) 50 — 250 ± 100 — 500 ± 200 — 800 ±
Intake	- Min. distance from weir/dam axis: Run-of-river : 20 m upstream of weir axis Dam + Waterway : 50 m upstream of dam axis
Headrace Tunnel	- Principally, pressure tunnel to be considered. Open channel proposed only

(to be continued)

Table 7.1 MAP STUDY - CRITERIA FOR GENERAL DEVELOPMENT PLAN (2/2)

Item	Guideline/Criteria for Planning
	for the cases where tunnel is apparently not applicable (flat topography on bank at intake level, or shallow tunnel coverture)
	- Min. tunnel coverture : 50 m along ridge, 25 m at creek
Surge Tank	: - Select the location on the well-formed slope, at a height corresponding to the proposed dam (weir) site level or max. dam crest
Penstock	: - Assume principally underground pressure shaft.
	- Select the route along well-formed/ sufficiently wide ridge.
Powerhouse	: - Basically, open-air powerhouse to be considered in initial planning.
Access Road	: - Determine approximate road route, from the existing road to site (on 1:50,000/ 1:250,000 map).
	- Road route to be along river valley as far as possible.
	- Length of access road :
Transmission Line	: - Determine approximate line route on 1:250,000, map from powerhouse to nearest major town where a receiving substation is expected.
	- Length of transmission line: Length measured on map x 1.2

Table 7.2 STANDARD OF GEOLOGIC ASSESSMENT

	Damsite	Waterway/ Power Tunnel	Power House	Reservoir	Construction Materials	
					Location	Quality
Excellent	A site of which possibility of construction of a concrete dam with normal foundation treatment.	Hard rock without any problem. (No supporting, No lining).	Geologically, the best site with thin overburden and hard rock.	A reservoir without any special geological problem.	Near (Less than 5 km)	Hard rock (Fresh, joints are closed tightly, no weathering) clear sound is emitted when hammered
Good	A site of which possibility of construction of a rock fill dam with normal foundation treatment.	Hard or rather hard rock with a little problem (Partial supporting, lining without reinforce)	A site without any geological problem.	A reservoir having a little geological problem.	Far (Between 5 and 10 km)	Rather hard (Slightly weathered, joints some times contain other minerals) A slightly dull sound is emitted when hammered.
Acceptable	A site of which possibility of construction of a rock fill dam with some special foundation treatment.	Hard, rather hard or rather soft rock with some problems; soft rock with a little problem or without any problem (Full length supporting, lining with partial reinforce)	A site for which some special execution of work will be required.	A reservoir having some geological problems such as leakage or land-slide, but not serious (such difficulty can be cleared by special treatment or countermeasure)	Very Far (Between 10 and 20 km)	Soft rock (Moderately weathered, joints some times contain clay) A dull sound is emitted when hammered.
Poor	A site with poor geological conditions (not recommendable due to some geological defects).	Soft rock with some problems (Heavy supporting, lining with heavy reinforce)	Not recommendable due to some geological defects.	Not recommendable due to some geological defects, such as big leakage through limestone zone and big scale of landslide areas around the reservoir.	Not recommendable (Over 20 km)	Not recommendable (due to strong weathered) A very dull sound is emitted when hammered.

Table 7.3 GEOLOGIC ASSESSMENT (1/3)

No.	Project ID	Scheme	Type	Coordinates Lat. (N)	Coordinates Long.(E)	Study Level	Lithology	Assessment: Dam site	Water way	Power house	Reservoir	Material
1	1-2-0-1	Rizal	1	16°23'10"	120°26'00"	GM	Cg	B/C	-	B	B	B/C
2	1-3-0-1	Bagulin	1	16°36'10"	120°28'44"	GM	Cg,SS	C	-	B	B	C/D
3*	1-3-0-2	Naguilian	2	16°30'37"	120°33'55"	FT	LS,SS,Cg	C	B	C	C	A
4	1-10-0-1	Luya	1	16°47'55"	120°32'09"	GM	Cg,SS,Wa	A/B	-	B	B	A
5*	1-10-0-2	Bakun	2	16°48'49"	120°38'50"	GM	Cg,SS,Wa	A	B	B	A	A
6	1-10-1-3	Tibunac	1	16°52'14"	120°32'52"	GM	Cg,SS,Wa	B	-	B	B	A
7*	1-10-1-4	Amburayan	2	16°36'53"	120°37'54"	FT	LS,Cg,SS	C/D	C	B	C	A
8	1-11-0-1	Uso	1	16°58'26"	120°32'17"	GM	Cg,SS,Wa	B	-	B	B	A
9	1-11-0-2	Chico-R	2	16°59'27"	120°35'00"	GM	Cg,SS,Wa	B	B	B/C	B	A
10*	1-22-0-1	Banaong	1	17°33'30"	120°28'18"	FT,GM	Ms,Qd,Sh	B	-	B	B	A
11	1-22-0-2	Langiden	1	17°40'50"	120°32'30"	GM	Ms	B	-	B	B	A
12	1-22-0-3	Bandi	1	17°43'10"	120°38'40"	GM	Cg,Wa,Da	B/C	-	B	B	A
13	1-22-0-4	Alip	1	17°47'00"	120°42'20"	GM	LS,An	D	-	B	C	B
14*	1-22-0-5	Supo	1	17°14'42"	120°40'36"	GM	Mv	B	-	B	B	A
15*	1-22-0-6	Eteb	1	17°10'42"	120°40'22"	GM	Mv	B/C	-	B	B	A
16	1-22-0-7	Buncit	1	17°05'18"	120°44'00"	GM	Cg,SS,An	C	-	B	B/C	B
17	1-22-0-8	Upper Buncit	1	17°03'30"	120°44'45"	GM	Cg,SS,An	C	-	B	B/C	B
18	1-22-0-9	Dayapan	1	16°55'10"	120°44'12"	GM	An,Qd	B/C	-	C	B	A
19*	1-22-0-10	Abra	2	16°50'44"	120°43'52"	GM	Qd,Cg,Mv	A	B	B	A	A
20	1-22-1-11	Naglibacan	1	17°51'30"	120°53'00"	GM	Da,Qd	B	-	B	B/C	A
21	1-22-1-12	Tineg-1	1	17°47'00"	120°47'00"	GM	Da,LS,An	B	-	B	B	A
22	1-22-1-13	Tineg-2	1	17°48'30"	120°52'00"	GM	Da,LS,An	B	-	B	B/C	B
23	1-22-1-14	Tineg-3	1	17°47'20"	120°57'35"	GM	Da,Qd	B/C	B	B	B	A
24	1-22-2-15	Binongan-R	2	17°38'48"	120°58'53"	GM	An,Qd	A	B/C	B	A	A
25	1-22-3-16	Paganao	1	17°39'50"	120°49'14"	GM	An,Da	B	-	B	B	A
26	1-22-3-17	Malanas(licu-ano)	1	17°37'00"	120°54'00"	GM	An,Da,Qd	C	-	B	B	A
27	1-22-4-18	Taping	1	17°33'55"	120°46'50"	GM	An,Da,LS	C	-	B/C	B	B
28	1-22-5-19	Upper Mangu-yepyep	1	17°26'50"	120°47'07"	GM	An,Qd,Da	C/D	-	B	C	B
29	1-22-5-20	Bucloc	1	17°26'34"	120°52'04"	GM	An,Qd,Gd	C	-	B	B	B
30	1-22-5-21	Daguioman	1	17°27'25"	120°55'00"	GM	Qd,Gd,An	C	-	B	B	B
31	1-22-5-22	Boyan	1	17°24'47"	120°46'36"	GM	Qd,Gd,An	B	-	B	B	A
32	1-22-5-23	Ikmin	2	17°22'48"	120°48'25"	GM	Qd,Gd,An	B	B/C	B	B	A
33	1-22-5-24	Toqueng	1	17°22'46"	120°49'53"	GM	Da,Qd,Gd	B/C	-	B	B/C	A
34	1-22-5-25	Danac	1	17°23'05"	120°52'38"	GM	Qd,An	C/D	-	B	C	B
35	1-22-6-26	Amluagan	1	17°18'35"	120°43'00"	GM	Cg,Wa,Mv	B	-	B	B	A
36	1-22-6-27	Damanit	2	17°20'31"	120°49'39"	GM	Qd,An	C	C	B	B	A
37	1-22-6-28	Naina	1	17°15'37"	120°43'20"	GM	Qd,Gd,Mv	A	-	B	B	A
38	1-22-6-29	Utip	2	17°15'17"	120°49'32"	GM	Qd,Gd,Mv	A	B	B	B	A
39	1-22-7-30	Kumanga	1	17°11'10"	120°43'24"	GM	Qd,Gd,Mv	B	-	B	B	A
40	1-22-3-31	Sasuyan	1	17°07'30"	120°44'20"	GM	Mv	B	-	B	B	B
41	1-37-0-1	Dingras	1	18°00'29"	120°45'39"	GM	Qd,Ga,An	B	-	B	B	A
42	1-39-0-1	Vintar	1	18°22'00"	120°44'30"	GM	Cg,SS,Sh	C	-	C/D	B	B/C
43	1-39-0-2	Tandagan	1	18°18'05"	120°47'20"	GM	Cg,SS,Sh	B	-	B	B	B/C
44	1-47-0-1	Bulu	1	18°31'08"	120°50'52"	GM	Ms,Mv	B/C	-	B	B	A
45	1-47-0-2	Bulu	2	18°28'48"	120°52'54"	GM	Ms,Mv	B	B	B	B	A
46	2-5-0-1	Luna	1	18°26'50"	121°14'00"	GM	Cg,Wa,Sh	B	-	B	B	A
47	2-5-0-2	Zimigui	1	18°24'45"	121°12'06"	GM	Cg,Wa,LS	B	-	B	D	A
48*	2-6-0-1	Sisiritan	1	18°09'42"	121°21'00"	GM,GP	LS,SS,SLT	C/D	-	B	D	B
49*	2-6-0-2	Bubulayan	1	18°06'18"	121°18'18"	GM,GP	LS,Ba	D	-	B	D	B
50*	2-6-0-3	Bulu	1	18°02'30"	121°13'00"	GM,GP	An,Di	C/D	-	B/C	C	A
51*	2-6-1-4	Nababarayan	1	18°02'00"	121°08'00"	GR,GP	An,Di	B	-	B/C	C	B
52*	2-6-1-5	Dibagat	1	18°05'20"	121°07'17"	GR,GP	An,Di,Ag	B	-	B	B	B
53*	2-6-1-6	Agbulu	1	18°08'20"	121°05'00"	GR,GP	An,Di,Ag	B	-	B	B	B
54	2-6-1-7	Aoan	1	18°15'30"	120°00'20"	GM	Qd,Mv	A	-	A	A	B

(to be continued)

Table 7.3 GEOLOGIC ASSESSMENT (2/3)

