2.5 ELECTRIFICATION STATUS ALL OVER THE PHILIPPINES

The installed and dependable capacities of each grid system in the Philippines as of 2009 are given in the following table. 85% of the total installed capacity of 15,610 MW is dependable capacity. The dependable output is based on monthly operation reports submitted to the DOE. It is examined using daily operational reports made by the NGCP.

Table 2.5-1 Installed and Dependable Capacity (2009)

Area	Plant Type	Capacity (MW)		Percent Share (%)	
		Installed	Dependable	Installed	Dependable
Luzon	Coal	3,849	3,450	32.4	33.7
	Oil Based	1,984	1,617	16.7	15.8
	Natural Gas	2,831	2,700	23.9	26.4
	Geothermal	886	431	7.5	4.2
	Hydro	2,280	1,999	19.2	19.5
	Wind	33	33	0.3	0.3
	Biomass	1	1	0.0	0.0
	Total	**11,863**	**10,230**		
Visayas	Coal	196	153	10.8	11.0
	Oil Based	615	426	33.9	30.6
	Geothermal	964	792	53.0	56.9
	Hydro	13	13	0.7	0.9
	Biomass	29	9	1.6	0.6
	Total	**1,818**	**1,392**		
Mindanao	Coal	232	210	12.0	12.4
	Oil Based	594	485	30.8	28.6
	Geothermal	103	98	5.4	5.8
	Hydro	998	902	51.8	53.2
	Solar	1	1	0.1	0.1
	Total	**1,929**	**1,697**		
Philippines	Coal	4,277	3,813	27.4	28.6
	Oil Based	3,193	2,528	20.5	19.0
	Natural Gas	2,831	2,700	18.1	20.3
	Geothermal	1,953	1,321	12.5	9.9
	Hydro	3,291	2,914	21.1	21.9
	Wind	33	33	0.2	0.2
	Solar	1	1	0.0	0.0
	Biomass	30	10	0.2	0.1
	Total	**15,610**	**13,319**		

Source : 2009 Power Sector Situationer, DOE Portal

Peak demands in 2008 and 2009 are given in the below table. Annual growth rate in the Mindanao grid in 2009 was 8.3%, 3% more than the previous year. Demand in Davao and Cotabato areas is increasing considerably.

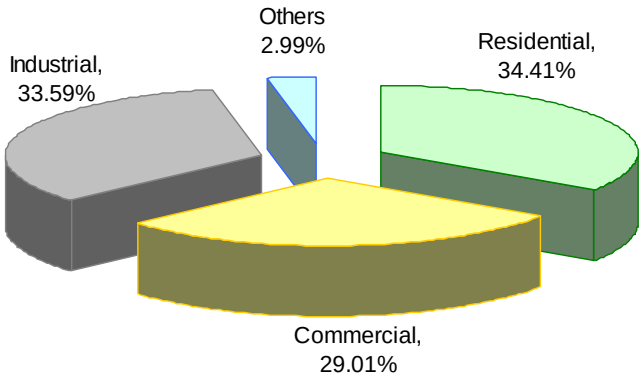
Table 2.5-2 Peak Demand by Region in 2008 and 2009

Grid	Peak Demand , MW		Changes	
	2008	2009	MW	%
Luzon	6,674	6,928	254	3.8
Visayas	1,176	1,241	65	5.5
Mindanao	1,204	1,303	99	8.3
Philippines	8,965	9,352	387	4.3

Note: Non coincident peak for total Philippines

Source : 2009 Power Sector Situationer, DOE Portal

Shares of electricity sales in 2009 are given in the below figure. The total sales in 2009 are about 9.2% more than those in 2008, at 46,582 GWh. The sales growth was due to the increased power consumption of public buildings, town lights, irrigation systems and others.



Source : 2009 Power Sector Situationer, DOE Portal

Fig. 2.5-1 Electricity Sales by Sector (2009)

2.6 STATUS OF RENEWABLE ENERGY DEVELOPMENT

2.6.1 Movement of Renewable Energy Projects

In January 2009, the "Renewable Energy Act of 2008" was enforced in order to promote development and utilization of RE such as geothermal, hydro, wind, solar and ocean power, in the Philippines.

According to the NREP (National Renewable Energy Plan) (2011-2030) announced by the DOE in June 2011, the target of additional RE capacity for the 20 years from 2011 to 2030 is around 3 times larger than the existing capacity. As seen in the table shown below, a total of 9,865 MW of new additional capacity from RE is to be developed, consisting of HEP of 5,394 MW (increase of 160%), geothermal power of 1,495 MW (increase of 75%), wind power of 2,345 MW, solar power of 284 MW, biomass power of 276 MW and ocean power of 70 MW.

Table 2.6-1 RE-Based Capacity Installation Targets up to 2030

Sector	Installed Capacity (MW) as of 2010	Target Capacity Addition by				Total Capacity Addition (MW) 2011-2030	Total Installed Capacity by 2030
		2015	2020	2025	2030		
Geothermal	1,966.0	220.0	1,100.0	95.0	80.0	1,495.0	3,461.0
Hydro	3,400.0	341.3	3,161.0	1,891.8	0.0	5,394.1	8,724.1
Biomass	39.0	276.7	0.0	0.0	0.0	276.7	315.7
Wind	33.0	1,048.0	855.0	442.0	0.0	2,345.0	2,378.0
Solar	1.0	269.0	5.0	5.0	5.0	284.0	285.0
Ocean	0.0	0.0	35.5	35.0	0.0	70.5	70.5
Total	**5,438.0**	**2,155.0**	**5,156.5**	**2,468.8**	**85.0**	**9,865.3**	**15,304.3**

Source :NREP (2011-2030), DOE

On the other hand, plans are to increase capacity installation targets of RE by 7,145 MW from 3,287 MW to 10,432 MW in Luzon, by 1,018 MW from 1,006 MW to 2,024 MW in Visayas and by 1,701 MW from 1,140 MW to 2,845 MW in Mindanao.

