



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org



09253



United Nations Industrial Development Organization

Distr.
LIMITED

ID/WG.305/18
13 November 1979

ENGLISH

Seminar-Workshop on the Exchange of Experience
and Technology Transfer on Mini Hydro Electric
Generation Units

Kathmandu, Nepal, 10 - 14 September 1979

MINI HYDRO POWER DEVELOPMENT IN THE PHILIPPINES*

by

E.R. Plamonte **

* The views expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

** Supervisor, Mini Hydro Office, National Electrification Administration, Philippines.

id.79-9051

Introduction

The ultimate objective of the Philippine Government to electrify the country as forecasted would be met by 1990 through the National Electrification Administration (NEA) which had organized and managing 111 Electric Cooperatives in the Philippines whereby (97) ninety seven are operational. On July 2 1979, the Electric Cooperatives successfully achieved a milestone in the field of rural electrification by providing electric service to one million households. The current consumption of the country's electric users reached to 19.98 billion KWH combined rural and urban consumers. The realization of the mini hydropower development basically aims to provide consistent electric service, substitute, supplement or minimize existing fuel fired generation and control power rate escalation. The high percentage of electric power derived from oil fired generation in the rural areas particularly in various Electric Cooperatives situated in the isolated islands is a vivid justification of the imperative need for the immediate and intensified implementation of the NEA mini hydro programme conforming with the ideal topographical and climatological condition of the Philippines. Prioritization of sites are to be developed technically/economically and crossed-matched with a power market order of development. Hence, simpler and economic sites are to be developed initially and further emphasis in terms of present electricity supply condition in these areas. Attached in this documentation is the preliminary listings of mini hydro potential sites in the Philippines.

1. Present Status

On February 1979, Letter of Implementation No. 80 underlined by the President and Prime Minister of the Philippines Ferdinand E. Marcos, appointed the National Electrification Administration (NEA) as the responsible agency on mini hydro power development. Presently, the following tasks are being undertaken:

A. Evaluation and review of the preliminary inventory report on mini hydro potentials in the Philippines. Data were gathered from various agencies, topography and electric Cooperative proposals are included in the inventory. The inventory report is subject to physical investigation planned to be initiated by NEA for appropriate programming. Relatively, the prioritization of the areas for immediate development would initially depend on the status applicable at this stage on area or site planning. Some of which to mention are:

- A.1) Existing and proposed Electric Cooperative distribution Systems;
- A.2) Construction Plans and Schedule;
- A.3) Expansion Plans;
- A.4) Power Market Availability;
- A.5) Technical and Economic Viability.

Based on the above-mentioned, a ten (10) year investment programme was evolved. The mini hydro development would exceed the 10 year planning scheme and a long range span is foreseen during the 5th year implementation stage. The mini hydro inventory report was accomplished on August of 1978.

B. Survey and preliminary studies of an initial 329 mini hydro potential sites with an estimated generating capacity of 745,670 with 48 provinces in the 12 regions of the Philippines.

C. Preparation of a training programme on mini hydro scheduled tentatively before 1980.

D. Evaluation of the survey/reconnaissance, pre-feasibility studies offered by various foreign entities participating under a government or a commercial package for the development of mini hydro projects in different islands and provinces in the Philippines. Should these offers justify its feasibility, NEA anticipates implementation within one (1) year from the date of a approval.

E. A joint venture project scheme on manufacture or fabrication of hydroelectric turbines and other auxiliaries locally between the Philippine Government and the People's Republic of China. Likewise, procurement planning of hydro electric generators from PROC is being initiated.

F. Expansion of the mini hydro organisation in par with the range of activities involved. The organisational structure requires the staffing of at least fifty (50) personnel before the end of 1979.

G. Coordination and comprehensive collection of available pertinent data from other agencies related to the development of mini hydro projects. (i.e. - National Irrigation Administration (NIA), National Water Resources Council (NWRC), Bureau of Public Works (BPW), National Power Corporation (NPC) and etc.).