No.	Project ID	Scheme	Type	Coordinates		Study Level	Lithology	Assessment				
				Lat. (N)	Long. (E)			Dam site	Water way	Power house	Reser-voir	Mate-rial
55*	2-6-1-8	Apayao	2	18°19'18"	120°58'53"	GM	Mv,Qd,LS	A	B	B	A	A
56	2-8-1-1	Zinundugan	1	17°59'45"	121°27'25"	GM	LS,SS	C/D	-	B	C	B
57	2-8-2-2	Capisayan	1	18°03'06"	121°51'15"	GM	SS,Cg	C	-	C	C	B
58	2-8-3-3	Basao	1	17°14'32"	121°07'30"	GR,OS	Ag,Ba	B	-	C	B	B
59*	2-8-3-4	Chico-1R	2	17°11'10"	121°03'53"	GM	Ag,Ba	B	B	B	B	A
60*	2-8-3-5	Sadanga	1	17°08'53"	121°03'08"	GR,OS	Ag,Ba	A	-	A	B	A
61*	2-8-3-6	Chico-2R	2	17°06'56"	129°01'30"	GM	Cg,Ba	A	C	C	B	A
62*	2-8-3-7	Chico-3R	2	17°06'01"	120°59'27"	GM	Ba,Gd,VL	B	B	B	B	A
63	2-8-3-8	Bontoc	1	17°04'18"	120°56'30"	GR,OS	Da,Ba	B	-	B	B	A
64*	2-8-3-9	Chico-4R	2	17°01'46"	120°56'23"	GM	Ba,Da,Ag	A	B	B	B	A
65	2-8-4-10	Matalag	1	17°49'53"	121°24'17"	GM	SS,Cg	B/C	-	B	B	C
66	2-8-4-11	Nabuangan	2	17°42'15"	121°13'41"	GM	An,Da,Gd	C	C	B	B	A
67	2-8-5-12	Pinukpuk	1	17°37'25"	121°22'58"	GM,OS	Cg,SS	B/C	-	B	B	C
68	2-8-5-13	Adaga	1	17°30'15"	121°16'20"	GM,OS	Sh,SS,Cg	B	-	A	B	B
69	2-8-5-14	Saltan-4	1	17°30'30"	121°11'00"	GM,OS	SS,MS,Cg	A	-	A	B	A
70*	2-8-5-15	Saltan	2	17°30'14"	121°07'50"	GM	Qd,An,SS	A	B	B	B	A
71	2-8-5-16	Saltan-5	1	17°30'04"	121°07'00"	GM	Qd,An	B	-	A	B	A
72	2-8-5-17	Babaca-R	1	17°35'48"	121°19'06"	GM	SS,Cg,SLT	B/C	-	B	B	B
73	2-8-5-18	Babaca	2	17°35'06"	121°13'23"	GM	LS,An,SS	A	B	B	B	B
74	2-8-6-19	Neneng	1	17°23'15"	121°16'41"	GM	SS,Cg,Ag	B	-	B	B/C	B
75	2-8-6-20	Mt. Boltontoc	1	17°23'15"	121°09'30"	GM	CS,SLT,An	C	-	B	B/C	B
76	2-8-6-21	Lower Pasir	1	17°23'59"	121°12'38"	GM	SS,CS	B/C	-	B	B	B/C
77*	2-8-6-22	Pasil	2	17°20'28"	121°03'25"	GM	An,Da,VL	A	B/C	B	A	A
78*	2-8-6-23	Tanudan	2	17°10'15"	121°12'38"	GM	SS,Cg,Cs	B	B	B	A	B/C
79*	2-8-7-24	Bantay	1	17°54'52"	121°49'39"	GM	SS	C	-	B/C	B	D
80*	2-8-8-25	Dabba	1	17°42'05"	121°50'05"	GM,OS	LS,Wa,An	D	-	B	C	B
81	2-8-8-26	Dalaya	1	17°41'20"	121°55'40"	GM,OS	An,Da,Wa	A	-	B	A	A
82	2-8-8-27	Tugegarao	2	17°36'59"	122°03'23"	GM	Mv,Ms	A	B	B	A	A
83	2-8-9-28	Sanpablo	1	17°28'30"	121°55'00"	GM	Wa,SS,Sh	B/C	-	B	B	B
84	2-8-11-29	Tamauni-1	1	17°18'25"	121°57'38"	GM,OS	Ag,SS,Wa	B	-	B	B	A
85	2-8-12-30	Natonin	1	17°08'00"	121°30'10"	GM	Sh,SS,Gw	B/C	-	B	C	B
86	2-8-12-31	Pastor	1	17°05'53"	121°20'18"	GM	Sc,Wa,Ms	B	-	B	A	B
87	2-8-12-32	Tabuk	1	17°16'40"	121°31'00"	GM	SS,Cg,Sh	C	-	C	C	C
88	2-8-13-33	Banatao	1	17°18'06"	121°28'55"	GM	Sh,SS,Cg	B/C	-	C	C	B
89*	2-8-14-34	Maliano	1	16°44'36"	122°04'00"	GM,OS	An,Dq,SS	A/B	-	B	B	A
90	2-8-14-35	Ilagan-1	1	16°35'03"	122°01'19"	GM	Ba,An,Ag	B	-	B	A	A
91	2-8-14-36	Ilagan-2	1	16°30'13"	122°00'01"	GM	Cg,Wa,Gw	B	-	B	B	A
92	2-8-14-37	Dinapiqui	1	16°32'34"	122°08'24"	GM	GW,Qd,Ms	A	B/C	B	B	B/C
93	2-8-15-38	Ballasang	1	17°05'05"	122°03'03"	GM	An,Ba,Mv	B	-	B	B	A
94	2-8-15-39	Abuan-1	1	17°05'22"	122°07'58"	GM	An,Ba,Mv	B	-	B	B	A
95	2-8-16-40	Catalangan	1	16°59'24"	122°04'05"	GM	An,Ag,Mv	B	-	B	B	A
96	2-8-16-41	Disusuan	1	16°57'28"	122°06'07"	GM	SS,Cg,Ls	C	-	B/C	D	B
97	2-8-16-42	Mariano	1	16°51'56"	122°08'35"	GM	Cg,Wa,Ba	B	-	B	B/C	B
98	2-8-19-43	Alimit-1	1	16°46'30"	121°15'45"	GM,OS	Ag,An,Mv	A	-	B	A	A
99	2-8-19-44	Alimit-2	1	16°54'11"	121°16'22"	GM,OS	Ag,An,Mv	A/B	-	B	A	A
100	2-8-20-45	Hucab	1	16°44'36"	121°10'00"	FT	Ag,Ba,Ms	B/C	-	C	C	A
101*	2-8-20-46	Ibulao	2	16°46'19"	120°59'29"	GM	Mv,Ms,Wa	B	B	B	A	A
102	2-8-22-47	Matuno-1R	2	16°39'46"	121°01'51"	GM	Mv,Ms	A	B	B	A	A
103	2-8-22-48	Matuno-2R	2	16°32'34"	120°58'49"	GM	Mv,Cg,SS	B	C	B	B	A
104	2-8-22-49	Sta. Cruz	1	16°22'00"	121°02'00"	FT,GM	To,Ba,An	B	-	C	C	B
105	2-8-26-50	Pinaripad	1	16°27'56"	121°34'50"	GM,OS	Ag,An,SS	B/C	-	B/C	B	B
106	2-8-27-51	Dibuluan	1	16°25'56"	121°50'40"	GM	LS,Cg,SS	C/D	-	B	C	B
107*	2-8-28-52	Cabingatan	1	16°13'32"	121°37'31"	GM,OS	LS,Wa,Sh	D	-	B	D	B
108	2-8-28-53	Ganip	2	16°04'41"	121°20'23"	GM	LS,SS,Cg	C/D	C	B	C	B/C

(to be continued)

Table 7.3 GEOLOGIC ASSESSMENT (3/3)

No.	Project ID	Scheme	Type	Coordinates Lat. (N)	Coordinates Long.(E)	Study Level	Lithology	Assessment Dam site	Water way	Power house	Reser-voir	Mate-rial
109	2-8-29-54	Dakgan	1	16 03'04"	121 27'31"	GM,OS	An,Tb	B/C	-	B	B	B
110	2-8-29-55	Maddela	1	16 01'04"	121 27'33"	GM,OS	SS,An	A/B	-	B	B	A
111	2-8-29-56	Kagipsipan	1	16 01'29"	121 22'43"	GM,OS	An,Ba	A/B	-	A	A/B	A
112	2-8-29-57	Gadeng	1	16 01'30"	121 20'54"	GM,OS	SS,An,Ba	A	-	A	A/B	A
113*	2-8-29-58	Casecnan	2	16 03'21"	121 16'45"	GM	An,Ba	B	B	B	A	A
114*	2-8-29-59	Upper Casecnan	2	16 06'39"	121 15'39"	GM	An,Sh	B	B/C	B	B	A
115	2-8-29-60	Upper Casec-nan-2	1	16 06'45"	121 15'28"	GM	An,Sh	B	B	B	B	A
116*	2-8-29-61	Upper Casec-nan-3	1	16 08'09"	121 14'34"	GM	An,Da	C	B	C	B	A
117	2-32-0-1	Taboan	1	17 55'58"	122 07'50"	GM	Cg,SS,LS	B	-	B	D	B
118	2-39-0-1	Dikatayan	1	17 28'13"	122 09'52"	GM	GW,Ba,Ms	A	-	B	B	B
119	2-47-0-1	Palanan	1	16 55'15"	122 23'50"	GM	LS,Mv	D	-	B	D	B
120	3-13-0-1	Malupa	1	15 44'40"	121 21'30"	GM	Ba,An,Mv	B	-	B	B	A
121	3-23-0-1	Umiray-3	1	15 04'32"	121 21'35"	GM	Wa,Sh,LS	B	-	C	D	A
122	3-23-0-2	Upper Umiray	1	14 57'25"	121 21'39"	GM	Wa,Sh,LS	D	-	B	D	B
123	3-25-1-1	Catmon	1	15 02'35"	121 13'59"	GM	Qd,Ag	B/C	-	B	B	A
124	3-25-2-2	Balintingon	1	15 18'01"	121 07'19"	GM	Wa,An,Qd	B	-	B	B	A
125	3-25-2-3	Papaya	1	15 21'39"	121 10'26"	GM	Wa,An	B/C	-	B	B	B
126	3-25-3-4	Lubingan	1	15 31'00"	121 19'00"	GM	Mv,Sc	C	-	B	B	A
127	3-27-0-1	Gumain	1	15 01'30"	120 27'45"	GM	VL	C	-	C	B/C	B
128	3-77-0-2	Pila	1	15 44'37"	120 15'20"	GM	Gb,Db	B	-	B	B	A
129	3-77-0-3	San Nicolas	1	16 07'20"	120 46'50"	GM	SS,MS	C/D	-	B	B	C
130	3-77-0-4	Tabu	1	16 16'43"	120 44'33"	FT	Ms,Di	A	B	C	C	A
131	3-77-0-5	Agno-1	2	16 33'47"	120 47'55"	GM,OS	Mv,Qd	A	B	B	B	A
132*	3-77-0-6	Agno-2	2	16 37'25"	120 49'47"	FT,OS	Mv,SS,Cg	B	B	B	B	A
133*	3-77-0-7	Agno-3	2	16 40'42"	120 49'20"	FT,OS	Ag,Br,Cg	B	B	B	A	A
134	3-77-1-8	Camiling-1	1	15 33'29"	120 20'29"	GM	An,Pt,Db	B	-	B	B	A
135	3-77-1-9	Camiling-2	1	15 32'52"	120 18'22"	GM	Pt,Gb	A	-	A	B	A
136	3-77-4-10	Pampang	2	16 14'16"	120 48'16"	GM	SS,An,Qd	B/C	C	B	B	A
137*	4-7-0-1	Kanan	1	14 44'30"	121 31'54"	GR,OS	Cg,GW	B	-	B	B	A
138*	4-7-0-2	Daraitan	1	14 36'00"	121 26'10"	GR,OS	Ls,Wa	D	-	C	C	B
139	4-7-0-3	Upper Agos-1M	1	14 37'39"	121 24'24"	GR,OS	LS,Cg,Wa	D	C	B	C	B
140	4-7-0-4	Upper Agos-1S	1	14 38'15"	121 24'30"	GR,OS	LS,Wa,Sh	D	C	-	C	B
141*	4-7-0-5	Upper Agos-2	1	14 48'40"	121 30'42"	GR,OS	Cg,GW	A	-	B	B	A
142*	4-115-1-1	Wawa	1	14 43'30"	121 11'24"	GR,FT	LS,GW	C/D	-	B	C	A
143*	5-14-1-1	Bosigon	1	14 10'07"	122 38'54"	FT,GM	An,Ba	C/D	-	B	B	C/D
144	5-20-0-1	Pulantuna	1	13 52'01"	122 54'50"	GM	VL	C	-	B	C	B/C
145	2-8-0-x	Cagayan-1	1	16 22'07"	121 44'06"	FT	LS	D	-	C	D	B

Note: Type 1 : Dam & Reservoir
Type 2 : Run of River
*: Schemes Passed First Screening

Study Level:
FT = Field trip (visited site)
GR = Geologic Report (Previous Study)
OS = Overflight Survey by Helicopter
Non= Not yet Assessed
GM = Geologic Map Study
GP = Geophotographic Study

Geology:
SS = Sanstone
LS = Limestone
SLT = Siltstone
CS = Claystone
Ag = Agglomerate
Cg = Conglomerate
Qd = Quartz diorite
Mv = Meta-volcanics
Ms = Meta-sediments
Da = Dacite
An = Andesite
Ga = Gabbro
Ba = Basalt
Gd = Granodiorite
Sh = Shale
Dq = Diorite-quartz
Wa = Wacke
GW = Graywacke
Sc = Schist
VL = Volcanics
Db = Diabase
MS = Mudstone
Pt = Peridotite
Gb = Gabbro
Br = Breccia
Di = Diorite
Tb = Tuffbreccia
To = Tonalite

Assessment:
A = Excellent
B = Good
C = Acceptable
D = Poor

Table 7.4 MAP STUDY - EXTRACTION OF SCHEME DATA

Item	Scheme Data Extracted from Map
Scheme ID Information	- Scheme ID No - Name of scheme - Zone No. - Province - Project grade
Location	- River Basin - Stream - Coordinates - Catchment area
Hydrological Information	- Average annual basin rainfall - Stream gauge corelated
Topographical Information	- Type of development - Type of Waterway layout - Reservoir area (by EL) - Damsite valley section (by EL) - Maximum dam crest (by EL) - Tailwater level - Headrace tunnel length - Penstock length (horizontal) - Water transfer facilities
Access Road	- Length - Place of origin
Transmission Line	- Length - Place of destination (place of receiving substation)
Other Information	- Land use in reservoir - Resettlement requirement - Submergence of roads - General geology (information on geological map)
Comments	- Any noteworthy observation on map
Map No.	- Serial no. of map used for map study
Report	- Reference to previous study report

Table 7.5 SCHEMES NEWLY IDENTIFIED THRU MAP STUDY (RESERVOIR TYPE)