Table 2.6-2(a) RE- Based Capacity Installation Targets up to 2030 in Luzon

Sector	Installed Capacity (MW) as of 2010	Target Capacity Addition by				Total Capacity Addition (MW) 2011-2030	Total Installed Capacity by 2030
		2015	2020	2025	2030		
Geothermal	899.0	100.0	720.0	0.0	0.0	820.0	1,719.0
Hydro	2,346.0	182.0	2,169.5	1,510.0	0.0	3,861.5	6,207.5
Biomass	9.0	97.3	0.0	0.0	0.0	97.3	106.3
Wind	33.0	841.0	840.0	432.0	0.0	2,103.0	2,136.0
Solar	0.0	228.05	0.0	0.0	0.0	228.05	228.05
Ocean	0.0	0.0	35.5	0.0	0.0	35.5	35.5
Total	**3,287.0**	**1,438.4**	**3,765.0**	**1,942.0**	**0.0**	**7,145.4**	**10,432.4**

Table 2.6-2(b) RE- Based Capacity Installation Targets up to 2030 in Visayas

Sector	Installed Capacity (MW) as of 2010	Target Capacity Addition by				Total Capacity Addition (MW) 2011-2030	Total Installed Capacity by 2030
		2015	2020	2025	2030		
Geothermal	964.0	70.0	140.0	65.0	60.0	335.0	1,299.0
Hydro	13.0	84.5	102.4	81.8	0.0	268.7	281.7
Biomass	29.0	142.6	0.0	0.0	0.0	142.6	171.6
Wind	0.0	217.0	0.0	10.0	0.0	227.0	227.0
Solar	0.0	34.0	0.0	0.0	0.0	34.0	34.0
Ocean	0.0	0.0	0.0	11.0	0.0	11.0	11.0
Total	**1,006.0**	**548.1**	**242.4**	**167.8**	**60.0**	**1,018.3**	**2,024.3**

Table 2.6-2(c) RE- Based Capacity Installation Targets up to 2030 in Mindanao

Sector	Installed Capacity (MW) as of 2010	Target Capacity Addition by				Total Capacity Addition (MW) 2011-2030	Total Installed Capacity by 2030
		2015	2020	2025	2030		
Geothermal	103.0	50.0	240.0	30.0	20.0	340.0	443.0
Hydro	1,040.0	74.8	889.1	300.0	0.0	1,263.9	2,303.9
Biomass	0.0	36.8	0.0	0.0	0.0	36.8	36.8
Wind	0.0	0.0	15.0	0.0	0.0	15.0	15.0
Solar	1.0	7.0	5.0	5.0	5.0	22.0	23.0
Ocean	0.0	0.0	0.0	24.0	0.0	24.0	24.0
Total	**1,144.0**	**168.6**	**1,149.1**	**359.0**	**25.0**	**1,701.7**	**2,845.7**

Source : NREP (2011-2030), DOE

The forecasted peak demand in each system and total capacity of RE targeted by the NREP are shown in the below table. Although large-scale HEP projects are included in renewable energy resources, the ratio of RE to peak demand is 40% at present. The additional capacity of RE up to 2030 is 2.8 times the existing capacity and the ratio of RE to peak demand increases 62%.

Table 2.6-3 Comparison of Forecasted Peak Demands and RE Installation Target

		Luzon	Visayas	Mindanao	Total
2010 (Existing)	All Energy	10,030	1,505	1,682	13,217
	RE	3,287	1,006	1,144	5,438
2020	All Energy*	11,349	2,082	2,223	15,654
	RE	8,490	1,796	2,461	12,749
2030	All Energy*	17,636	3,404	3,493	24,533
	RE	10,432	2,043	2,845	15,304

* : Peak demand, RE : Renewable Energy

The framework for RE development is shown in the following figure. To accelerate the development and utilization of RE, sub-programs for industry supply, resource development, research, development and demonstration, and RE technology support are described. Policy formulation, implementation and monitoring of RE laws, registration processing, information exchange, etc. are proposed in order to support the development of RE.