II. Potentials and Prospects of Developing Mini Hydro in the Philippines

Based on feasibility studies, topographical findings and provincial proponent reports on potential mini hydro sites, NEA had come up with an inventory of 4,539 streams of which, 773 are with adequate to indicative data and 3,766 sites without data subject to site verification and reconnaissance study. The thrust in the planning of mini hydro potentials and approach on the scheme of power development in the Philippines is geared particularly in the rural potential market without an apparent existence of electrification and where development of mini hydro power generation would deem economically and technically feasible.

Development prospects and estimated generating capacities KW:

LUZON	482,360
VISAYAS	177,250
MINDANAO	86,060
TOTAL	<u>745,670</u>

The 745,670 KW from 329 sites is currently under the stage of studies, assessment and planning. It is expected that the potentials reported may tend to increase during the physical investigations and foreseen recommendations from different provinces. Site selection would be basically composed of guidelines criteria which is in the process of formulation concerning areas on:

- II. a) Selection of equipment for application categorized as low, medium and high heads and discharge requirement;
- II. b) Investment and financial viability;
- II. c) Location and distance from power market load;
- II. d) Construction and engineering strategy;
- II. e) Existence of a power market.

The Philippine's topographical feature and prolific stream lines indicate a highly promising venture for mini hydro development apparently conducive to the rural electrification programme, specifically in island grid planned to be self-reliance on electricity.

III. Problems and Constraints in the Development of Mini Hydro Generation in the Philippines

The serious emphasis on the development of mini hydro in the country has been initiated recently due to the intensive fuel crisis which is vitally affecting the normal serviceability of electric power primarily in the rural areas and furthermore, to contribute effectively to the development of the rural electrification programme in the Philippines. For existing electrification projects utilizing oil fired generating units, the NEA Mini Hydro Office is determined to establish mini hydro installations in these areas to minimize, if not displace the existing fuel fired units. However, an optimistic observation which might hinder the progress of the implementation pace are as follows:

- III. a) At present, the mini hydro detailed mechanics and standardized approach are yet to be harnessed from foreign proponents. Transfer of technology and application has yet to be developed;
- III. b) Immediate development of water impounding projects to compensate the low potential sites due to insufficient drainage or catchment areas. Irrigation systems and reforestation programmes likewise has to be considered;
- III. c) Gaging stations would be established in some of the numerous streams and the maintenance of gage keepers;
- III. d) Hydro electric generating sets with the corresponding accessories are currently being imported from various manufacturers from different countries where designs, engineering methods and materials has yet to be exposed to be able to locally produce mini hydro turbo gensets;
- III. e) Accessibility and location of isolated areas with mini hydro potentials will incur a considerable length of time for development.

IV. Suggestions for a Solution to these Problems

The primary element which may resolve to the immediate solution would be the provision of a comprehensive training programme to be more in cognizance on the technical and detailed aspects on mini hydro project development. Imperatively, the transfer of technology from foreign proponents would disseminate advancement for programme application.

For sites with highly indicative potentials (sites with available hydrological, geological, rainfall and topographical data where construction would be immediately applied), consideration for development would be credited. Therefore, pilot projects would be of much relevance to attain the required experience in field operations, desk or office planning and other related tasks to be professed in the future term. Some immediate sites may be emphasized on existing dam structures, waterfalls and irrigation systems.

To gradually refrain, minimize and ultimately eliminate the process of importation of turbo gensets, local fabrication scheme would seemingly be advantageous in the areas of time factors, expenditures and employment benefits. In relation to providing employment, local gage keepers should immediately require the appropriate training and must be hired to maintain the stations in their respective area.

The information dissemination and involvement of the Electric Cooperatives regarding potential mini hydro sites in their areas is expected to minimize or shorten the time table on field surveys.

The optimum effectivity and realization of the mini hydro power development in the Philippines would emerge on terms that the programme had provenly contributed in the aspects of fuel economy/oil savings and provide electrification in most isolated areas within the Electric Cooperative coverage with no immediate or planned schemes for energization.