No.	Region No.	Scheme Name	River Name	Co-ordinate		Drainage Area (km^2)			Average Annual Rainfall (mm)	Power Output (MW)
				N-Lat.	E-Longi.	Gross	Direct	Indirect		
1.	II	Taboan	Taboan	17-55-58	122-07-50	332.1	332.1	-	3,337	50.3
2.	"	Babaca	Babaca	17-35-48	121-19-06	247.7	247.7	-	2,357	8.0
3.	"	Dikatayan	Dikatayan	17-28-13	122-09-52	222.2	222.2	-	4,440	117.5
4.	"	Lower Pasil	Pasil	17-23-59	121-12-38	371.0	371.0	-	2,500	56.0
5.	"	Abuan-1	Abuan	17-05-22	122-07-58	355.3	355.3	-	3,598	185.6
6.	"	Dinapiqui	Dinapiqui	16-32-34	122-08-24	95.0	81.4	13.6	2,467	58.3
7.	"	Ilagan-1	Pin. De Ilagan	16-35-05	122-01-19	413.7	413.7	-	2,845	208.4
8.	"	Ilagan-2	"	16-30-13	122-00-01	323.9	323.9	-	2,871	95.3
9.	"	Upper Casecnan-2	Casignan	16-06-45	121-15-28	243.0	243.0	-	2,250	64.0
10.	"	Upper Casecnan-3	"	16-08-09	121-14-34	172.1	172.1	-	2,250	70.0
11.	III	Catmon	Angat	15-02-35	121-13-59	254.0	218.0	36.0	2,250	4.6
12.	"	Upper Umiray	Umiray	14-57-25	121-21-39	211.4	211.4	-	5,164	216.1
13.	IV	Upper Agos-1M	Lenatin	14-37-39	121-24-24	136.0	136.0	-	3,799	44.7
14.	"	Upper Agos-1S	"	14-38-15	121-24-30	135.7	135.7	-	3,799	23.5
15.	"	Upper Agos-2	Kanan	14-48-40	121-30-42	286.4	286.4	-	5,798	135.2
16.	V	Bosigon	Labo	14-10-07	122-38-54	335.7	335.7	-	3,923	44.7

Table 7.5 SCHEMES NEWLY IDENTIFIED THRU MAP STUDY (RUN-OF-RIVER TYPE)

No.	Region No.	Scheme Name	River Name	Co-ordinate N. Lat.	Co-ordinate E. Longi	Drainage Area (km^2) Gross	Drainage Area (km^2) Direct	Drainage Area (km^2) Indirect	Average Annual Rainfall (mm)	Power Output (MW)
1.	I	Bulu-2	Bulu	18-28-48	120-52-54	129.7	129.7	0	4,000	7.5
2.	"	Binongan-R	Binongan	17-38-48	120-58-53	296.9	206.7	90.2	2,500	5.7
3.	"	Ikmin	Ikmin	17-22-48	120-48-25	192.8	147.8	45.0	2,500	10.2
4.	"	Damanit	Damanit	17-20-31	120-49-39	45.0	45.0	0	2,500	6.3
5.	"	Utip	Utip	17-15-17	120-49-32	144.2	144.2	0	2,750	11.4
6.	"	Chico-R	Chico	16-59-27	120-35-00	126.3	60.0	66.3	2,575	14.3
7.	"	Abra	Abra	16-50-44	120-43-52	107.1	107.1	0	3,000	10.7
8.	"	Bakum	Bakum	16-48-49	120-38-50	108.3	108.3	0	3,193	33.9
9.	"	Luya	Amburayan	16-40-21	120-34-00	403.0	403.0	0	3,400	39.6
10.	"	Amburayan	Amburayan	16-36-53	120-37-54	339.6	231.6	108.0	3,466	61.1
11.	"	Naguilian	Naguilian	16-30-37	120-33-55	134.3	134.3	0	3,769	37.2
12.	II	Apayao	Apayao	18-19-18	120-58-53	148.9	148.9	0	3,583	15.7
13.	"	Nabuangan	Matalag	17-42-15	121-13-41	121.4	78.8	42.6	2,664	3.9
14.	"	Tugegarao	Tugegarao	17-36-59	122-03-23	95.3	95.3	0	4,500	11.4
15.	"	Babaca	Babaca	17-35-06	121-13-23	134.9	134.9	0	2,446	6.3
16.	"	Saltan	Saltan	17-30-14	121-07-50	205.8	164.8	41.0	2,500	12.1
17.	"	Pasil	Pasil	17-20-28	121-03-25	208.1	166.2	41.9	2,500	20.0
18.	"	Tanudan	Tanudan	17-10-15	121-12-38	175.6	175.6	0	3,523	24.5
19.	"	Chico-4R	Chico	17-01-46	120-56-23	193.2	193.2	0	3,463	11.8
20.	"	Chico-3R	"	17-06-01	120-59-27	449.7	449.7	0	3,238	17.8
21.	"	Chico-2R	"	17-06-56	121-01-30	592.0	592.0	0	3,361	33.4
22.	"	Chico-1R	"	17-11-10	121-03-53	806.8	806.8	0	3,372	26.6
23.	"	Ibulao	Ibulao	16-46-19	120-59-29	159.1	150.7	8.4	2,827	16.3
24.	"	Matuno-1R	Matuno	16-39-46	121-01-51	177.3	177.3	0	2,714	9.2
25.	"	Matuno-2R	"	16-32-34	120-58-49	85.2	85.2	0	2,750	8.7
26.	"	Upper Casecnan	Casigunan	16-06-39	121-15-39	247.0	247.0	0	2,250	12.2
27.	"	Casecnan	"	16-03-21	121-16-45	286.4	286.4	0	2,250	11.2
28.	"	Ganip	Conwap	16-04-41	121-20-23	114.7	89.7	25.0	2,250	7.9
29.	III	Agno-3	Agno	16-40-42	120-49-20	195.7	144.3	51.4	2,885	9.3
30.	"	Agno-2	"	16-37-25	120-49-47	225.7	221.1	34.6	3,011	10.5
31.	"	Agno-1	"	16-33-47	120-47-55	347.1	347.1	0	2,941	4.6
32.	"	Pampang	"	16-14-16	120-48-16	192.7	192.7	0	2,629	6.3

Table 8.1 POWER OUTPUT CALCULATION CRITERIA (1/4)

	RUN-OF-RIVER SCHEME	RESERVOIR SCHEME
PLANT DISCHARGE		
1. Firm discharge	97.3% discharge evaluated on flow-duration curve (flow guaranteed throughout 97.3% period of a given long-term range). See Fig. 8.2.	Firm reservoir release (Q_f) interpolated on dimensionless storage-draft curve (See Fig. 8.1.). Reservoir capacity is determined against a 1/50 droughty year.
2. Max. Plant Discharge	$Q_p = f(DR)$ $DR = A_p / A_o$ where, DR : Discharge development ratio = 1.0, 0.9, 0.8,···DRmin (Ref. Sec. 8.2.2) DRmin : Discharge development ratio when plant peak discharge is identical to the long term average discharge Q_p : Max. plant discharge, i.e., installed capacity discharge (m^3/s) A_p : Turbinable flow which is equal to the area of flow duration curve under the line of the selected Q_p (See Fig. 8.2). A_o : Entire square area on Fig. 8.2. under the line of Q_p.	$Q_p = Q_f / C_f$ where, Q_p : Max.plant discharge (installed capacity discharge) (m^3/s) Q_f : Firm regulated discharge from reservoir (m^3/s) C_f : Ratio of firm discharge to peak discharge
3. Dependable Peak Discharge	If head pondage has diurnal regulating capacity : $Q_{dp} = Q_f / LF$ where, Q_{dp} : Dependable daily peak discharge (m^3/s) Q_f : Firm discharge (m^3/s) LF : Assumed load factor = 0.6 If no diurnal regulating capacity : $Q_{dp} = Q_f$	Same as max. plant discharge.

Table 8.1 POWER OUTPUT CALCULATION CRITERIA (2/4)

RUN-OF-RIVER SCHEME	RESERVOIR SCHEME
Operating Level and Head	
1. Operating Level	
(1) Minimum operating level	**(1) Lowest minimum operating level**
MOL = RL + h + Ho = RL+h + $(Qp/2)^{1/2}$	MOLmin = SEDL + 2.0 × WDIA
where,	where,
MOL : Minimum operating level (EL. m)	MOLmin : Lowest minimum operating level (EL. m)
RL : Riverbed level (EL. m)	SEDL : Reservoir sedimentation level (EL. m)
Q_p : Max. plant discharge (m^3/s)	WDIA : Diameter of waterway at end of intake vermouth, at a flow velocity of 3 m/s.
V : Flow velocity at trashrack = 0.5 m/s	
B : Channel width at trashrack = 4xHo (m)	
Ho : Water depth at trashrack (m) Ho = Qp/(BxV) = $(Qp/2)^{\frac{1}{2}}$	
h : h = 1.0. Sill of intake is set at 1 m higher than the sill of weir or riverbed level.	
(2) Full supply level	**(2) Highest full supply level**
FSL = MOL + Hsc	FSLmax = TPL
where,	where,
FSL : Full supply level (EL. m)	FSLmax : Maximum full supply level (EL. m)
Hsc : Head corresponding to storage requirement for daily peaking operation (m).	TPL : Water level at which reservoir gross storage is equivalent to the annual runoff volume (EL. m)
(3) Average operating level	
AOL = 1/2·(FSL + MOL)	AOL = 2/3·(FSL + MOL)
where,	where,
AOL : Average operating level (EL. m).	AOL : Average operating level (EL. m).

Table 8.1 POWER OUTPUT CALCULATION CRITERIA (3/4)

	RUN-OF-RIVER SCHEME	RESERVOIR SCHEME
2. Operating Head	HGROS = AOL - TWL where, HGROS : Operating head, gross (m) AOL : Average operating level in head pondage (EL. m) TWL : Tailwater level at powerhouse as extracted from map (EL. m).	(1) Average gross head : HGROS = AOL – TWL where, AOL : Average operating level (EL. m) HGROS : Average operating head, gross (m) TWL : Tailwater level at power house (EL. m). (2) Minimum operating head at which the minimum or guaranteed capacity is calculated: MHD = MOL-TWL where, MHD : Minimum operating head (m) TWL : Tailwater level at power house (EL. m) MOL : Minimum operating level (EL. m).

Hydropower Computation

1. Power

$$Pins = 9.8 \times EFF \times Q_p \times (HGROS - HLOS)$$

$$Pfirm = 9.8 \times EFF \times Q_f \times (HGROS - HLOS)$$

$$Pgrt = 9.8 \times EFFR \times Q_p \times (MOL - TWL - HLOS) \quad \text{(for Reservoir type)}$$

$$= 9.8 \times EFF \times Q_f \times (MOL - TWL - HLOS) \times 0.9 \quad \text{(for Run-of-river type)}$$

$$P_{dp} = 9.8 \times EFF \times Q_{dp} \times (HGROS - HLOS) \quad \text{(for Run-of-river type)}$$

where,

Pins : Installed capacity (kW)
Pfirm : Firm capacity (kW)
Pgrt : Guaranteed power output (kW)
P_{dp} : Dependable power output (kW)
EFF : Overall efficiency of generating equipment = 0.84
EFFR : Reduced efficiency = 0.80
Q_P : Maximum plant discharge (m^3/s)
Q_f : Firm discharge (m^3/s)
Q_{dp} : Dependable daily peak discharge (m^3/s)

(to be continued)

Table 8.1 POWER OUTPUT CALCULATION CRITERIA (4 / 4)

RUN-OF-RIVER SCHEME	RESERVOIR SCHEME

(continued)

HGROS : Average operating head, gross (m)
MOL : Minimum operating level (EL.m)
TWL : Tailwater level (EL.m)
HLOS : Average head loss consisting of friction loss in power conduits and other local losses :
-Friction loss calculated, plus 1.0 % of HGROS for local losses.

2 Annual Energy Output

(1) Firm energy E_f = Pfirm × 24 (hr) × 365 (day)

where,

E_f : Firm energy output (kWh)
Pfirm : Firm capacity (kW).

(2) Secondary energy

$Es = 9.8 \times 0.84 \times (Qturb - Q_f) \times (FSL - TWL - HLOS) \times 24 \times 365 \times 0.9$

$Es \simeq 9.8 \times 0.84 \times (Qave - Q_f) \times (1 - C_f) \times (FSL - TWL - HLOS) \times 24 \times 365$

where,

Es : Secondary energy (kWh)
Qturb : Average turbinable flow (m³/s)
Qave : Long-term average discharge (m³/s)
Q_f : Firm discharge (m³/s)
FSL : Full supply level (EL. m)
TWL : Tailwater level (EL. m)
HLOS : Average head loss (m)
C_f : Ratio of firm discharge to peak discharge

Table 9.1 COMPONENTS OF PRELIMINARY COST ESTIMATE

	Classification		Description	Estimate by
A	POWER DEVELOPMENT			
	A 1	Storage dam	Dam (reservoir type)	Cost formula
	A 2	Spillway	Incl. gates (reservoir type)	Cost formula
	A 3	Diversion Tunnel	Pressure type (reservoir type)	Cost formula
	A 4	Diversion Dam/Weir	Dam/weir without or with daily regulating capacity (height less than 15 m, run-of-river)	Cost formula
	A 5	Intake	Pressure type (reservoir) or non-pressure type (run-of-river), incl. sand-trap basin (for the latter), gates and trashracks	Cost formula
	A 6	Headrace Tunnel	Pressure type (reservoir) or non-pressure type (run-of-river), concrete lined, single or plural tunnels	Cost formula
	A 7	Surge Tank	Excavated vertical shaft construction (reservoir)	Cost formula
	A 8	Head Tank	Applied for run-of-river	Cost formula
	A 9	Pressure Shaft	Incl. steel liners, single or plural penstock lines	Cost formula
	A10	Powerhouse Buildings	Building works incl. substructures equipment and tailrace bay	Cost formula
	A11	Miscellaneous Civil Works	Spoil banks, finishing works, other works not listed above	5% of A1 to A10
	A12	Power Equipment	Main and auxiliary equipment, incl. switchyard equipment	Cost formula
	A13	Engineering and Administration	Survey, design and construction administration	12.5% or less of A1 to A12
	A14	Contingency	Physical contingencies	20% of A1 to A13
	A15	Total Cost	Total of A1 to A14	
B	ACCESS ROAD			
	B 1	Access Road	Construction cost	Unit price
	B 2	Engineering and Administration	Survey, design and construction administration	8% of B1
	B 3	Contingency	Physical contingencies	20% of B1 to B2
	B 4	Total Cost	Total of B1 to B3	
C	TRANSMISSION LINE			
	C 1	Transmission Lines	Construction	Unit price
	C 2	Substation	Construction	Unit price
	C 3	Engineering and Administration	Survey, design and construction administration	12.5% of C1 to C2
	C 4	Contingency	Physical contingencies	15% of C1 to C3
	C 5	Total Cost	Total of C1 to C4	