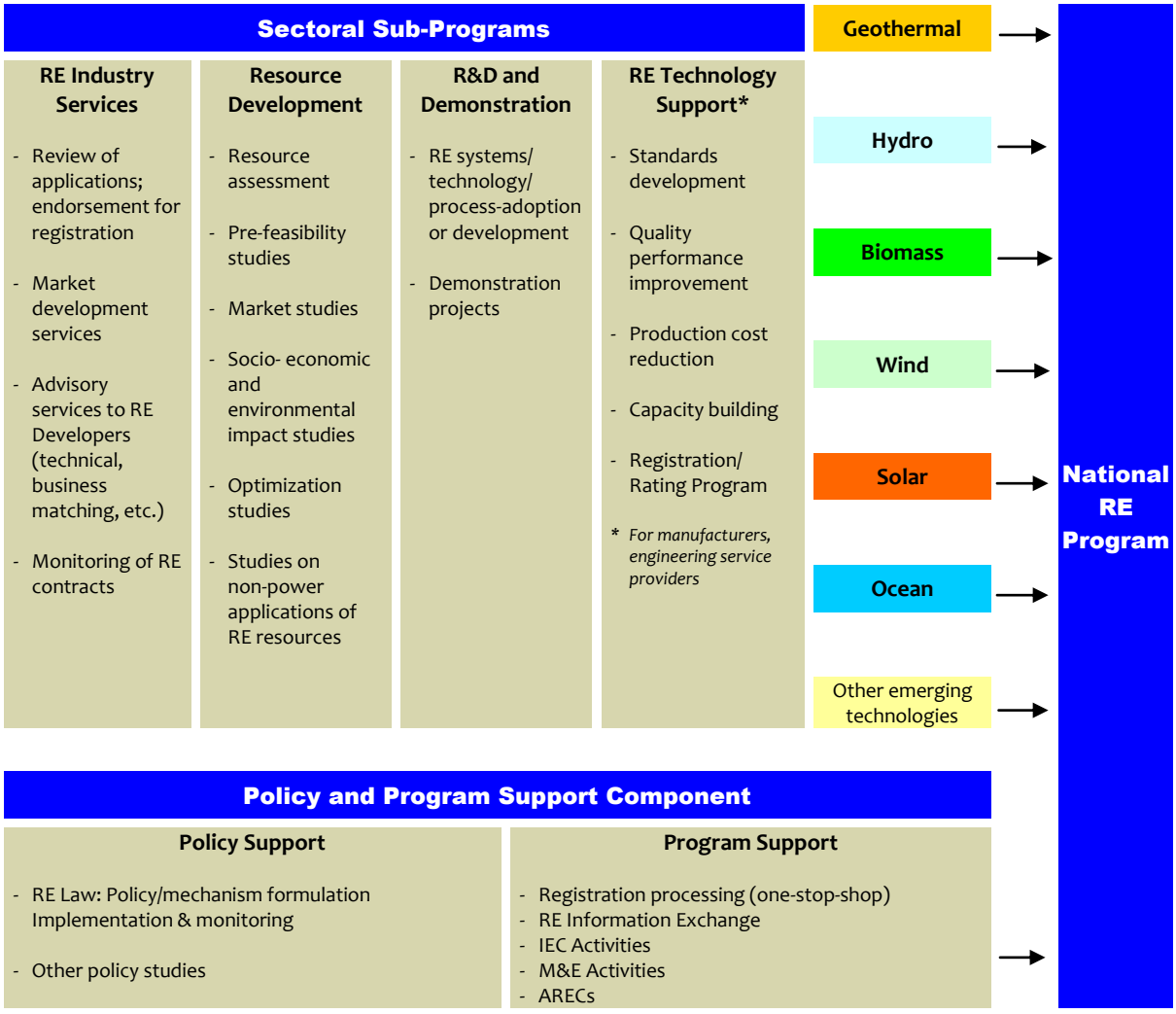


Fig. 2.6-1 National Renewable Energy Plans and Program Development Framework

Source : NREP (2011-2030), DOE

At first, in October 2009, the DOE approved 87 new RE projects with a total project cost of 2.2 billion USD and applied for by 18 enterprises. The total output is 4,042 MW consisting of biomass, geothermal, hydro, wave, solar and wind power projects. Among the 87 projects, 65 are RE service contracts and the remaining 22 are RE conversion contract, consisting of 17 hydropower and 5 thermal power plants.

"RE service contract" refers to a service agreement between the government through the DOE, and an RE developer over a period in which the RE developer has the exclusive right to a particular RE area for exploration and development. The RE service contract is divided into two stages: a pre-development stage and development / commercial stage. The preliminary assessment and feasibility up to financial closing constitute the pre-development stage. The construction and installation of the facilities up to operation phase are the development stage. On the other hand, for existing RE plants, the contract holder may elect to convert its service contract/agreement under applicable laws by applying for an RE contract. A conversion contract is applied to existing RE projects.

As of September 2011, 237 RE projects with a total capacity of around 2,400 MW have been awarded to RE developers.

Table 2.6.4 List of Awarded Renewable Energy Projects

Renewable Energy	Number	Potential Output (MW)	Output (MW)
Geothermal	21	606	1,972
Hydropower	124	797	135
Wind power	6	936	0
Biomass	41	469	292
Ocean power	3	5	0
Photo voltaic power	2	31	0
Total	**237**	**2,844**	**2,399**

Source : DOE Portal site September, 2011

2.7 RENEWABLE ENERGY LAW

2.7.1 Enactment of the Renewable Energy Law

On December 16, 2008, the "Renewable Energy Act of 2008, RA.9315" was enforced after endorsement by President Arroyo, and then, on May 25, 2009, the Implementing Rules and Regulations (IRR) were issued.
Energy sources include biomass, PV, wind, hydro, geothermal and ocean, and hybrid systems.

The objective of the RE Act is to promote RE development through preferential tax measures dealing with environmental and energy issues established by the NREB (National Renewable Energy Bureau).

According to the law, rural economy development in isolated non-grid connected islands and development of environment-friendly energy will be achieved. Furthermore, private sector participation and investment in RE business are promoted through preferential measures in order to promote the utilization of rural RE by means of market-led approach.

The purposes of the RE law are as below.

① To promote RE energy development as self-sustaining energy by surveying, development and utilization of RE energy such as biomass, solar, wind, hydro, geothermal power, ocean resources and hybrid systems.

② To increase utilization of RE energy in broad commercial applications and effective uses by institutionalizing RE utilization, developing capacity on the national and regional levels in the use of the system, as well as providing financial and non-financial incentives and subsidies.

③ To promote the development and utilization of RE energy by effectively preventing or reducing hazardous wastes , in order to balance the goals of economic growth and development with the required health and environmental protection.

④ To build the infrastructure and mechanisms necessary to exercise the rights set forth in the law and other current legislation.

The main contents of the law are as below.

① Provision of incentives for RE producers
② Obligation placed on private energy producers to start RE production in order to diversify sources of energy
③ Setting of a pricing mechanism to promote use of RE by consumers and users from an eco-friendly viewpoint
④ Establishment of a fund to finance activities related to various new RE
⑤ Installation of hybrid systems to increase the reliability of the system

2.7.2 Establishment of the National Renewable Energy Board

In order to ensure the proper enforcement of the law, and to assist the DOE, the NREB was established. The rights and duties of the NREB are as follows.