- 6 -

POTENTIAL HYDRO SITES FOR REGIONS I TO REGION XII
(Estimated Capacity of 500 KW and Above)

S U M M A R Y

<u>REGION</u>	<u>PROVINCE</u>	<u>NO. OF SITES</u>	<u>CAPACITY (KW)</u>
I	Ilocos Norte	18	23,600
	Ilocos Sur	9	11,480
	Abra	14	33,360
	Benguet	2	10,900
	La Union	6	7,020
	Pangasinan	7	35,570
II	Mt. Province	2	1,900
	Apayao	18	41,520
	Ifugao	3	3,900
	Cagayan	7	5,540
	Isabela	14	58,260
	Nueva Vizcaya	8	22,270
III	Bulacan	6	4,040
	Pampanga	6	12,180
	Nueva Ecija	18	36,870
	Tarlac	8	16,320
	Zambales	14	22,370
IV	Palawan	15	14,120
	Laguna	5	12,800
	Marinduque	1	1,000
	Quezon	17	61,090
	Batangas	1	4,000
	Mindoro Oriental	4	8,200
	Mindoro Occidental	3	2,050
V	Albay	3	3,200
	Camarines Sur	7	22,300
	Catanduanes	2	1,860
	Masbate	1	800
	Sorsogon	2	1,640
	Romblon	2	2,200

<u>REGION</u>	<u>PROVINCE</u>	<u>NO. OF SITES</u>	<u>CAPACITY (KW)</u>
VI	Iloilo	2	5,770
	Aklan	6	16,200
	Capiz	2	5,300
	Antique	13	1,600
	Negros Occidental	16	61,700
VII	Cebu	6	8,330
	Bohol	2	3,000
	Negros Oriental	9	19,530
VIII	Samar	8	33,580
	Leyte	9	8,220
IX	Zamboanga del Sur	2	6,200
	Basilan	1	900
X	Bukidnon	10	40,240
	Surigao del Norte	1	2,000
	Surigao del Sur	2	5,500
XI	Cotabato	10	24,440
XII	Lanao del Norte	1	1,780
	Lanao del Sur	1	5,000
TOTAL		330	745,670

ESTIMATED CAPACITIES AND DRAINAGE AREAS OF POSSIBLE HYDRO SITES

REGION I

Provinces: Ilocos Norte

<u>Location</u>	<u>River Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (KW)</u>
Pagudpud	Agua Grande Falls	18,200	200	1,200
Solsona	Gasgas	5,300	25	1,500
Vintar	Vintar	13,900	160	1,200
Solsona	Cura	6,700	90	720
Dingras	Bonga	53,400	10	800
Carasi	Cura	22,700	60	1,200
Dingras	Madongan	15,400	120	900
Nueva Era	Banga	5,200	160	1,200
Laoag	Laoag	135,500	25	1,800
Sto. Nino	Papa	5,100	90	720
Nagrebcan	Tibangran	7,200	160	960
Palsiguan	Palsiguan	15,200	180	1,400
Bulu	Bulu Creek	16,500	220	1,700
Tandagan	Tandagan	24,800	160	1,800
Maypalig	Quiadit	1,400	140	1,000
	Labugaon	6,000	30	1,500
	Taudagan	11,300	20	2,000
	Bornay	7,000	50	2,000

Province: Ilocos Sur

San Vicente	Candon	16,000	15	1,200
Eteb	Abra No. 3	11,000	884	1,760
Padaoil	Padaoil	14,000	24	1,000
Bucnit	Abra	19,000	563	1,500
Suysuyan	Balasian	12,000	164	960
Tibunes	Baklin	19,000	244	1,500
Santay	Abra	481,300	20	1,600
Barrucal	Lancaas	5,500	140	1,000
Bugui	Sta. Maria	3,400	120	960

Province: Abra

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (K)</u>
	Tineg	66,400	15	2,400
Tayum	Abra	257,500	30	1,800
Amluagan	Damanit	14,870	100	800
Naian	Utip	25,810	100	800
Matibuay	Maputik	2,130	100	800
Kumanga	Bitong	9,930	140	1,200
Mabungtan	Manikel	4,050	80	640
Mantaujan	Languyon	9,000	90	560
Taping	Baay	14,740	200	1,600
Paganao	Malanas	12,380	120	960
Bandi	Saquet/Soot	11,790	100	800
Alsola	Binongan	49,200	210	9,000
Naglibacan	Anaya	17,100	140	8,000
	Sapang Dacu	3,700	90	1,000