Table 9.2 PRELIMINARY ESTIMATE OF POWER DEVELOPMENT COST
COST FORMULAE (1/3)

	Item	Cost Formula	Parameter
A 1	Storage Dam	$CDM = 70 \cdot VD^{0.8734}$	CDM : Cost of rockfill-dam (US$) VD : Dam embankment volume (m^3)
A 2	Spillway	$CSP = CSC + CSG$ $CSC = 1,556\ Qds^{\frac{1}{4}}.HD$ $CSG = 297\ Qds$	CSP : Total cost of spillway (US$) CSC : Spillway concrete cost (US$) CSG : Spillway gate cost (US$) Qds : Spillway design flood discharge (m^3/S) HD : Dam height (m)
A 3	Diversion Tunnel	$CDT = 390.6.DIAD^{1.433}.LDT.ND$ $DIAD = 0.291\ Qdt^{\frac{1}{4}}$	CDT : Cost of diversion tunnel (US$) DIAD: Inner diameter of diversion tunnel (m) LDT : Length of diversion tunnel (m) ND : Number of tunnels
A 4	Diversion dam/ weir	$CDD = 140.3\ .\ VDD^{0.921}$	CDM : Cost of diversion dam (US$) VDD : Volume of dam concrete (m^3)
A 5	Intake	Pressure type (Reservoir) $CIP = CPS + CPG$ $CPS = 6,282 \cdot \{(Ha+DHTP) \cdot Q_p\}^{0.622}$ $CPG = 11,000 \cdot \{(Ha+DHTP)^{1/9} \cdot Q_p\}^{0.997}$	CIP : Cost of pressure type intake (US$) CPS : Cost of intake structure (US$) CPG : Cost of intake gates and others (US$) Ha: Reservoir drawdown depth (m) DHTP: Tunnel diameter calculated in A6 below (m) Ap : Installed capacity discharge (m^3/S)
		Non-pressure type (run-of-river) $CIN = CNS + CNB$ $CNS = 20,400 \cdot DHTN^{0.557}$ $CNB = 58,800 \cdot Q_p^{0.741}$	CIN : Cost of non-pressure type intake, incl. sand trap basin (US$) CNS : Cost of intake structure (US$) CNB : Cost of sand trap basin (US$) DHTN: Tunnel diameter (m) Q_p : Installed capacity discharge (m^3/S)
A 6	Headrace Tunnel	Pressure tunnel $CHP = 390.6 \cdot DHTP^{1.433} \cdot UHT \cdot N$	CHP : Cost of pressure type head-race tunnel (US$) DHTP: Inner diameter of headrace tunnel (m) LHT : Length of tunnel (m) N : Number of tunnels

Table 9.2 PRELIMINARY ESTIMATE OF POWER DEVELOPMENT COST
COST FORMULAE (2/3)

	Item	Cost Formula	Parameter
		Non-pressure type (1)	
		(horse-shoe shape)	
		$CHN1 = 230.8.DHN.LHT.N$	CHN1: Cost of non-pressure type headrace tunnel (horse-shoe shape, US$)
		Non-pressure type (2)	
		(semi circle/rectangular)	
		$CHN2 = 308.B^{1.282}.LHT.N$	CHN2: Cost of non-pressure type headrace tunnel (semi circle/ rectangular, US$) DHN : Inner diameter of headrace tunnel (horse shoe shape, m) B : Inner width of tunnel (semi circle/rectangular, m)
A 7	Surge Tank	$CST = 4,821.[Qt.(Ha+LT)^{\frac{1}{2}}]^{0.962}.N$	CST : Cost of surge tank (US$) Qt : Max. discharge per headrace tunnel (m^3/S) Ha : Reservoir drawdown depth (m) LT : Headrace tunnel length (m) N : Number of surge tanks, to be same as the number of headrace tunnels.
A 8	Head Tank	$CHD = 70,600 . Q_p^{0.613}$	CHD : Cost of head tank (US$) Q_p : Installed capacity discharge (m^3/S)
A 9	Pressure Shaft	Pressure Shaft	
		$CPS = 1,043.DIAP^{0.749}.LPT.N$	CPS : Cost of pressure shaft (US$) DIAP: Inner diameter of penstock (m) LPT : Total length of penstock (m) LPT = LP + 0.47 (HGROS - Ho) N : Number of penstock lines
		Steel Liner	
		$CSL = (0.7833.HEF + 18.94).Qs + 208.73.HEF^{0.162}$	CSL : Cost of steel liner (US$) HEF : Effective head (m) Qs : Max. discharge per pressure shaft (m^3/S)

Table 9.2 PRELIMINARY ESTIMATE OF POWER DEVELOPMENT COST
COST FORMULAE (3/3)

	Item	Cost Formula	Parameter
A10	Powerhouse	Powerhouse building	
	Civil Works	$CHP_1 = 892.Q_p.HEF^{2/3}.N^{\frac{1}{2}}$	CHP_1: Cost of powerhouse building (super-structures) (US$) Q_p : Installed capacity discharge (m^3/S) HEF : Effective head (m)
		Substructures	
		$CHP_2 = 1,115 \cdot Q_p.HEF^{2/3}.N^{\frac{1}{2}}$	CHP_2: Cost of substructures incl. equip. foundation (US$) N : Number of units
A12	Power Equipment	$CPE = 6,500 \cdot [P/HEF^{\frac{1}{2}}]^{0.90}$	CPE : Cost of power equipment, incl. switchyard equipment (US$) P : Installed power capacity (kW) HEF : Effective head (m)

Table 11.1 OUTLINE ON THE INVENTORY OF HYDROPOWER SITE

TOTAL SCHEMES : 145 FINAL OUTPUT AS OF JUL.1987 PRICE LEVEL : END - 1985

NO.	PROJECT ID #	PROJECT NAME	TYPE	POWER		ACCESS ROAD		TRANS. LINE		TOTAL COST	INDICES	
				INST.CAP. (MW)	COST (MIL USD)	LENGTH (KM)	COST (MIL USD)	LENGTH (KM)	COST (MIL USD)	MILLION US DOLLAR	USD/KW	USD/KWH
1	1- 2- 0- 1-0	RIZAL	RES	15.1	169.4	5.0	1.4	4.0	0.5	171.3	11306.7	2.398
2	1- 3- 0- 1-0	BASULIN	RES	183.8	416.2	10.0	2.9	18.0	3.8	422.8	2300.4	1.454
3	1- 3- 0- 2-0	NAGUILIAN	ROR	37.2	41.9	12.4	3.5	17.4	1.7	47.2	1268.6	0.760
4	1- 10- 0- 1-0	LUYA	RES	411.7	871.8	0.	0.	45.0	14.1	885.8	2151.9	1.360
5	1- 10- 0- 1-1	LUYA (ROR ALT.)	ROR	39.6	48.8	15.0	4.3	35.0	2.8	55.8	1410.2	0.858
6	1- 10- 0- 2-0	BAKUM	ROR	33.9	23.1	7.0	2.0	18.2	1.8	26.9	793.3	0.488
7	1- 10- 1- 3-0	TIBUNEC	RES	97.7	283.7	0.	0.	27.0	5.1	288.8	2957.5	1.801
8	1- 10- 1- 4-0	AMBURAYAN	ROR	61.1	72.6	15.4	4.4	32.8	3.7	80.7	1320.4	0.811
9	1- 11- 0- 1-0	USO	RES	10.1	223.5	0.	0.	40.0	1.5	225.0	22307.5	4.792
10	1- 11- 0- 2-0	CHICO-R	ROR	14.3	27.4	8.5	2.4	37.0	1.5	31.3	2191.6	1.347
11	1- 22- 0- 1-0	BANAOANG	RES	264.5	438.9	0.5	0.1	24.0	8.1	447.1	1690.5	0.547
12	1- 22- 0- 2-0	LANGIDEN	RES	3.0	75.1	12.5	3.6	21.0	1.0	79.6	26360.7	5.750
13	1- 22- 0- 3-0	BANDI	RES	3.1	180.6	0.5	0.1	35.0	1.4	182.1	57849.3	12.696
14	1- 22- 0- 4-0	ALIP	RES	17.0	171.5	8.0	2.3	10.0	0.6	174.4	10257.4	2.261
15	1- 22- 0- 5-0	SUPO	RES	142.1	243.2	3.1	0.9	31.7	5.8	249.9	1758.7	0.715
16	1- 22- 0- 6-0	ETEB	RES	107.1	232.9	0.2	0.1	36.5	6.5	239.4	2235.6	0.946
17	1- 22- 0- 7-0	BUCNIT	RES	148.1	349.5	15.0	4.3	50.0	8.4	362.2	2446.1	1.559
18	1- 22- 0- 8-0	UPPER BUCNIT	RES	124.4	294.3	10.5	3.0	53.0	8.9	306.1	2461.0	1.578
19	1- 22- 0- 9-0	DAYAPAN	RES	23.9	335.4	4.0	1.1	12.0	0.7	337.3	14083.3	3.096
20	1- 22- 0-10-0	ABRA	ROR	10.7	15.1	10.0	2.9	8.0	0.6	18.5	1724.5	0.788
21	1- 22- 1-11-0	NAGLIBACAN	RES	12.1	159.7	38.0	10.8	27.0	1.2	171.7	14227.5	3.137
22	1- 22- 1-12-0	TINEG-1	RES	367.9	618.6	16.0	4.6	15.0	5.5	628.7	1708.6	1.107
23	1- 22- 1-13-0	TINEG-2	RES	108.9	356.6	36.0	10.3	27.0	5.1	371.9	3416.3	2.134
24	1- 22- 1-14-0	TINEG-3	RES	17.9	241.0	51.0	14.5	39.0	1.5	257.0	14395.6	3.175
25	1- 22- 2-15-0	BINONGAN-R	ROR	5.7	26.2	27.0	7.7	36.0	1.4	35.3	6244.4	1.624
26	1- 22- 3-16-0	PAGANAO	RES	10.2	145.6	17.0	4.8	15.0	0.8	151.3	14812.0	3.263
27	1- 22- 3-17-0	MALANAS (LICUANO)	RES	5.3	114.6	17.0	4.8	26.0	1.1	120.5	22944.9	5.051
28	1- 22- 4-18-0	TAPING	RES	5.4	176.5	4.0	1.1	18.0	0.9	178.5	33040.5	7.110
29	1- 22- 5-19-0	UPPER MAGUYEPYEP	RES	9.5	139.5	14.0	4.0	55.0	2.0	145.4	15349.5	3.351
30	1- 22- 5-20-0	BUCLOC	RES	6.3	154.8	25.0	7.1	38.0	1.5	163.4	25997.3	5.726