① Evaluate and recommend to the DOE the mandated RPS and minimum RE generation capacities in off-grid areas, as it deems appropriate;

② Recommend specific actions to facilitate the implementation of NREP to be executed by the DOE and other appropriate agencies of government and to ensure that there shall be no overlapping and redundant functions within the national government agencies concerned;

③ Monitor and review the implementation of the NREP, including compliance with the RPS and minimum RE generation capacities in off-grid areas;

④ Oversee and monitor the utilization of the RE Trust Fund created pursuant to Section 28 of this Act (RE Trust Fund) and administered by the DOE; and

⑤ Perform such other functions, as may be necessary, to attain the objectives of this Act.

Source: Republic Act NO. 9513, An Act Promoting the Development, Utilization and Commercialization of RE resources and for Other Purposes

The following tax exemptions are provided to RE developers for RE development.

① ITH (Income Tax Holiday) - For the first seven (7) years of the its commercial operations, the duly registered RE developer shall exempt from income taxes levied by the National Government.

② Duty-free Importation of RE Machinery, Equipment and Materials - Within the first ten (10) years upon the issuance of a certification of an RE developer, the importation of machinery and equipment, and materials and parts thereof, including control and communication equipment, shall not be subject to tariff duties: Provided, however That the said machinery, equipment, materials and parts are directly and actually needed and used exclusively in the RE facilities for transformation into energy and delivery of energy to the point of use and covered by shipping documents in the name of the duly registered operator to whom the shipment will be directly delivered by customs authorities: Provided, further, That endorsement of the DOE is obtained before the importation such machinery, equipment, materials and parts is made.

③ Special Reality Tax Rates on Equipment and Machinery – Any law to the contrary notwithstanding realty and other taxes on civil works, equipment, machinery, and other improvements of a registered RE Developer actually and exclusively used for RE facilities shall not exceed one and a half percent (1.5%) of their original cost less accumulated normal depreciation or net book value: Provided, That in case of an integrated resource development and generation facility as provided under Republic Act No. 9136, the real property tax shall only be imposed on the power plant.

④ NOLCO (Net Operating Less Carry-Over) - The NOCLO of the RE Developer during the first three (3) years from the start of the commercial operation which had not been previously offset as deduction from gross income shall be carried over as a deduction from gross income for the next seven (7) consecutive taxable years immediately following year of such loss: Provided, however, that operating loss resulting from the availment of incentives provided for in this Act shall not be entitled by NOLCO.

⑤ Corporate Tax Rate - After seven (7) years of ITH, all RE Developers shall pay a corporate tax of ten percent (10%) on its net taxable income as defined in the NIRC (National Internal Revenue Code) 1997, as amended by Republic Act No. 9337: Provided, That the RE Developer shall pass on the savings to the end-users in the form of a lower power rate.

⑥ Accelerated Depreciation - If, and only if, an RE project fails to receive an ITH before full operation, it may apply for Accelerated Depreciation in its tax books and be taxed based on such: Provided, That if it applies for Accelerated Depreciation, the project or its expansions shall no longer be eligible for an ITH. Accelerated depreciation of plant, machinery, and equipment that are reasonably needed and actually used for the expansion, development and utilization of RE resources may be depreciated using a rate no exceeding twice the rate which would have been used had the annual allowance been computed in accordance with the rules and regulations prescribed by the Secretary of Department of Finance and the provisions of the NIRC of 1997, as amended. Any of the following methods of accelerated depreciation may be adopted: i) Declining balance method: and ii) Sum-of-the year digit method.

⑦ Zero Percent Value-Added Tax Rate - The sale of fuel and power generation from renewable source of energy but not limited to, biomass, solar, wind, hydropower, geothermal, ocean energy and other emerging energy sources using technologies such as fuel cells and hydrogen fuels shall be subject to zero percent (0%) VAT (Value-Added Tax), pursuant to the NIRC of 1997, as amended by RA No. 9337.
All RE Developers shall be entitled to zero percent (0%) VAT on its purchases of local supply of goods, properties and services needed for the development, construction and installation of its plant facilities.

⑧ Cash Incentive of RE Development for Missionary Electrification- A RE developer, established after the affectivity of the Act, shall be entitled to a cash generation-based incentive per kilowatt-hour (kWh) rate generated, equivalent to fifty percent (50%) of the universal charge for power needed to service missionary areas where it operates the same, to chargeable against the universal charge for missionary electrification

⑨ Tax Exemption of Carbon Credits - All proceeds from the sale of carbon emission credits shall be exempt from any and all taxes.

⑩ Tax Credit on Domestic Capital Equipment and Services - Tax credit equivalent to one hundred percent (100%) the value of the VAT and custom duties that would have been paid on the RE machinery, equipment, materials and parts had these items been imported shall be given to an RE operating contract holder who purchases machinery, equipment, materials and parts from a domestic manufacturer for purposes set forth in this Act: Provided, That prior approval by the DOE was obtained by the local manufacturer: Provided: That the acquisition of such machinery, equipment, materials and parts shall be made within the validity of the RE operating contract.

Source: RA NO. 9513, An Act Promoting the Development, Utilization and Commercialization of RE resources and for Other Purposes

According to the RPS regulated by law, which will soon be declared in the Philippines, all power supply companies will be obligated to contribute to the development of RE projects. According to the NREB, the RPS apply to any power supplier. It is regulated by the law that both existing companies and newcomers should contribute towards the increase in RE capacity.

2.8 ELECTRICITY MARKET

Fig. 2.8-1 shows the current structure of the electric power sector in the Philippines.

In June 2001, the Philippine EPIRA was enacted and the Philippines took a big step forward towards liberalization of the electric power industry for the first time amongst developing countries.