Province: Benguet

Kabayan	Agno	24,600	9	1,900
Bakling	Bakling	56,200	200	9,000

Province: La Union

San Juan	Barrobo	12,000	120	1,000
Naguilan	Naguilan	31,910	100	800
	Pising	25,200	10	1,000
Duplas	Duplas	3,039	60	1,450
Drissor	Cabasitan	3,126	60	1,450
Rizal	Gallano	12,637	140	1,320

Province: Pangasinan

San Miguel	Toboy	7,400	103	5,770
Sta. Barbara	Sinocolan	18,000	9	1,400
Rosales	Agno	220,900	200	8,000
Bayambang	Poponio	2,100	16	1,200
Mangatarem	Pila	11,700	131	8,000
Mabini	Balinaguing	14,500	15	1,600
Bayaoas	Bayaoas	6,300	97	9,600

REGION II

Province: Mt. Province

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (</u>
Nationin	Siffu Nr. 1	11,400	100	800
Pastor	Siffu Nr. 2	35,900	140	1,100

Province: Apayao

Budtol	Abulug	143,200	45	3,600
Tabuk	Tanundan	36,500	195	3,200
Tinglayan	Chico	108,700	160	9,800
Balbalan	Saltan	25,500	25	600
Luna	Zuuanan	2,570	85	680
Nababalayan	Apayao	105,000	70	5,600
Pimukpuk	Saltan	81,740	8	1,280
Mt. Bolanto	Pasil	25,000	114	1,800
Banatan	Mallig	34,510	110	4,400
Taotao	Taotao	38,700	30	720
Abulug	Sisiritan	53,000	25	3,100
	Bubulayan	21,500	71	590
	Gened	40,500	143	1,200
	Bulu	16,700	151	1,300
	Nagbabalayan	4,200	79	650
	Dinagat	10,100	143	1,100
	Agbulu	9,910	140	1,200
	Aoan	6,500	83	700

Province: Ifugao

Alimit Nr. 2	Alimit	51,300	220	1,600
Alimit Nr. 2	Alimit	42,600	120	960
Lagawe	Tbulao	52,600	120	1,340

Province: Cagayan

Madella	Cagayan	232,300	12	1,060
Tuguegarao	Pinacanauan	65,500	9	700
Alcala	Paret	90,700	6	900
Rizal	Mataing	65,500	10	800

Province: Cagayan

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meter</u>	<u>Estimated Capacity (KM)</u>
Gattaran	Dummon	30,800	7	560
Zimigui	Zimigui	31,700	100	800
Sta. Ana	Paluig	10,000	90	720

Province: Isabela

Jones	Dibulan	27,200	8	1,670
Echague	Cagayan	424,400	10	7,890
San Mariano	Disabungan	19,800	45	3,240
San Mariano	Pinacanan	156,500	100	8,070
Roxas	Siffu	68,600	8	1,620
Naguillan	Cagayan	626,600	9	4,800
San Mateo	Nagt	415,000	114	1,820
Tumauini	Tumauini Irrig.	17,000	6	1,000
Tumauini	Nagt Irrig.	415,000	114	2,700
San Agustin	Dabubu	16,200	80	9,980
Roxas	Malug	56,300	10	530
Catalagan	Catalagan	28,610	115	7,020
Balasang	Abuan	49,300	142	3,120
Divisoria	Calumangan	7,779	120	4,800

Province: Nueva Viscaya

Madella	Cagayan	232,300	10	1,200
Aglipay	Addalan	72,100	12	2,000
Bambang	Natuno	55,800	75	1,200
Bayombong	Nagt	178,400	15	800
Kayapa	Sta. Cruz	16,200	75	1,200
Cadeng	Casocman	56,500	150	4,870
Kagipipan	Casicman	60,900	160	2,500
Sta. Rosa	Asbayadan	25,600	151	8,500

REGION III

Province: Bulacan

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (t)</u>
San Ildefonso	Gablang	8,500	50	800
Norzagaray	Angat	62,900	25	560
Calumpit	Pampanga	791,000	8	640
Calumpit	Labanga	101,600	10	800
San Rafael	Maasim	15,000	30	600
Madlum	Madlum	7,600	80	640