NOTES : RES - RESERVOIR LHD - RUN-OF-RIVER WITH A LOW HEAD DAM
ROR - RUN-OF-RIVER LOT - LAKE OUTLET

Table 11.1 OUTLINE ON THE INVENTORY OF HYDROPOWER SITE

TOTAL SCHEMES : 145 FINAL OUTPUT AS OF JUL.1987 PRICE LEVEL : END - 1985

NO.	PROJECT ID #	PROJECT NAME	TYPE	POWER		ACCESS ROAD		TRANS. LINE		TOTAL COST	INDICES	
				INST.CAP. (MW)	COST (MIL USD)	LENGTH (KM)	COST (MIL USD)	LENGTH (KM)	COST (MIL USD)	MILLION US DOLLAR	USD/KW	USD/KWH
31	1- 22- 5-21-0	DAGUIOMAN	RES	2.9	102.5	30.0	8.6	41.0	1.6	112.6	39084.0	8.555
32	1- 22- 5-22-0	BOYAN	RES	13.0	267.4	20.0	5.7	56.0	2.0	275.1	21205.9	4.605
33	1- 22- 5-23-0	IKMIN	ROR	10.2	24.2	20.5	5.8	40.0	1.5	31.5	3088.8	1.406
34	1- 22- 5-24-0	TOQUENG	RES	8.6	190.5	30.0	8.6	36.0	1.4	200.5	23392.5	5.108
35	1- 22- 5-25-0	DANAC	RES	5.9	108.6	36.5	10.4	32.0	1.3	120.3	20506.4	4.521
36	1- 22- 6-26-0	AMLUAGAN	RES	7.2	221.5	13.0	3.7	24.0	1.1	226.3	31423.5	6.892
37	1- 22- 6-27-0	DAMANIT	ROR	6.3	10.2	30.5	8.7	44.0	1.7	20.5	3233.6	1.479
38	1- 22- 6-28-0	NAINA	RES	16.2	275.0	14.0	4.0	33.0	1.3	280.4	17332.6	3.704
39	1- 22- 6-29-0	UTIP	ROR	11.4	19.1	34.0	9.7	45.0	1.7	30.5	2666.3	1.217
40	1- 22- 7-30-0	KUMANGA	RES	5.6	130.3	10.0	2.9	40.0	1.5	134.7	24111.8	5.231
41	1- 22- 7-31-0	SUYSUYAN	RES	10.0	182.8	13.0	3.7	46.0	1.7	188.2	18737.9	4.110
42	1- 37- 0- 1-0	DINGRAS	RES	5.1	119.7	5.5	1.6	16.0	0.8	122.0	23713.0	4.595
43	1- 39- 0- 1-0	VINTAR	RES	2.5	56.2	1.0	0.3	13.0	0.7	57.2	22904.8	4.490
44	1- 39- 0- 2-0	TAMDAGAN	RES	13.1	167.5	7.0	2.0	22.0	1.0	170.5	13015.4	2.524
45	1- 47- 0- 1-0	BULU-1(ILOCOS)	RES	14.9	196.2	2.0	0.6	8.0	0.6	197.4	13204.4	2.554
46	1- 47- 0- 2-0	BULU-2(ILOCOS)	ROR	7.5	13.3	15.5	4.4	42.0	1.6	19.3	2581.5	1.421
47	2- 5- 0- 1-0	LUNA	RES	51.7	165.3	13.5	3.8	30.0	3.4	172.5	3336.6	1.404
48	2- 5- 0- 2-0	ZIMIGUI	RES	64.7	165.6	10.5	3.0	21.0	2.6	171.3	2648.1	1.124
49	2- 6- 0- 1-0	SISIRITAN	RES	418.3	522.9	0.	0.	44.4	13.9	536.8	1283.4	0.714
50	2- 6- 0- 2-0	BUBULAYAN	RES	577.1	707.8	2.0	0.6	56.0	34.5	742.9	1287.3	0.427
51	2- 6- 0- 3-0	BULU	RES	408.0	496.6	4.0	1.1	65.5	19.9	517.7	1268.8	0.416
52	2- 6- 1- 4-0	NABABARAYAN	RES	304.0	432.0	6.0	1.7	75.0	22.6	456.3	1501.3	0.618
53	2- 6- 1- 5-0	DIBAGAT	RES	301.7	428.0	3.6	1.0	75.6	22.8	451.8	1497.5	0.497
54	2- 6- 1- 6-0	AGBULU	RES	216.4	301.1	6.5	1.9	78.6	12.5	315.5	1458.2	0.481
55	2- 6- 1- 7-0	AOAN	RES	196.8	450.5	18.0	5.1	49.0	8.3	463.9	2356.8	1.534
56	2- 6- 1- 8-0	APAYAO	ROR	15.7	25.7	32.4	9.2	39.4	1.5	36.5	2330.1	1.071
57	2- 8- 1- 1-0	ZINUNDUNGAN	RES	5.6	47.7	3.5	1.0	47.0	1.7	50.4	9000.6	1.968
58	2- 8- 2- 2-0	CAPISAYAN	RES	3.3	55.6	13.0	3.7	32.0	1.3	60.6	18298.7	3.738
59	2- 8- 3- 3-0	BASAO	RES	522.4	902.2	2.5	0.7	9.0	6.6	909.5	1741.0	1.134
60	2- 8- 3- 4-0	CHICO-1R	ROR	26.6	35.0	0.	0.	20.5	1.0	36.0	1353.1	0.581

NOTES : RES - RESERVOIR LHD - RUN-OF-RIVER WITH A LOW HEAD DAM
ROR - RUN-OF-RIVER LOT - LAKE OUTLET

Table 11.1 OUTLINE ON THE INVENTORY OF HYDROPOWER SITE

TOTAL SCHEMES : 145 FINAL OUTPUT AS OF JUL.1987 PRICE LEVEL : END - 1985

NO.	PROJECT ID #	PROJECT NAME	TYPE	POWER		ACCESS ROAD		TRANS. LINE		TOTAL COST	INDICES	
				INST.CAP. (MW)	COST (MIL USD)	LENGTH (KM)	COST (MIL USD)	LENGTH (KM)	COST (MIL USD)	MILLION US DOLLAR	USD/KW	USD/KWH
61	2- 8- 3- 5-0	SADANGA	RES	238.2	453.7	0.	0.	28.1	9.2	463.0	1943.4	0.844
62	2- 8- 3- 6-0	CHICO-2R	ROR	33.4	43.0	0.	0.	12.6	1.4	44.4	1331.5	0.573
63	2- 8- 3- 7-0	CHICO-3R	ROR	17.8	25.3	0.	0.	6.6	0.5	25.8	1454.2	0.627
64	2- 8- 3- 8-0	BONTOC	RES	73.3	236.7	0.	0.	6.0	2.1	238.8	3256.5	1.988
65	2- 8- 3- 9-0	CHICO-4R	ROR	11.8	21.1	0.	0.	1.2	0.4	21.5	1821.3	0.785
66	2- 8- 4-10-0	MATALAG	RES	23.4	78.2	1.5	0.4	28.0	1.2	79.8	3414.6	1.109
67	2- 8- 4-11-0	NABUANGAN	ROR	3.9	11.2	24.0	6.8	49.0	1.8	19.8	5087.6	2.188
68	2- 8- 5-12-0	PINUKPUK	RES	18.6	271.6	3.0	0.9	32.0	1.3	273.7	14724.4	3.227
69	2- 8- 5-13-0	ADAGA	RES	69.0	196.3	21.0	6.0	47.0	4.9	207.2	3002.2	1.896
70	2- 8- 5-14-0	SALTAN-4	RES	12.1	247.5	3.0	0.9	41.0	1.6	249.9	20636.9	4.393
71	2- 8- 5-15-0	SALTAN	ROR	12.1	21.8	2.0	0.6	51.6	1.9	24.2	1995.7	0.860
72	2- 8- 5-16-0	SALTAN-5	RES	5.9	112.7	7.5	2.1	39.0	1.5	116.3	19799.3	4.208
73	2- 8- 5-17-0	BABACA-R	RES	8.0	82.1	11.5	3.3	42.0	1.6	87.0	10847.5	2.373
74	2- 8- 5-18-0	BABACA	ROR	6.3	10.6	24.0	6.8	48.0	1.8	19.3	3074.9	1.325
75	2- 8- 6-19-0	NANENG	RES	82.2	231.0	3.5	1.0	35.0	6.3	238.2	2896.5	1.261
76	2- 8- 6-20-0	MT.BOLONTOC	RES	11.3	267.6	4.5	1.3	26.0	1.1	270.0	23885.7	4.874
77	2- 8- 6-21-0	LOWER PASIL	RES	56.0	170.0	0.	0.	30.0	3.4	173.4	3098.1	1.889
78	2- 8- 6-22-0	PASIL	ROR	20.0	24.2	2.0	0.6	9.6	0.6	25.4	1270.9	0.548
79	2- 8- 6-23-0	TANUDAN	ROR	24.5	29.3	13.0	3.7	25.8	1.1	34.2	1392.6	0.600
80	2- 8- 7-24-0	BANTAY	RES	39.8	90.6	0.	0.	50.4	3.7	94.3	2368.5	0.964
81	2- 8- 8-25-0	DASBA	RES	60.3	140.4	14.5	4.1	23.0	2.8	147.4	2444.2	0.993
82	2- 8- 8-26-0	DALAYA	RES	100.9	232.1	30.0	8.6	24.0	4.7	245.3	2431.4	1.441
83	2- 8- 8-27-0	TUGUEGARAO	ROR	9.2	14.1	37.0	10.5	16.0	0.8	25.5	2755.8	1.255
84	2- 8- 9-28-0	SAN PABLO	RES	17.6	385.3	20.0	5.7	15.0	0.8	391.8	22216.9	4.660
85	2- 8-11-29-0	TUMAUINI-1	RES	52.7	195.8	24.5	7.0	27.0	3.2	205.9	3906.4	2.287
86	2- 8-12-30-0	NATONIN	RES	5.0	63.8	17.0	4.8	8.0	0.6	69.2	13720.0	2.868
87	2- 8-12-31-0	PASTOR	RES	6.7	92.1	13.0	3.7	41.0	1.6	97.4	14449.1	2.976
88	2- 8-13-32-0	TABUK	RES	36.6	86.2	12.5	3.6	12.0	1.4	91.2	2489.2	1.476
89	2- 8-13-33-0	BANATAO	RES	14.7	41.2	17.0	4.8	18.0	0.9	47.0	3204.5	1.779
90	2- 8-14-34-0	MALIANO	RES	175.3	371.9	34.0	9.7	70.0	11.3	392.9	2241.2	0.912

NOTES : RES - RESERVOIR LHD - RUN-OF-RIVER WITH A LOW HEAD DAM
ROR - RUN-OF-RIVER LOT - LAKE OUTLET

Table 11.1 OUTLINE ON THE INVENTORY OF HYDROPOWER SITE

TOTAL SCHEMES : 145 FINAL OUTPUT AS OF JUL.1987 PRICE LEVEL : END - 1985

NO.	PROJECT ID #	PROJECT NAME	TYPE	POWER		ACCESS ROAD		TRANS. LINE		TOTAL COST	INDICES	
				INST.CAP. (MW)	COST (MIL USD)	LENGTH (KM)	COST (MIL USD)	LENGTH (KM)	COST (MIL USD)	MILLION US DOLLAR	USD/KW	USD/KWH
91	2- 8-14-35-0	ILAGAN-1	RES	208.4	364.2	76.0	21.7	66.0	10.7	396.6	1902.8	1.190
92	2- 8-14-36-0	ILAGAN-2	RES	95.3	227.0	90.0	25.7	68.0	11.0	263.7	2767.3	1.659
93	2- 8-14-37-0	DINAPIGUI	RES	58.3	128.3	40.0	11.4	67.0	6.7	146.4	2509.8	1.067
94	2- 8-15-38-0	BALLASANG	RES	139.2	326.3	12.0	3.4	58.0	9.6	339.3	2437.2	1.386
95	2- 8-15-39-0	ABUAN-1	RES	185.6	370.8	22.5	6.4	27.0	5.1	382.4	2059.8	1.267
96	2- 8-16-40-0	CATALANGAN	RES	48.1	147.8	1.5	0.4	27.0	3.2	151.4	3149.9	1.742
97	2- 8-16-41-0	DISUSUAN	RES	5.6	64.1	7.5	2.1	41.0	1.6	67.8	12106.3	2.458
98	2- 8-16-42-0	MARIANO	RES	10.5	109.9	34.0	9.7	45.0	1.7	121.3	11574.8	2.445
99	2- 8-19-43-0	ALIMIT-1	RES	62.3	170.2	17.0	4.8	36.0	4.0	179.0	2874.5	1.670
100	2- 8-19-44-0	ALIMIT-2	RES	63.3	208.9	15.5	4.4	41.0	4.4	217.8	3439.6	1.980
101	2- 8-20-45-0	HUOAB	RES	97.1	307.5	1.5	0.4	41.0	7.1	315.1	3246.3	1.893
102	2- 8-20-46-0	IBULAO	ROR	16.3	20.6	14.2	4.0	42.0	1.6	26.3	1611.6	0.759
103	2- 8-22-47-0	MATUNO-1R	ROR	9.2	19.8	38.0	10.8	29.0	1.2	31.8	3467.4	1.630
104	2- 8-22-48-0	MATUNO-2R	ROR	8.7	13.0	30.0	8.6	17.0	0.9	22.4	2579.0	1.214
105	2- 8-22-49-0	STA.CRUZ	RES	2.4	72.9	0.	0.	15.0	0.8	73.6	30173.4	5.522
106	2- 8-26-50-0	PINARIPAD	RES	78.7	200.0	5.0	1.4	38.0	6.7	208.1	2645.9	1.434
107	2- 8-27-51-0	DIBULUAN	RES	50.2	163.0	18.0	5.1	57.0	5.8	174.0	3462.6	2.075
108	2- 8-28-52-0	CABINGATAN	RES	265.5	326.5	38.5	11.0	72.0	21.7	359.2	1353.3	0.551
109	2- 8-28-53-0	GANIP	ROR	7.9	10.0	49.0	14.0	59.0	2.1	26.1	3307.8	1.515
110	2- 8-29-54-0	DAKGAN	RES	169.0	314.6	23.5	6.7	55.0	9.1	330.4	1955.6	1.190
111	2- 8-29-55-0	MADDELA	RES	9.3	170.4	25.5	7.3	54.0	2.0	179.6	19359.9	4.044
112	2- 8-29-56-0	KAGIPSIPAN	RES	158.4	332.1	7.5	2.1	70.0	11.3	345.6	2182.0	1.330
113	2- 8-29-57-0	GADENG	RES	138.5	357.2	2.5	0.7	69.0	11.2	369.0	2663.6	1.606
114	2- 8-29-58-0	CASECNAN	ROR	11.2	20.8	10.0	2.9	66.0	2.3	26.0	2309.8	1.054
115	2- 8-29-59-0	UPPER CASECNAN	ROR	12.2	21.5	17.0	4.6	57.6	2.1	28.4	2335.3	1.067
116	2- 8-29-60-0	UPPER CASECNAN-2	RES	64.0	186.1	12.0	3.4	51.0	5.3	194.8	3045.8	1.294
117	2- 8-29-61-0	UPPER CASECNAN-3	RES	70.0	164.3	37.0	10.5	48.0	5.0	179.9	2571.7	1.088
118	2- 32- 0- 1-0	TABOAN	RES	50.3	137.6	6.0	1.7	68.0	6.8	146.1	2905.3	1.189
119	2- 39- 0- 1-0	DIKATAYAN	RES	117.5	278.7	10.0	2.9	27.0	5.1	286.6	2439.8	1.493
120	2- 47- 0- 1-0	PALANAN	RES	23.4	63.4	27.0	7.7	68.0	2.4	73.4	3143.9	1.691