Due to the restructuring of the electric power sector, the investment pattern of the electric power sector replaced the previous BOT (Build-Operate-Transfer) and BOO (Build-Own-Operate) with new investment by the private sector (commercial plants in relative agreement with distribution power companies, electricity markets), which has now become the mainstream.

(Note: The BOT and BOO schemes are independent of the RA of 2008.)

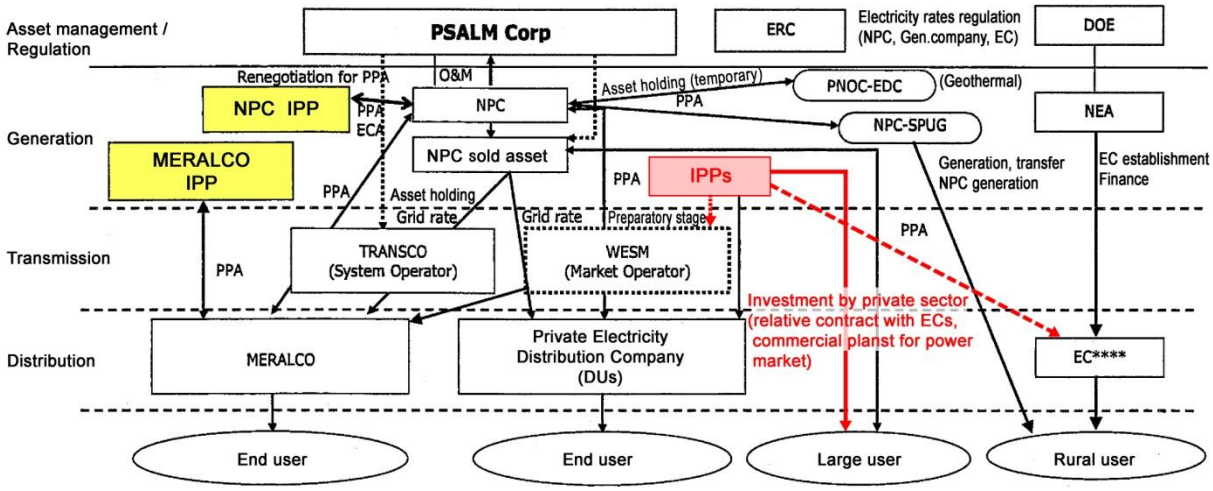


Fig. 2.8-1 Structure of Philippine Power Sector

Source : Report on Project formation in Energy Conservation Field, Republic of the Philippines DOE, March 2008, JICA

The ERC (Energy Regulatory Commission) is the agency that promotes competitive operations and regulates the performance of participants of the electricity market in the liberalized power sector. The ERC promulgates implementing rules and regulations of the EPIRA, and determines, establishes and approves transmission and distribution wheeling charges and retail rates through an ERC-established and -enforced rate-setting methodology.
The ERC monitors and takes measures to discourage/penalize abuses of market power, cartelling and any anti-competitive or discriminatory behavior by any electric power industry participant.

The PSALM, which manages and disposes of all assets such as the NPC's facilities, debts, IPP contracts, etc., was newly established by the enforcement of the EPIRA. Transmission line assets facilities and their operation and maintenance under the NPC were transferred to the TRANSCO. After the privatization of the NPC, the NPC-SPUG operates as a state-run company and is responsible for the operation and maintenance of existing power plants, mainly in the off-grid areas where no profits are obtained and rural electrification is the purpose. TRANSCO is responsible for the construction, operation and maintenance of transmission lines. Concerning the privatization of TRANSCO, TRANSCO manages its

transmission line facilities and a JV (Joint Venture) consisting of a Chinese company and a local conglomerate that was awarded a concessionary contract (25 years) for transmission line business authorization. he concessionaire has the responsibility of expanding transmission line facilities based on the Transmission Development Plan.

Distribution line cooperatives consist of 16 PIOUs, 119 ECs and 8 LGUOUs, so the total number is 143. MERALCO (Manila Electric Company) is the largest utility in the Philippines. In urban areas where profits are obtained, PIOUs are operating, however, in the rural areas where it is difficult to earn profits, ECs are operating under the supervision of the NEA.

The PEMC (Philippines Electric Market Corporation) was established by the DOE to prepare and oversee initial operation of a WESM. Test operations of the WESM started in Luzon in April 2005 and in Visayas in October 2005. In the Luzon grid, the WESM went into commercial operation in June 2006.

In Luzon, 27 registered trading teams from 18 generating companies are directly participating in the WESM. Of these, 2 are from the NPC, 3 from the PSALM, 2 from First Gen Hydro and 2 from Aboitiz-controlled AP Renewables, while the rest are from other independent generating companies. These companies trade about 11,743 MW of capacity from 32 registered generating plants of different fuel resources. As for customers, there are 14 registered members composed of 10 ECs, 3 PIOUs and 1 industrial/commercial customer.

Among the 43 ECs in Luzon, 10 ECs are direct WESM members and 7 are indirect members, while another 7 ECs are intent on becoming members.

Monitoring of market power in the electric power industry is done pursuant to the EPIRA, which provides that no company or related group can own, operate or control more than 30 percent of the installed generating capacity of a grid and/or 25 percent of the national installed generating capacity. The ERC adjusts the installed generating capacity per grid, the national installed generating capacity, and the market share limitations.
The market share in All Philippines, Luzon, Visayas and Mindanao is given in Figs. 2.8-2 to 2.8-5.