Province: Pampanga

Floridablanca	Gaulaman	7,200	18	580
	Gumain	12,800	93	4,000
Arayat	Pampanga	648,700	5	5,000
Candaba	Maasim	17,400	12	800
Apalit	Sulipan	787,400	10	1,000
Lubao	Gumain	37,000	14	800

Province: Nueva Ecija

Caranglan	Caranglan	25,800	15	1,100
Pantabangan	Pantabangan	25,300	10	900
Pantabangan	Pampanga	83,800	110	7,300
Bongabon	Digmala	8,900	84	3,500
Bongabon	Coronai	70,900	60	3,720
Pias	Sumacbao	28,700	15	2,640
Gen. Tinio	Chico	14,900	86	810
Gapan	Penaranda	57,300	20	600
Munoz	Baliwag	28,400	8	500
San Jose	Talavera	26,100	5	2,200
San Jose	Dupinga	8,500	10	800
Zaragoza	Rio Chico	117,900	15	4,000
Balantingon	Sumacbao	23,600	140	2,000
Lubingan	Lubingan	13,400	215	2,000
Bugnam	Bugnam	3,900	77	800
Cebu	Talictic	7,100	100	1,600
Marinat	Marinat	12,400	50	1,800
Canaan	Banco	7,100	31	600

Province: Tarlac

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (KW)</u>
Capas	O'Donnel	24,000	26	1,000
Capas	Banagat	9,000	60	1,600
Tarlac	Bulsa	40,500	39	4,200
Mayantoc	Camiling	14,200	136	5,760
Queson	Rio Chico	209,000	10	800
Bamban	Parua	14,800	12	860
	O'Donnel	21,300	10	500
San Nicolas	Malago	7,500	60	1,600

Province: Zambales

Botolan	Faguiguis	3,000	35	500
Botolan	Tumanoc	6,700	36	900
Sta. Cruz	Nayon	12,800	20	960
Palauig	Bagit	6,800	11	660
Botolan	Bucac	61,500	160	7,200
San Marielino	Sto. Thomas	1,700	3	800
	Cabaluan	21,000	10	1,200
Marella	Marella	7,500	80	600
Mapanupe	Mapanupe	3,200	30	600
Candelaria	Mambura/Tapoco	6,400	160	4,000
Cabangan	Tonguey	3,400	12	650
Tabung	Matain	13,100	60	1,500
Subic	Caulaman	17,200	100	800

Province: Zambales, Olongapo City

	Sta. Rita	14,000	80	2,000
--	-----------	--------	----	-------

REGION IV

Province: Palawan

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (KW)</u>
Iwahig	Iwahig	25,700	40	2,000
Sogon	Marangas	14,822	160	1,280
Mainit	Tigaplan	2,532	150	1,200
Barong-barong	Barong-barong	7,174	115	900
Filantropia	Filantropia	4,400	90	720
Quezon	Kinlungan	3,849	70	560
Quezon	Lamakan	10,600	90	720
Aborlan	Panacan	3,664	130	1,000
Malasgao	Malasgao	10,796	110	880
Inagawan	Inagawan	11,785	80	640
Baton-baton	Baton-baton	7,978	140	1,100
Apurawan	Apurawan	7,894	100	800
Babuyan	Babuyan	21,329	80	640
Caramay	Risal	12,933	120	960
Langogan	Langogan	19,817	90	720

Province: Laguna

	Maapon	23,100	7	700
	Bonbongan	21,100	12	2,000
	Botocan	21,800	13	2,000
	Malaking Hog	56,000	12	4,000
Caliraya	Caliraya	91,500	106	4,100

Province: Marinduque

Boac	Boac	21,800	140	1,000
------	------	--------	-----	-------

Province: Quezon

Daraitan	Kalivia	34,000	106	3,300
Kanan	Kanan	35,700	20	640
Madella	Dibuluan	19,280	150	2,400
Madella	Cagayan	231,680	50	9,000
Pinaripad	Addalam	84,810	85	6,800

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (KW)</u>
Madella	Taboyong	12,810	95	1,500
Madella	Diduyon	4,850	110	4,400
Cabingatan	Conwap	147,300	135	9,850