NOTES : RES - RESERVOIR LHD - RUN-OF-RIVER WITH A LOW HEAD DAM
ROR - RUN-OF-RIVER LOT - LAKE OUTLET

Table 11.1 OUTLINE ON THE INVENTORY OF HYDROPOWER SITE

TOTAL SCHEMES : 145 FINAL OUTPUT AS OF JUL.1987 PRICE LEVEL : END - 1985

NO.	PROJECT ID #	PROJECT NAME	TYPE	POWER		ACCESS ROAD		TRANS. LINE		TOTAL COST	INDICES	
				INST.CAP. (MW)	COST (MIL USD)	LENGTH (KM)	COST (MIL USD)	LENGTH (KM)	COST (MIL USD)	MILLION US DOLLAR	USD/KW	USD/KWH
121	3- 13- 0- 1-0	MALUPA	RES	13.9	396.0	18.0	5.1	52.0	1.9	403.1	28952.1	5.878
122	3- 23- 0- 1-0	UMIRAY-3	RES	153.7	439.0	20.0	5.7	52.0	8.7	453.4	2949.8	1.283
123	3- 23- 0- 2-0	UPPER UMIRAY	RES	216.1	383.7	38.5	11.0	41.0	7.1	401.8	1859.4	1.224
124	3- 25- 1- 1-0	CATMON	RES	4.6	67.7	33.0	9.4	34.0	1.4	78.4	17211.4	3.290
125	3- 25- 2- 2-0	BALINTINGON	RES	7.2	96.9	22.0	6.3	33.0	1.3	104.5	14562.1	2.977
126	3- 25- 2- 3-0	PAPAYA	RES	2.4	57.9	22.0	6.3	36.0	1.4	65.6	27365.8	5.619
127	3- 25- 3- 4-0	LUBINGAN	RES	6.9	132.1	6.0	1.7	58.0	2.1	135.9	19605.1	3.521
128	3- 27- 0- 1-0	GUYAIN	RES	1.6	59.8	6.0	1.7	21.0	1.0	62.5	39698.3	7.985
129	3- 77- 0- 2-0	PILA	RES	5.8	238.9	10.0	2.9	42.0	1.6	243.4	41604.6	8.647
130	3- 77- 0- 3-0	SAN NICOLAS	RES	16.4	248.4	2.0	0.6	25.0	1.1	250.1	15282.0	3.153
131	3- 77- 0- 4-0	TABU	RES	67.4	156.9	6.0	1.7	27.0	3.2	161.8	2402.4	0.782
132	3- 77- 0- 5-0	AGNO-1	ROR	4.6	9.9	9.0	2.6	26.0	1.1	13.6	2965.8	1.336
133	3- 77- 0- 6-0	AGNO-2	ROR	10.5	19.4	4.3	1.2	27.6	1.2	21.8	2070.9	0.937
134	3- 77- 0- 7-0	AGNO-3	ROR	9.3	15.8	0.	0.	32.0	1.3	17.1	1836.9	0.829
135	3- 77- 1- 8-0	CAMILING-1	RES	9.8	303.4	6.0	1.7	25.0	1.1	306.2	31178.6	6.584
136	3- 77- 1- 9-0	CAMILING-2	RES	8.1	130.6	12.0	3.4	29.0	1.2	135.2	16717.7	3.554
137	3- 77- 4-10-0	PAMPANG	ROR	6.3	10.7	22.0	6.3	35.0	1.4	18.4	2893.3	1.309
138	4- 7- 0- 1-0	KANAN	RES	213.9	467.9	14.0	4.0	18.6	3.9	475.8	2224.7	0.738
139	4- 7- 0- 2-0	DARAITAN	RES	61.2	117.3	20.0	5.7	23.0	2.8	125.9	2055.8	0.857
140	4- 7- 0- 3-0	UPPER AGOS-1M	RES	44.7	84.9	23.0	6.6	18.0	2.4	93.8	2099.4	1.369
141	4- 7- 0- 4-0	UPPER AGOS-1S	RES	23.5	63.1	23.0	6.6	18.0	0.9	70.6	3007.5	1.669
142	4- 7- 0- 5-0	UPPER AGOS-2	RES	135.2	251.8	18.6	5.3	21.0	4.3	261.4	1933.2	0.641
143	4-115- 1- 1-0	WAWA	RES	60.9	160.8	3.6	1.0	21.0	2.6	164.4	2701.5	0.889
144	5- 14- 1- 1-0	BOSIGON	RES	44.7	88.2	0.	0.	30.0	3.4	91.7	2051.2	1.111
145	5- 20- 0- 1-0	PULANTUNA	RES	9.1	37.0	4.5	1.3	36.0	1.4	39.7	4366.7	1.424

NOTES : RES - RESERVOIR LHD - RUN-OF-RIVER WITH A LOW HEAD DAM
ROR - RUN-OF-RIVER LOT - LAKE OUTLET

Table 11.2 EXISTING HYDROELECTRIC PLANTS

Water Resources Region	Power Station	No. of Unit	Installed Capacity (MW)	Generated Energy (GWh)	Commission Year
II	Magat	4	360	1,044	1983
	Sub-Total	4	360	1,044	
III	Ambuklao	3	75	355	1956
	Binga	4	100	494	1960
	Angat	8	228	562	1967
	Pantabangan	2	100	172	1977
	Masiway	1	12	47	1981
	Sub-Total	18	515	1,630	
IV	Caliraya	4	32	16	1945
	Botocan	3	17	47	1948
	Kalayaan (Pumped storage)	2	300	211	1983
	Sub-Total	9	349	274	
V	Buhi-Barit	1	1.8	8	1957
	Cawayan	1	0.4	0	1959
	Sub-Total	2	2.2	8	
Total		33	1,226	2,956 1/	

Remark: 1/ Figure indicates annual energy product recorded in 1986.

Table 11.3 HYDROPOWER PROJECTS COMMITTED AND F/S COMPLETED

Water Resources Region	Project Name	Installed Capacity (MW)	Generated Energy 1/ (GWh)	Commission Year
Committed				
IV	Pantay	23	153	1993
II/III	Casecnan	268	1,379	1995
Total		291	1,532	
F/S Completed				
I	Tina-Gasgas-Cura	5.6	24	
	Palsiguan	42	200	
	Binongan	175	718	
	Sub-Total	222.6	942	
II	Chico-4	360	955	
	Gened	600	1,632	
	Matuno	180	528	
	Diduyon	352	957	
	Sub-Total	1,492	4,072	
III	Balog-Balog	33	99	
	San Roque	390	1,214	
	Sub-Total	423	1,313	
IV	Agos	140	623	
	Sub-Total	140	623	
Total		2,277.6	6,950	

Remark : 1/ Total of firm and secondary energy

Table 11.4 HYDROPOWER POTENTIAL IN LUZON ISLAND (1/2)

(Unit: MW)

Water Resources Region	River System	Undeveloped potential (identified)[1]						Developing potential[2] (2)		Developed potential[3] (3)		Total Potential (1)+(2)+(3)	
		Total identified		Technically possible[4] (1)		Overlapped[5]							
		Power	(Nos.)	Power	(Nos.)	Power	(Nos.)	Power	(Nos.)	Power	(Nos.)	Power	(Nos.)
I	Arinay	15.1	(1)	-	(0)	15.1	(1)					-	(0)
	Naguilian	221.0	(2)	183.8	(1)	37.2	(1)					183.8	(1)
	Amburayan	644.0	(5)	604.4	(4)	39.6	(1)					604.4	(4)
	Chico	24.4	(2)	14.3	(1)	10.1	(1)					14.3	(1)
	Abra	1,490.4	(31)	334.5	(7)	1,155.9	(24)	222.6	(3)			557.1	(10)
	Laoag	5.1	(1)	-	(0)	5.1	(1)					-	(0)
	Vintar	15.6	(2)	-	(0)	15.6	(2)					-	(0)
	Bulu	22.4	(2)	7.5	(1)	14.9	(1)					7.5	(1)
	Region Total	2,438.0	(46)	1,144.5	(14)	1,293.5	(32)	222.6	(3)	-	(0)	1,367.1	(17)
II	Gattu	116.4	(2)	116.4	(2)	-	(0)					116.4	(2)
	Abulog	2,438.0	(8)	428.9	(3)	2,009.1	(5)	600.0	(1)			1,028.9	(4)
	Cagayan	3,849.7	(61)	2,260.0	(34)	1,589.7	(27)	1,160.0	(4)[6]	360.0	(1)	3,780.0	(39)
	Taboan	50.3	(1)	50.3	(1)	-	(0)					50.3	(1)
	Dikatayan	117.5	(1)	117.5	(1)	-	(0)					117.5	(1)
	Palanan	23.4	(1)	23.4	(1)	-	(0)					23.4	(1)
	Region Total	6,595.3	(74)	2,996.5	(42)	3,598.8	(32)	1,760.0	(5)	360.0	(1)	5,116.5	(48)
III	Cabatangan	13.9	(1)	-	(0)	13.9	(1)					-	(0)
	Umiray	369.8	(2)	216.1	(1)	153.7	(1)					216.1	(1)
	Pampanga	21.1	(4)	-	(0)	21.1	(4)			330.0	(3)	330.0	(3)
	Colo	1.6	(1)	-	(0)	1.6	(1)					-	(0)
	Agno	138.2	(9)	93.5	(4)	44.7	(5)	423.0	(2)	175.0	(2)	691.5	(8)
	Region Total	544.6	(17)	309.6	(5)	235.0	(12)	423.0	(2)	505.0	(5)	1,237.6	(12)

Table 11.4 HYDROPOWER POTENTIAL IN LUZON ISLAND (2/2)

(Unit: MW)

Water Resources Region	River System	Undeveloped potential (identified)[1] Total identified Power	(Nos.)	Technically possibile[4] (1) Power	(Nos.)	Overlapped[5] Power	(Nos.)	Developing potential[2] (2) Power	(Nos.)	Developed potential[3] (3) Power	(Nos.)	Total Potential (1)+(2)+(3) Power	(Nos.)
IV	Agos	478.5	(5)	135.2	(1)	343.3	(4)	163.0	(2)			298.2	(3)
	Pasig	60.9	(1)	60.9	(1)	-	(0)			359.0[7]	(3)	419.9	(4)
	Region Total	539.4	(6)	196.1	(2)	343.3	(4)	163.0	(2)	359.0	(3)	718.1	(7)
V	Matogdon	44.7	(1)	44.7	(1)	-	(0)					44.7	(1)
	Bicol	9.1	(1)	9.1	(1)	-	(0)					-	(0)
	Buhi-Barit	-	(0)	-	(0)	-	(0)			1.8[8]	(1)	0.0	(0)
	Cawayan	-	(0)	-	(0)	-	(0)			0.4[8]	(1)	0.0	(0)
	Region Total	53.8	(2)	53.8	(2)	-	(0)	-	-	2.2[8]	(2)	44.7	(1)
Total in Luzon		10,171.1	(145)	4,700.5	(65)	5,470.6	(80)	2,568.6	(12)	1,224.0	(11)	8,493.1	(86)

Remarks:

1/ Potential of the schemes identified in the study

2/ Potential of the projcets committed, or for which detailed design or feasibility studies have been completed

3/ Potential of the existing hydroelectric plants

4/ Schemes selected out of mutually exclusive schemes judging from power output and cost index, this category excludes schemes of power output below 5.0 MW

5/ Mutually exclusive schemes with technically possible schemes for development, or with developing projects

6/ Including Casecnan Trans-basins Development Project

7/ Including Kalayaan Pumped Storage Plant

8/ Total potential excludes those potential since it is below 5.0 MW

Table 11.5 BIG POTENTIAL SCHEMES

	Scheme	River System	Installed Capacity1/ (MW)	Annual Energy2/ (GWh)	Construction Cost (mil. US$)
Reservoir Type Development (over 200 MW)					
1.	Buburayan	Abulog	576.4	1,867	742.9
2.	Basao	Chico, Cagayan	522.4	894	909.5
3.	Sisiritan	Abulog	417.6	1,080	536.8
4.	Luya	Amburayan	411.7	768	885.8
5.	Bulu	Abulog	408.1	1,366	517.7
6.	Tineg-1	Tineg, Abra	367.7	640	628.7
7.	Nababarayan	Abulog	304.2	907	456.3
8.	Dibagat	Abulog	301.7	978	451.8
9.	Cabingatan	Casecnan, Cagayan	265.1	818	359.2
10.	Banaoang	Abra	264.6	926	447.1
11.	Sadanga	Chico, Cagayan	238.4	612	463.0
12.	Agbulu	Abulog	216.3	712	315.5
13.	Up. Umiray	Umiray	215.5	357	401.8
14.	Kanan	Kanan, Agos	213.5	689	475.8
15.	Ilagan-1	Ilagan, Cagayan	208.0	400	396.6
Run-of-river Type Development (over 20 MW)					
1.	Amburayan	Amburayan	61.1	250	80.7
2.	Luya (ROR Alt)	Amburayan	39.6	164	55.8
3.	Naguilian	Naguilian	37.2	152	47.2
4.	Bakum	Amburayan	33.9	138	26.9
5.	Chico-2R	Chico, Cagayan	33.4	176	44.4
6.	Chico-1R	Chico, Cagayan	26.6	140	36.0
7.	Tanudan	Tanudan, Cagayan	24.5	129	34.2
8.	Pasil	Pasil, Cagayan	20.0	105	25.4

Remarks: 1/ Installed capacity is estimated on the basis of variant plant factor.