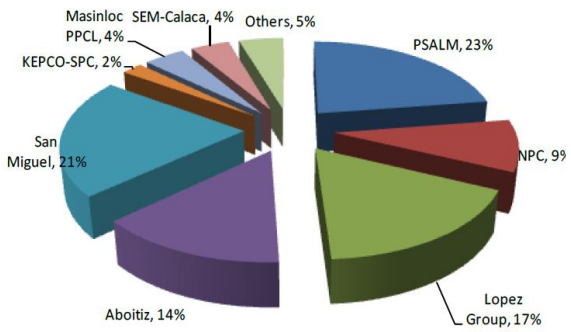


Fig. 2.8-2 Market Share of Electricity Producers (Generation Company) in National Grid System

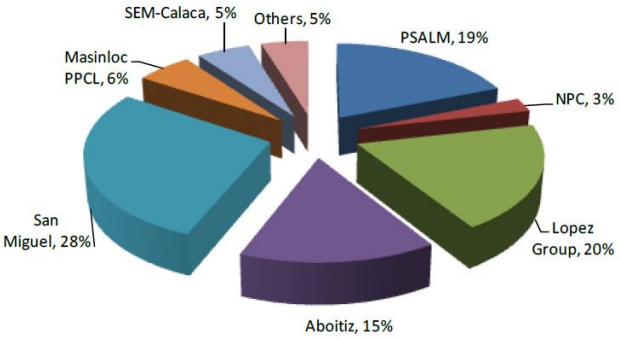


Fig. 2.8-3 Market Share of Electricity Producers (Generation Company) in Luzon Grid System

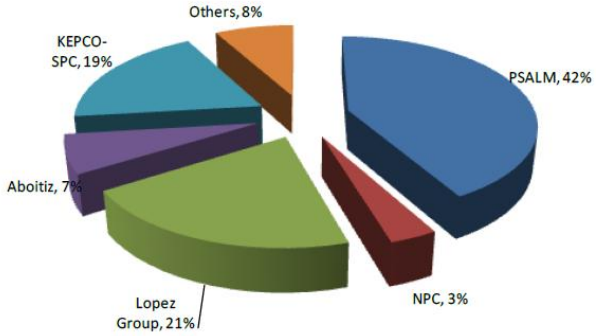


Fig. 2.8-4 Market Share of Electricity Producers (Generation Company) in Visayas Grid System

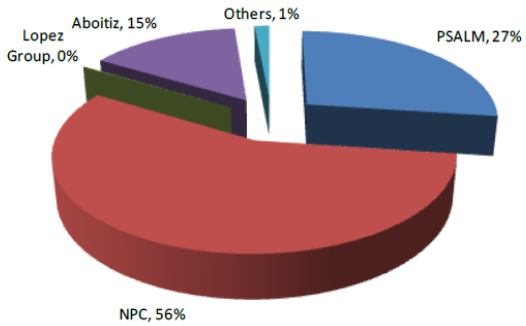


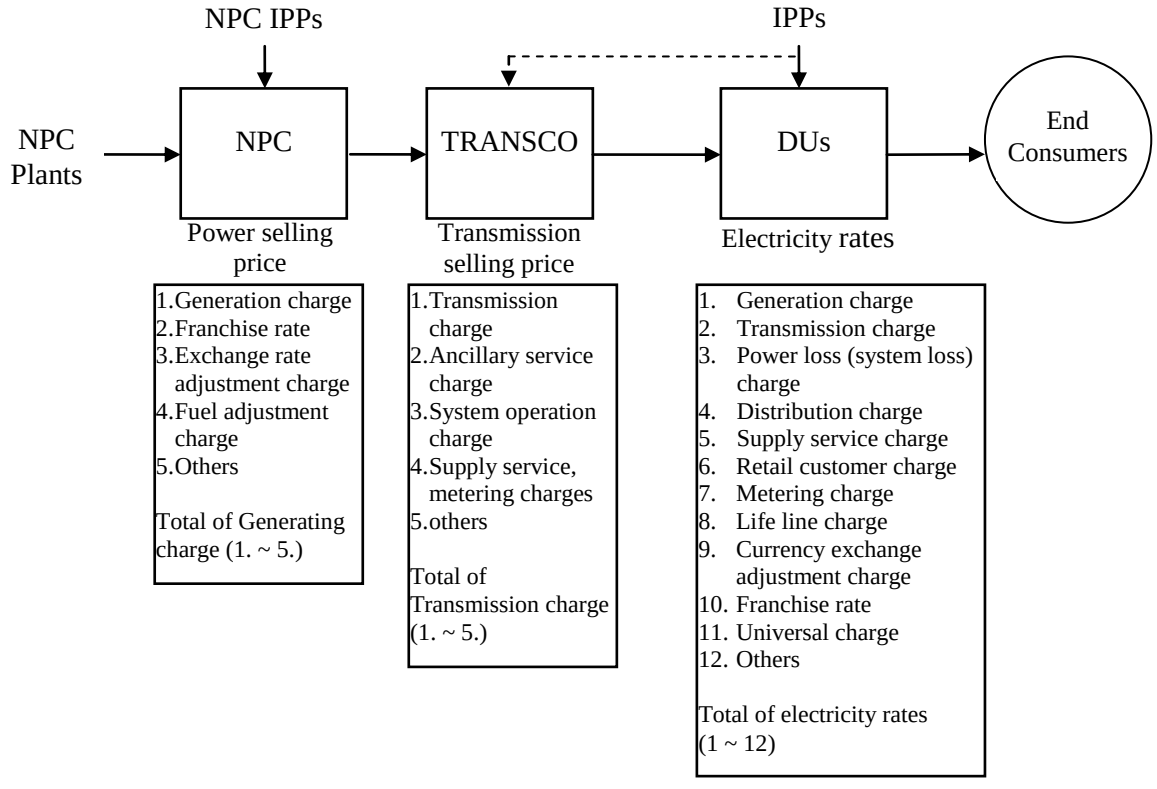
Fig. 2.8-5 Market Share of Electricity Producers (Generation Company) in Mindanao Grid System

2.9 ELECTRICITY RATES

After the EPIRA was enforced, electric utility companies have obligations to present detailed compositions of electricity rates as given in Table 2.9-1 for consumers. An electricity rate table provided by DUs (Distribution Utilities) gives the charge according to each charge item.