Province: Quezon

Tayabas	Gumaca Nr. 1	5,400	9	1,500
Tayabas	Ibia	1,500	15	800
	Agos	39,700	130	1,500
	Cambangan	27,900	10	8,000
	Calabgan	2,400	30	500
	Lanco	3,600	10	500
Bosigan	Bosigan	6,300	15	1,800
Malupa	Malupa	20,200	100	1,600
Dakgan	Casemon	82,000	110	7,000

Province: Batangas

Rosario	Malaking	23,467	50	4,000
---------	----------	--------	----	-------

Province: Oriental Mindoro

	Bongabon	32,000	15	4,000
Calapan	Bucayao	33,900	25	1,600
Naujan	Nagasawang Tubig	43,500	18	1,400
	Pangalaan	2,800	15	1,200

Province: Occidental Mindoro

Abra de Ilog	Mamburao	18,900	23	550
Mamburao	Pagbanan	26,300	31	1,000
San Jose	Ibog Sablayan	19,600	25	500

REGION V

Province: Albay

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (KW)</u>
Oas	Irraya	21,700	18	560
Ligao	Taliray	9,000	80	640
Oas	Quinale	23,200	8	2,000

Province: Camarines Sur

Tabua	Bicol	90,500	5	1,060
Lupi	Pulautuna	17,200	90	5,120
Lupi	Culacling	6,400	45	1,270
Sipocot	Sipocot	44,700	20	5,480
	Lake Buhi	12,800	14	7,600
	Manapot	3,590	90	1,040
	Darit	14,200	7	750

Province: Catanduanes

Sagrada	Miga	3,911	110	900
Pagsagnahan	Bato	7,926	130	960

Province: Masbate

Mandaon	Batongan	7,200	25	800
---------	----------	-------	----	-----

Province: Sorsogon

	Bulusan	10,300	14	1,040
Sorsogon	Cauayan	1,500	10	600

Province: Ponblon

	Odiongan	7,500	10	900
San Fernando	Catingas	4,800	12	1,300

REGION VI

Province: Iloilo

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (KW)</u>
Passi	Jalaur Nr. 3	53,400	32	510
Padre Duenas	Ulian	24,700	110	880
Pototan	Jalaar Nr. 5	149,900	16	1,280
Iloilo	Sibalom	11,700	100	800
Dap	Alibunan	1,800	100	700
Tibum	Tigum	4,700	100	800
Carucuan	Tauian	4,000	100	800

Province: Aklan

Malinaw	Aklan	70,500	35	6,200
	Basang	80,000	10	1,600
Talangran	Tingbaban	11,300	70	800
Mt. Gaguman	Ibajay	11,700	170	6,500
Maloco	Maloco	6,700	40	600
Ragador	Dumalaylay	6,300	40	500

Province: Capiz

Cuartero	Panay	88,000	60	4,000
	Tibiao	15,000	19	1,300

Province: Negros Occidental

Murcia	Hinugaan	48,800	25	900
Kabankalan	Ibog Nr. 1	124,500	30	

<u>Location</u>	<u>River Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (KW)</u>
Kabankalan	Ilog No. 2	134,000	100)	
"	" No. 3	194,700	25)	45,000
"	" No. 4	195,900	50)	
rong	Ilog No. 5	28,300	70)	
Kabankalan	Hilabangan No. 1	43,100	90)	1,440
Magallon	Binalban	35,000	90)	6,000
Isio	Isio	5,600	110)	800
Province: Negros Occidental				
Dapdap Hill	Binulig Creek	16,100	70	1,600
Sipalay	Calatong	7,300	90	1,440
Hinoba	Maragandang	1,300	300	500
Mambucal	Asia-Sinagnan	1,000	373	1,500
Marcia	Big Caliban	5,000	23	1,000
	Malogo	12,900	10	720
	Bago	44,500	115	800
Province: Antique				
Codasi	Basong	5,400	150	1,200
Bug		17,000	150	1,500
Sibalom	Sibalom	63,500	20	1,000
	Tibiao	57,500	60	900
	Bauayan	70,000	40	800

Provinces: Antique

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (KW)</u>
Panglanganan	Timpuluan	6,800	190	1,600
Villa Salomen	Ipayo	5,300	180	2,800
San Agustin	Cangaran	6,600	190	800
Pan-an	Palanas	12,200	190	1,600
San Roque	San Roque	2,300	90	500
Rizal	Maninila	11,500	170	800
Bacacay Esperanza	Panganta	15,200	30	1,500
Idio	Kataw Falls		60	600