2/ Annual energy is total of firm and secondary energy.

Table 12.1 MAIN FEATURES OF RESERVOIR TYPE SCHEME

River	Scheme Name	Combined with	FSL (EL-m)	MOL (EL-m)	TWL (EL-m)	PMF (M^3/s)	Design Flood for River Div. (M^3/s)	Plant Discharge		Power Output	
								Qfirm (m^3/s)	Qmax (m^3/s)	Pfirm (MW)	Popt (MW)
Abra	Supo	-	320.0	278.8	204.0	11,265	5,400	43.3	173.0	35.5	142.1
	Eteb	-	371.0	331.4	273.0	8,637	4,600	39.4	157.8	26.8	107.1
	Supo	Eteb	263.0	251.8	178.0	11,265	5,400	38.8	155.1	24.9	99.7
Abulog	Sisiritan	-	100.0	65.2	10.0	17,633	6,400	111.4	668.6	69.7	418.3
	Bulu	-	218.0	161.5	78.3	19,984	5,900	139.8	419.5	139.8	419.5
	Nababarayan	-	240.0	186.8	101.0	14,664	4,700	77.9	311.4	77.9	311.4
	Dibagat	-	341.0	261.8	155.0	12,610	4,100	78.1	234.4	100.6	301.7
	Agbulu	-	346.0	278.1	185.0	11,640	1,300	64.6	193.9	72.1	216.4
	Sisiritan	Agbulu+Bulu	68.3	51.9	10.0	17,633	6,400	159.1	477.6	66.5	199.8
	Sisiritan	Agbulu	100.0	65.2	10.0	17,633	6,400	155.8	623.3	97.4	389.8
	Bulu	Agbulu	175.0	140.3	78.3	19,984	5,900	130.6	522.5	89.1	356.5
Chico	Basao	Sadanga	666.0	658.3	510.0	7,415	1,253	44.5	133.7	54.3	163.0
	Sadanga	-	890.0	820.2	676.0	7,061	1,100	38.9	155.5	59.6	238.2
	Sadanga	Chico-1R	890.0	811.6	625.0	7,061	1,100	39.5	157.8	75.3	301.4
Paret	Bantay	-	62.0	44.5	20.0	7,528	3,000	34.6	138.5	10.0	39.8
Ilagan	Maliano	-	292.0	232.7	145.0	11,200	2,400	43.0	171.9	43.8	175.3
Agno	Tabu	Binga	404.0	390.1	290.0	9,637	4,754	26.4	158.4	22.7	135.8
Agos	Kanan	-	294.0	231.0	100.0	9,123	2,800	51.3	153.8	71.3	213.9
	Up. Agos 2*	-	316.0	267.3	166.0	10,834	800	41.8	125.5	45.1	135.2
	Kanan	Up. Agos 2	156.0	149.3	100.0	9,123	2,800	45.5	181.9	19.3	77.1
Marikina	Wawa*	-	151.0	108.8	24.3	4,916	600	22.4	67.1	20.3	60.9
Labo	Bosigon	-	80.0	56.8	23.0	6,914	2,100	19.0	114.1	7.4	44.7

Remarks: 1/: Scheme with (*) is concrete gravity type dam, and other is fill type dam.

2/: Design flood for river diversion; 2-year flood for concrete gravity type dam, 25-year flood for fill type dam.

Table 12.2 MAIN FEATURES OF RUN-OF-RIVER TYPE SCHEME

River	Schemc Name	Inlet Level (EL-m)	FSL (EL-m)	TWL (EL-m)	Average Head (m)	Plant Discharge		Power Output	
						Qfirm (m3/s)	Qmax. (m3/s)	Pfirm (MW)	Pmax. (MW)
Naguilian	Naguilian	480.0	484.9	159.0	301.1	1.0	15.0	2.4	37.2
AMburayan	Luya	263.0	273.0	140.0	119.4	2.6	40.3	2.6	39.6
	Bakum	685.0	689.2	267.0	407.0	0.7	10.1	2.2	33.9
	Amburayan	510.0	517.3	280.0	214.2	2.3	34.7	4.0	61.0
Abra	Abra	800.0	804.3	600.0	189.2	0.9	6.9	1.4	10.7
Apayao	Apayao	450.0	455.1	305.0	135.8	1.2	14.0	1.4	15.7
Chico	Chico-1R	617.0	624.2	555.0	63.4	6.2	50.9	3.2	26.6
	Chico-1R 1/	617.0	623.0	555.0	62.9	40.0	51.0	20.7	26.4
	Chico-2R	774.0	780.4	660.0	109.1	4.5	37.2	4.1	33.4
	Chico-3R	864.0	868.6	780.0	81.5	3.2	26.5	2.2	17.8
	Chico-4R	990.0	994.4	870.0	112.5	1.6	12.7	1.4	11.8
Saltan	Saltan	675.0	679.6	454.4	201.7	0.9	7.3	1.5	12.1
Pasil	Pasil	845.0	849.6	495.0	329.1	0.9	7.4	2.4	20.0
Tanudan	Tanudan	784.0	790.2	520.0	249.9	1.5	11.9	3.0	24.5
Ibulao	Ibulao	810.0	813.7	540.0	254.1	0.7	7.8	1.5	16.3
Casecnan	Casecnan	543.0	548.2	448.0	89.8	1.5	15.2	1.1	11.2
	UP. Casecnan	670.0	675.0	550.0	112.7	1.3	13.1	1.2	12.2
Agno	Agno-2	1010.0	1014.1	850.0	148.5	0.7	8.6	0.9	10.5
	Agno-3	1210.0	1215.2	1015.0	183.0	0.5	6.2	0.8	9.3

Remark: 1/: Combined with Sadanga scheme.

Table 12.3 CONSTRUCTION COST OF RESERVOIR TYPE SCHEME

(Unit: 10^6 US$)

SCHEME NAME	SCHEME ID. NO.	POWER DEVELOPMENT CONSTRUCTION COST														OTHER COST (ACCESS ROAD (TRANSMISSION LINE) (LAND ACQUISITION)	TOTAL CONSTRUCTION COST
		DAM	SPILLWAY	DIVERSION	INTAKE	HEADRACE	SURGE TANK	PENSTOCK	POWER HOUSE	TAILRACE	MISCELLANEOUS CIVIL WORK	POWER EQUIPMENT	ENGINEERING & ADMINISTRATION	CONTINGENCY	SUB-TOTAL		
SUPO	1-22-0-5-0-1	77.58	19.85	32.38	3.80	3.05	2.83	1.53	8.23	0.80	7.50	36.74	24.19	32.77	251.24	6.76	258.00
SUPO (+ETEB)	1-22-0-5-4-1	20.79	16.33	24.01	2.73	7.87	1.75	1.32	7.36	1.17	5.28	29.80	17.59	23.74	182.03	6.65	188.68
ETEB	1-22-0-6-0-1	72.60	23.16	15.14	3.48	3.11	3.21	1.77	7.50	1.68	6.58	31.09	21.17	28.57	219.06	6.71	225.77
SISIRITAN	2-6-0-1-0-1	218.35	32.05	20.86	13.14	16.68	11.77	9.31	25.92	3.94	17.60	109.85	39.02	77.77	596.27	14.26	610.53
SISIRITAN (+AGBULU)	2-6-0-1-1-1	218.35	32.05	20.86	12.06	14.08	10.19	8.24	22.57	3.79	17.11	103.09	38.28	75.10	575.77	14.27	590.04
SISIRITAN (+AG. + BULU)	2-6-0-1-2-1	93.71	29.47	19.17	8.41	8.56	6.97	4.94	15.29	4.01	9.53	67.92	28.68	44.50	341.15	7.83	348.98
BULU	2-6-0-3-0-1	220.33	30.22	37.55	9.13	6.83	9.44	5.58	17.87	3.78	17.04	87.94	37.54	72.49	555.75	21.51	577.26
BULU (+AGBULU)	2-6-0-3-1-1	106.65	32.49	35.38	10.36	9.23	10.80	5.25	19.95	2.00	11.60	91.53	32.29	55.13	422.64	21.27	443.91
NABABARAYAN	2-6-1-4-0-1	209.89	27.32	36.61	7.03	5.07	8.19	5.90	14.14	1.91	15.80	67.33	35.41	65.19	499.78	24.45	524.23
DIBAGAT	2-6-1-5-0-1	249.83	20.35	43.75	6.16	7.29	9.25	4.92	13.08	1.00	17.78	59.00	36.94	70.40	539.74	23.96	563.70
AGBULU	2-6-1-6-0-1	198.17	20.94	10.74	3.21	0.00	0.00	2.86	10.15	1.81	12.39	46.76	30.82	50.68	388.53	14.48	403.01
BASAO (+SADANGA)	2-8-3-3-1-1	353.41	29.99	20.10	2.28	3.19	1.20	4.93	8.10	0.52	21.19	34.93	39.03	77.83	596.68	4.20	600.88
SADANGA	2-8-3-5-0-1	319.77	30.10	15.19	3.92	5.13	5.36	3.69	10.22	0.72	19.70	44.13	38.08	74.40	570.41	9.31	579.72
SADANGA (+CHICO-1R)	2-8-3-5-1-1	319.77	30.10	15.19	4.09	7.56	5.47	10.90	11.62	0.59	20.26	49.34	38.82	77.06	590.78	9.31	600.09
BANTAY	2-8-7-24-0-1	28.46	23.77	0.51	2.82	0.00	0.00	4.91	5.70	2.56	3.44	20.38	11.57	15.62	119.74	13.61	133.35
MALIANO	2-8-14-34-0-1	250.42	28.58	17.00	4.09	3.69	5.20	3.00	8.67	2.31	16.15	40.29	34.47	62.08	475.96	22.06	498.02
TABU (+BINGA)	3-77-0-4-1-1	86.49	42.87	43.69	2.87	2.96	2.26	3.29	7.96	0.59	9.65	34.95	26.91	39.67	304.16	8.61	312.77
KANAN	4-7-0-1-0-1	430.85	23.75	32.68	3.79	4.65	4.81	4.45	9.87	1.42	25.81	41.81	43.31	94.08	721.28	8.32	729.60
KANAN (+UP. AGOS 2)	4-7-0-1-1-1	20.48	38.82	10.55	2.95	0.00	0.00	3.24	7.29	1.67	4.25	28.85	14.76	19.93	152.78	7.79	160.57
UPPER AGOS 2	4-7-0-5-0-1	136.94	16.92	7.58	2.03	0.00	0.00	1.56	7.59	1.43	8.70	31.15	25.45	35.90	275.24	9.93	285.17
WAWA	4-115-1-1-0-1	83.18	13.46	4.56	1.11	0.00	0.00	0.65	5.45	1.04	5.47	16.44	16.42	22.17	169.95	5.25	175.20
BOSIGON	5-14-1-1-0-1	31.04	24.71	5.27	2.39	2.66	1.79	0.58	5.66	0.74	3.74	19.68	12.28	16.58	127.12	5.04	132.16

Table 12.4 CONSTRUCTION COST OF RUN-OF-RIVER TYPE SCHEME

(Unit: 10^6 US$)