Cost-plus pricing method is applied to the NPC, TRANSCO and PIOUs and Cash-basis method is applied to ECs for calculation of electricity rates. It is regulated that the maximum limit of profit rate for the former is 12% and one for the latter is 10%.
Approach of Cost-plus pricing method also known as markup pricing method sets prices that cover the cost of production and provide enough profit margin to the firm to earn its target rate of return in maximizing profits. Cash-basis method recognizes revenues and expenses at the time physical cash is actually received or paid out.

Electricity rates consist of generation charges, transmission charges, distribution charges and other charges. The Other charges are system loss charge, supply service charge, retail customer charge, metering charge, lifeline charge (lifelines discount funding sources), UC (rural electrification and environmental mitigation costs), Currency exchange adjustment charge franchise tax, tax of the country and local government, . In electricity rates, the VAT since December 2006 (currently: 12%) is imposed according to the VAT revised law.



Source : NPC

Fig. 2.9-1 Compositions of Electricity Rates after Enforcement of the EPIRA

As an example, the electricity rates of MERALCO in June 2007 are shown in Table 2.9-1. According to the breakdown ratio of the generation, transmission, distribution and system loss, the ratio of generation charge is 52% and the ratio of system loss is 9%.

The electricity rate is 9.5 PHP/kWh, which is 25.2 JPY/kWh at a rate of 2.65 JPY/PHP (as of June 2007).

Table 2.9-1 MERALCO Electricity Rates (June 2007)

Item		PhP/kWh	Ratio
Generation	Generation Charge	4.4290	**52.0%**
Transmission	Transmission Charge	0.9163	**10.8%**
System Loss	System Loss Charge	0.7296	**8.6%**
Distribution	Distribution Charge	1.6615	**28.7%**
	Retail Customer Charge	5 (PhP/Customer/month)	
	Metering Charge	0.2435	
	Supply Service Charge	0.5271	
	Subtotal	**8.51**	**100%**
Subsidiary	Lifeline Charge	0.1026	
Government Taxes	Valued Added Tax	0.8847	
Universal Charges	Missionary electrification	0.0373	
	Environment Fund	0.0025	
	Total	**9.54**	

Source: MELARCO

(1) NPC Basic Generation Charges

The ERC provisionally authorized the NPC on February 16 and 23, 2009, to increase its basic generation charge by an average of 0.4682 PhP /kWh in Luzon; 0.8376 PhP /kWh in Visayas; and 0.714 PhP /kWh in Mindanao. According to the ERC, the provisional relief granted to the NPC and its co-applicant, PSALM was intended to immediately alleviate NPC's current financial difficulties given its current costs of generating power.

Relative to the NPCs recovery of fuel, power purchase and foreign exchange cost components of its generation charges, NPC effective generation charges is 4.5046 PhP /kWh in Luzon; 4.0550 PhP /kWh in Visayas; and 2.9425 PhP /kWh in Mindanao calculated by the Rules for the Automatic Recovery of Monthly Fuel and Purchased Power Costs and Foreign-Exchange Related Costs by the NPC.

(2) Transmission Rates

Pursuant to the Rules for Setting Transmission Wheeling Rates for 2003 to around 2027, the ERC approved the NGCP's application for the ASPA (Ancillary Services Procurement Agreement) executed between the NGCP and NPC. In its decision, the ERC approved the NPC's Ancillary Service rates as shown in Table 2.9-2.

Table 2.9-2 ERC-Approved NPC Ancillary Service Charges

GRID	Luzon	Visayas	Mindanao
Regulating Reserve, Contingency Reserve and Dispatchable Reserve, PhP/kW per hour	1.1805	1.7368	1.3044
Reactive Power Support, PhP/mVar/hour	0.0533	0.0241	0.0295

Source: 16th EPIRA

(3) Distribution Utilities Rates

The ERC started to implement a new rate methodology for the on-grid ECs under the 2009 RSEC-WR (Rules for Setting the Electric Cooperatives Wheeling Rates), and also started to accept applied rate filings of off-grid ECs. Meanwhile, six (6) PIOUs joined the PBR (Performance-Based Rate) methodology.

The country's total average effective electricity rates as of December 2009 were estimated at 7.2491 PhP /kWh, higher than 1.4766 PhP /kWh compared with the December 2008 average effective electricity rates mainly as a result of the increase in basic generation rates in the three grids, notably, the NPC basic generation rates.

Table 2.9-3 EC's Average Effective Residential Electricity Rates, December 2009

(PhP/kWh)

Bill Subgroup	LUZON		VISAYAS		MINDANAO		NATIONAL	
	PhP/kWh	%	PhP/kWh	%	PhP/kWh	%	PhP/kWh	%
Generation	3.7494	46.2	3.9158	48.7	2.7968	43.2	3.4873	46.2
Transmission	1.0779	13.3	1.1966	14.9	1.0055	15.5	1.0933	14.5
System Loss	0.7782	9.6	0.6917	8.6	0.5645	8.7	0.6781	9.0
Distribution *	1.8748	23.1	1.6919	21.0	1.6508	25.5	1.7392	23.0
Subsidies	0.0350	0.4	0.0593	0.7	0.0066	0.1	0.0338	0.4
Government Taxes	0.6029	7.4	0.4925	6.1	0.4452	6.9	0.5135	6.8
Total	**8.1182**	**100.0**	**8.0478**	**100.0**	**6.4694**	**100.0**	**7.5452**	**100.0**

Source: 16th EPIRA

For the average effective residential rates, MERALCO still has the highest at 8.47 PhP/kWh while DALIGHT is the lowest at 5.48 PhP/kWh. MERALCO effective residential rates for the different residential customer classes ranged from 7.13 PhP/kWh to 8.21 PhP/kWh.