REGION VII

Province: Negros Oriental

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (KW)</u>
	Daoy	32,300	10	780
Amlan	Amlan	2,700	18	800
Carambahan	Pangatban	36,100	170	4,000
Sta. Catalina	Cavitan	6,200	150	1,200
Siaton	Siaton	18,100	20	750
Bayawan	Sicopong	18,900	70	1,500
Maluminsag	Libertad	22,600	130	2,500
Bigao	Pagatban	36,500	190	5,000
Bayawan	Bayawan	24,800	110	3,000

Province: Cebu

Barili	Mantupayan	1,500	104	800
Panao City	Luyang	4,700	60	4,700
Talisay	Managal	4,800	46	690
Argao	Argao	5,600	65	600
	Sapang Daku	5,600	130	1,000
Mantauijan	Laugayon	6,000	90	560

Province: Besol

Loboc	Loboc	61,800	11	800
Inabanga	Cantakoy Falls	58,900	8	1,000
Sierra Bullones	Wahig-Inabanga	864,000	60	1,200

REGION VIII

Province: Samar

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has)</u>	<u>Head Meters</u>	<u>Estimated Capacity (KW)</u>
Las Navas	Catubig	25,200	35	2,800
	Mawo	13,900	15	2,000
	Borongon	8,700	20	1,400
	Candora	11,500	10	3,780
	Tan-ok Falls	3,100	80	1,600
	Victoria	6,700	120	8,500
	Ulot	4,400	35	6,500
	Bolusao	3,800	12	1,000

Province: Leyte

Guinsangan	Himbangan	4,700	110	720
Amparo	Amparo	6,600	100	800
Kananga	Bao	6,500	30	1,600
Buraven	Buraven	13,500	25	500
Abuyog	Bito	9,400	90	1,400
Dagani	Nitomog	500	67	800
	Tunga	7,000	48	1,000
	Binahan	13,000	20	900
Carigara	Naliwatan	1,900	15	500

REGION IX

Province: Zambo ga del Sur

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (KW)</u>
	Lake Wood	6,700	40	5,000
	Dacu	37,500	15	1,200

Province: Basila

Isabela		12,000	50	900
---------	--	--------	----	-----

2346 2347

REGION X

Province: Bukidnon

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meters</u>	<u>Estimated Capacity (KW)</u>
Tigbao	Agusan	30,000	34	6,900
Baungon	Babunayan Falls	30,000	42	5,000
Malaybalay	Alalum	3,000	30	3000
Kibawe	Mulita	73,600	20	3,800
	Bayog	48,000	20	10,000
	Cagayan	55,000	15	8,000
	Malunum	20,000	18	1,200
Valencia	Sagomata	1,900	20	540
Valencia	Pulangui	273,000	10	1,800
Valencia	Manupoli	48,700	18	2,200

Province: Surigao del Norte

Hubo	21,200	10	2,000
------	--------	----	-------

Province: Surigao del Sur

Tago	Tago	67,600	10	3,000
Cantillan	Carac-an	24,000	10	2,500

REGION XI

Province: Cotabato

<u>Location</u>	<u>River/Creek</u>	<u>Drainage Area (Has.)</u>	<u>Head Meter</u>	<u>Estimated Capacity (KW)</u>
Carmen	Pulangui	675,200	35	9,280
Matalam	Kabakan	69,800	12	860
Pikit	Maridagao	135,300	60	3,000
Bagong Tapay	Maglasila	14,500	25	940
Isulan	Allah	93,600	8	960
	Malaang	87,900	18	600
	Bugasan	9,700	37	600
	Buaton	373,800	10	2,500
	Lumpequeno	75,700	10	4,700
Tinanan Plain	Kulamlam	21,000	12	1,000

REGION XII

Province: Lanao del Norte

Lala	Maranding	34,500	25	1,780
------	-----------	--------	----	-------

Province: Lanao del Sur

Matling	Matling	75,700	85	5,000
---------	---------	--------	----	-------



C-209



80.06.23

gr