SCHEME NAME	SCHEME ID. NO.	POWER DEVELOPMENT CONSTRUCTION COST													OTHER COSTS (ACCESS ROAD) (TRANSMISSION LINE) (LAND ACQUISITION)	TOTAL CONSTRUCTION COST
		RIVER INTAKE WEIR	INTAKE	HEADRACE	HEAD TANK	PENSTOCK	POWER HOUSE	TAILRACE	WATER TRANSFER FACILITY	MISCELLANEOUS CIVIL WORK	POWER EQUIPMENT	ENGINEERING & ADMINISTRATION	CONTINGENCY	SUB-TOTAL		
NAGUILIAN	1-003-00-02-0-2	2.22	0.32	10.71	1.20	4.49	4.47	0.87	0.00	1.21	8.05	4.19	5.66	43.38	5.15	48.53
LUYA	1-010-00-01-1-2	4.67	0.85	14.06	1.25	1.10	5.43	0.78	0.00	1.41	10.91	5.06	6.83	52.35	7.99	60.34
BAKUM	1-010-00-02-0-2	4.57	0.22	4.38	1.01	2.68	4.07	0.31	0.00	0.86	6.37	3.06	4.13	31.67	3.71	35.38
ABMURAYAN	1-010-01-04-0-2	4.86	0.73	19.89	0.89	1.01	5.88	0.34	4.25	1.89	12.47	6.52	8.81	67.53	7.91	75.44
ABRA	1-022-00-10-0-2	2.07	0.16	4.57	0.47	0.51	2.37	0.12	0.00	0.51	3.26	1.76	2.37	18.16	3.33	21.49
APAYAO	2-066-01-08-0-2	2.30	0.30	9.78	0.64	0.52	3.25	0.32	0.00	0.86	4.42	2.80	3.78	28.97	10.40	39.37
CHICO-1R	2-008-03-04-0-2	6.99	1.07	5.47	1.14	0.48	4.29	0.22	0.00	0.98	10.10	3.84	5.19	39.77	0.96	40.73
CHICO-1R (+SADANGA)	2-008-03-04-1-2	5.71	1.07	5.48	1.14	0.48	4.20	0.22	0.00	0.92	10.07	3.66	4.94	37.88	0.96	38.84
CHICO-2R	2-008-03-06-0-2	3.13	0.78	11.58	0.94	0.65	4.28	0.18	0.00	1.08	9.77	4.05	5.46	41.90	1.44	43.34
CHICO-3R	2-008-03-07-0-2	3.85	0.56	6.19	0.90	0.54	3.44	0.21	0.00	0.78	6.25	2.84	3.84	29.41	0.54	29.95
CHICO-4R	2-008-03-09-0-2	7.05	0.27	7.70	0.54	0.33	2.68	0.18	0.00	0.94	3.73	2.93	3.95	30.31	0.38	30.69
SALTAN	2-008-05-15-0-2	2.70	0.17	5.57	0.52	0.73	2.46	0.13	1.08	0.67	3.57	2.20	2.97	22.75	2.44	25.19
PASIL	2-008-06-22-0-2	2.56	0.17	7.61	0.63	1.12	2.80	0.25	1.81	0.85	4.44	2.78	3.75	28.77	1.18	29.95
TANUDAN	2-008-06-23-0-2	2.79	0.26	8.34	0.62	1.28	3.19	0.27	0.00	0.84	5.03	2.83	3.82	29.28	4.68	33.96
IBULAO	2-008-20-46-0-2	1.78	0.18	6.33	0.60	0.78	2.98	0.18	0.74	0.68	4.15	2.30	3.10	23.78	5.49	29.27
CASECNAN	2-008-29-58-0-2	2.18	0.33	6.52	0.56	0.30	3.04	0.26	0.00	0.66	3.98	2.23	3.01	23.06	5.06	28.12
UP. CASECNAN	2-008-29-59-0-2	2.92	0.28	7.34	0.49	0.31	3.03	0.26	0.00	0.73	3.84	2.40	3.24	24.85	6.72	31.57
AGNO-2	3-077-00-06-0-2	2.11	0.19	5.09	0.49	0.40	2.95	0.31	1.30	0.64	3.60	2.14	2.88	22.10	2.35	24.45
AGNO-3	3-077-00-07-0-2	3.08	0.14	3.86	0.43	0.80	2.71	0.22	1.10	0.62	2.92	1.99	2.68	20.56	1.30	21.86

Table 12.5 PRICE CONVERSION FACTOR FOR LOCAL PORTION COST

Year	General wholesale price index (1978=100) All items (50%)	Construction Material 1/ (35%)	Petroleum 2/ (15%)	Weighted Average	Conversion Factor (1985=100)
1985	411.1	428.5	567.9	440.8 3/	1.0
84	346.5	333.1	503.7	365.5	1.206
83	208.0	189.8	331.0	220.1	2.004
82	179.0	173.6	289.7	193.8	2.273
81	161.1	157.7	275.3	177.1	2.488
80	140.8	140.0	203.0	149.9	2.941
79	119.0	115.3	128.4	119.2	3.704
78	100.0	100.0	100.0	100.0	4.405
77	95.4	91.4	98.0	94.4	4.673
76	88.8	85.2	92.0	88.0	5.00

Notes: 1/: It is categorized as miscellaneous manufactured articles in general wholesale price index.

2/: Similarly it is represented by mineral fuels, lubricants and related materials among these price index.

3/: 440.8 = 411.1 x 0.5 + 428.5 x 0.35 + 567.9 x 0.15

Source: Philippine Statistical Yearbook 1985, NEDA, Aug. 1985

Table 12.6 WHOLESALE PRICE INDEX (1980 = 100)

Year	Foreign exchange central rate Peso/US dollar 1/	General commodities		
		Industrial countries	U.S.A.	Japan
1985	19.03	(123.5)	114.9	99.5
84	19.76	123.5	115.4	100.7
83	14.00	118.3	112.7	100.9
82	9.17	114.6	111.3	103.2
81	8.20	108.7	109.1	101.4
80	7.60	100.0	100.0	100.0
79	7.42	88.2	87.6	84.9
78	7.38	80.4	77.9	79.1
77	7.37	76.1	72.2	81.2
76	7.43	71.5	68.1	79.7
75	7.50	67.0	65.0	75.9
74	7.07	62.2	59.5	73.7
73	6.73	51.8	50.1	56.0

Note: 1/ Data refers to last working day of the year.

Source: International Financial Statistics, IMF, Aug. 1986
Key Indicators of Developing Member Countries, ADB, July 1986
Economic Statistics Annual 1985, The Bank of Japan, Mar. 1986

Table 12.7 UPDATING OF PROJECT COST OF F/S COMPLETED PROJECT

Project Name	Installed Capacity (MW)	Energy Output (GWh)	Project Cost Estimate (10^6US$)				Project Cost Updated (10^6US$)		
			Estimated Year	Local	Foreign	Total	Local	Foreign	Total
1. Binongan	175	718	1984	97.8	145.2	243.0	124.0	145.2	269.2
2. Palsiguan	42	200	1980	52.5	91.6	144.1	60.0	113.1	173.1
3. Apayao-Abulog	600	1,632	1979	325.8	289.9	615.7	475.6	405.9	881.5
4. Chico-IV	360	955	1980	117.4	322.9	440.3	136.1	398.8	534.9
5. Diduyon	352	957	1980	211.0	181.9	392.9	244.6	224.6	469.2
6. Matuno	180	528	1983	85.0	170.0	255.0	89.5	177.5	267.0
7. Casecnan	268	1,379	1982	187.6	226.4	414.0	201.7	244.1	445.8
8. San Roque	390	1,214	1979	141.0	145.3	286.3	205.8	203.4	409.2
9. Balog-Balog	33	99	1980	14.5	18.7	33.2	16.8	23.1	39.9
10. Agos	140	625	1980	47.1	248.5	295.6	54.5	306.9	361.4

Table 13.1 BENEFIT-COST ANALYSIS FOR IDENTIFIED SCHEMES (1/2)

Scheme ID No.	Scheme Name	Installed Capacity (MW)	Annual Energy (GWh)	Plant Factor (%)	Acc. Benefit (10^6US$)	Acc. Cost (10^6US$)	B-C (10^6US$)	Discount Rate (%)
2-006-00-03-0	Bulu	408.1	1,365.5	38	979.2	861.5	117.7	18
2-006-00-02-0	Buburayan	576.4	1,867.4	36	1,346.8	1,236.3	110.5	18
2-006-01-05-0	Dibagat	301.7	978.3	37	746.8	736.8	10.0	17
2-006-01-06-0	Agbulu	216.3	712.3	37	542.3	514.5	27.8	17
2-008-29-52-0	Cabingatan	265.1	818.1	35	625.9	585.8	40.1	17
2-006-00-01-0	Sisiritan	417.6	1,080.3	29	901.3	858.3	43.0	16
1-022-00-01-0	Banaoang	264.6	925.7	39	741.0	714.8	26.2	16
2-006-01-04-0	Nababarayan	304.2	907.3	34	742.0	730.0	12.0	16
4-007-00-05-0	Upper Agos - 2	135.1	439.1	37	406.5	402.4	4.1	14
1-022-00-05-0	Supo	142.3	438.7	35	407.2	384.7	22.5	14
4-007-00-01-0	Kanan	213.5	688.9	36	743.4	707.6	35.8	12
2-008-07-24-0	Bantay	39.8	122.5	35	132.4	130.8	1.6	12
4-007-00-02-0	Daraitan	61.0	175.7	32	192.3	187.2	5.1	12
5-014-01-01-0	Bosigon	44.7	122.7	31	134.5	127.2	7.3	12
2-008-03-05-0	Sadanga	238.4	611.5	29	745.6	678.0	67.6	11
1-022-00-06-0	Eteb	107.0	296.5	31	356.0	350.6	5.4	11
2-008-14-34-0	Maliano	175.4	540.4	35	636.0	575.4	60.6	11
2-008-08-25-0	Dabba	60.2	186.2	35	219.0	215.9	3.1	11
4-115-01-01-0	Wawa	60.9	201.7	37	258.7	237.5	21.2	10
1-022-01-12-0	Tineg - 1	367.7	639.8	19	929.9	908.1	21.8	10
2-008-14-37-0	Dinapiqui	60.0	165.0	31	217.6	211.5	6.1	10
2-008-29-54-0	Dakgan	168.6	350.2	23	486.7	477.2	9.5	10
2-008-29-61-0	Up. Casecnan - 3	69.5	194.1	31	266.1	259.8	6.3	10
2-005-00-02-0	Zimigui	64.7	177.3	31	258.7	244.6	14.1	9
2-008-03-03-0	Basao	522.4	894.3	19	1,443.6	1,298.4	145.2	9
3-077-00-04-0	Tabu	67.3	460.2	78	256.6	231.0	25.6	9
2-008-14-35-0	Ilagan - 1	208.0	400.2	21	626.5	566.2	60.3	9
2-008-04-10-0	Matalag	23.4	80.6	39	113.5	108.3	5.2	9
3-023-00-02-0	Up. Umiray	215.5	357.1	18	581.6	573.6	8.0	9
2-032-00-01-0	Taboan	50.3	152.5	34	218.3	208.6	9.7	9

Table 13.1 BENEFIT-COST ANALYSIS FOR IDENTIFIED SCHEMES (2/2)

Scheme ID No.	Scheme Name	Installed Capacity (MW)	Annual Energy (GWh)	Plant Factor (%)	Acc. Benefit (10^6US$)	Acc. Cost (10^6US$)	B-C (10^6US$)	Discount Rate (%)
2-008-15-39-0	Abuan - 1	185.4	373.3	22	577.8	545.9	31.9	9
2-008-29-56-0	Kagipsipan	157.8	326.1	23	501.5	493.4	8.1	9
2-008-26-50-0	Pinaripad	78.5	215.3	31	311.7	297.1	14.6	9
2-008-15-38-0	Ballasang	139.1	340.6	27	504.3	484.4	19.9	9
4-007-00-03-0	Upper Agos - 1M	44.6	76.2	19	137.3	127.0	10.3	8
3-023-00-01-0	Umiray - 3	153.9	392.9	29	648.8	641.5	7.3	8
2-008-06-19-0	Naneng	82.0	209.5	29	345.9	337.0	8.9	8
2-008-29-60-0	Up. Casecnan - 2	63.6	174.4	31	283.9	275.6	8.3	8
1-010-00-01-0	Luya	411.7	768.1	21	1,352.3	1,253.3	99.0	8
2-008-13-32-0	Tabuk	36.7	81.1	25	137.2	123.4	13.8	8
2-039-00-01-0	Dikatayan	117.5	239.9	23	412.9	405.5	7.4	8
1-003-00-01-0	Bagulin	183.4	343.1	21	603.6	598.2	5.4	8
2-008-08-26-0	Dalaya	100.6	224.0	25	377.9	347.1	30.8	8
4-007-00-04-0	Up. Agos - 1S	23.4	61.1	29	99.6	95.6	4.0	8
2-047-00-01-0	Palanan	23.4	65.1	31	104.9	99.3	5.6	8
1-022-00-08-0	Upper Bucnit	124.4	223.3	20	448.1	430.8	17.3	7
1-022-00-07-0	Bucnit	148.0	269.7	20	539.1	509.7	29.4	7
2-006-01-07-0	Aoan	196.8	337.8	19	686.1	652.8	33.3	7
2-008-29-57-0	Gadeng	138.6	292.9	24	564.2	519.3	44.9	7
2-008-14-36-0	Ilagan - 2	95.1	201.8	24	388.4	371.1	17.3	7
2-005-00-01-0	Luna	51.7	145.4	32	265.7	242.8	22.9	7
2-008-19-43-0	Alimit - 1	62.3	145.1	26	273.4	251.9	21.5	7
2-008-13-33-0	Banatao	14.7	38.1	29	70.2	63.7	6.5	7
2-008-16-40-0	Catalangan	48.1	126.0	29	231.7	213.1	18.6	7
5-020-00-01-0	Pulantuna	9.1	46.6	58	60.4	54.1	6.3	6
1-010-01-03-0	Tibunec	97.4	201.5	23	445.5	406.1	39.4	6
2-008-06-21-0	Lower Pasil	55.8	115.4	23	255.2	243.8	11.4	6
2-008-20-45-0	Huoab	96.9	223.9	26	482.8	443.1	39.7	6
2-008-19-44-0	Alimit - 2	63.2	150.8	27	322.9	306.3	16.6	6
2-008-05-13-0	Adaga	69.1	128.7	21	292.2	291.4	0.8	6
2-008-03-08-0	Bontoc	73.1	150.5	23	385.9	337.6	48.3	5
2-008-27-51-0	Dibuluan	50.5	107.9	24	274.3	246.0	28.3	5
1-022-01-13-0	Tineg - 2	108.7	209.6	22	546.1	525.8	20.3	5
2-008-11-29-0	Tamauini - 1	52.5	121.0	26	302.2	291.1	11.1	5