Table 2.9-4 PIOUs Average Effective Rates, December 2009

PDUs	Residential PhP/kWh	Commercial PhP/kWh	Industrial PhP/kWh	Others PhP/kWh	Average PhP/kWh
DECORP Dagupan Electric Corp., Pangasinan	6.5535	6.5866	6.0268	7.4422	6.4996
AEC (Angeles Electric Company, Pampanga	6.4605	6.5601	7.2585	5.831	6.5163
SFELAPCO San Fernando Electric Light & Power Company, Pampanga	6.6364	6.1324	5.5722	6.0484	6.025
IEEC Ibaan Electric & Engineering System, Inc., Batangas	6.8668	6.0542	8.4299	5.7905	6.8454
MERALCO Manila Electric Company	8.4749	7.4709	6.0791	8.8894	7.3845
VECO Visayan Electric Company, Cebu	7.5120	7.7059	6.3307	6.9602	6.9901
BLCI Bohol Light Company Inc.	5.8120	6.0307	-	5.2343	5.8589
CEPALCO Cagayan Electric Power & Light Company, Misamis Oriental	6.5887	6.5781	5.5701	5.5900	6.1192
DLPC Davao Light & Power Company, Inc., Davao del Sur	5.4773	5.3538	4.7779	5.1181	5.0979
COLIGHT Cotabato Light & Power Company, Inc., Maguindanao	5.9427	6.3332	4.9562	5.8095	5.562

Note : Based on Monthly Operations Report submitted by Private DUs

Source: 16th EPIRA

Table 2.9-5 MERALCO's Effective Residential Unbundled Rates, December 2009

Bill Subgroup	0-200 kWh		201-300 kWh		301-400 kWh		401-over kWh	
	PhP/kWh	Percent share	PhP/kWh	Percent share	PhP/kWh	Percent share	PhP/kWh	Percent share
Generation	4.1741	59	4.1741	56	4.1741	54	4.1741	51
Transmission	0.7445	10	0.7445	10	0.7445	10	0.7445	9
Distribution *	1.5017	21	1.8057	24	2.0916	27	2.5903	32
System Loss	0.5983	8	0.5983	8	0.5983	8	0.5983	7
Lifeline subsidy**	0.1125	2	0.1125	2	0.1125	1	0.1125	1
Total ***	7.1311	100	7.4351	100	7.7210	100	8.2197	100

* Includes Distribution, Supply and Metering Charges
** Starts @ 101 kWh consumption
*** Total rates excluding Subsidies and Government Taxes.

Source : MERALCO Website

(4) Administration of Universal Charge

A UC is imposed on all electricity end-users, including self-generation entities, for the following specific purposes;

- Payments of stranded debts and stranded contract costs,
- Missionary electrification,
- Equalization of taxes and royalties applied to indigenous or renewable sources of energy vis-á-vis imported energy fuels,
- An environmental charge for watershed rehabilitation and management; and
- A charge to account for all forms of cross-subsidies.

As of March 2010, a UC for Missionary Electrification in the amount of 0.0978 PhP/kWh and UC for Environment and Watershed Rehabilitation in the amount of 0.0025 PhP/kWh have been imposed and are being collected from all end-users.

CHAPTER 3

POWER DEVELOPMENT PROGRAM IN THE PHLIPPINES

CHAPTER 3 POWER DEVELOPMENT PROGRAM IN THE PHILIPPINES

3.1 HYDROPOWER DEVELOPMENT PLAN

As of 2010, installed capacity of HEP (Hydro Electric Power) is about 3,400 MW, which is about 21% of the total installed capacity of 16,359 MW in the Philippines.

Table 3.1-1 Installed Capacity of HEP by Location (as of 2010)

Location	Capacity (MW)	Share (%)
Luzon	2,346	69.0
Visayas	13	0.4
Mindanao	1,040	30.6
Total	3,399	100.0

The HEP potential in the Philippines is estimated to be about 13,100 MW, which consists of 11,233 MW of large-scale HEP, and 1,847 MW of medium and small-scale HEP.

According to the NREP (National Renewable Energy Plan) 2011-2030, the total targeted HEP additional capacity all over the Philippines for the 15 years from 2011 to 2030 is 5,394 MW, i.e. 3,861 MW in Luzon, 269 MW in Visayas and 1,264 MW in Mindanao. This addition is around 1.6 times larger than existing capacity as of 2010. Particularly from 2016 to 2020, large-scale HEP projects are to be developed to meet a targeted additional 3,161 MW of HEP capacity.

But, as of 2010, 9 HEP projects were committed and the total installed capacity is only 27.8 MW.

Table 3.1-2 Targeted Hydropower Capacity Addition by Location

Location	Commissioning Year			Total Capacity Addition (MW)	% Share
	2011-2015	2016-2020	2021-2025		
Luzon	182.0	2,169.5	1,510.0	3,861.5	71.6
Visayas	84.5	102.4	81.8	268.7	5.0
Mindanao	74.8	889.1	300.0	1,263.9	23.4
Total Philippines	**341.3**	**3,161.0**	**1,891.8**	**5,394.1**	**100.0**

Source : NREP (2011-2030), Department of Energy (DOE)

In order to develop the untapped HEP resources all over the country toward the 2030 target, it is proposed that the HEP sub-programs regarding RE (Renewable Energy) industrial services, resources, resource research, development and demonstration, and RE technology support shall be promoted continuously as shown in the following table in NREP.

The hydropower sector work program is given in Table 3.1-3 and its schedule is shown in Fig. 3.1-1.

Table 3.1-3 Hydropower Sector Work Program (2011 ~ 2030)

Type of Activity	Work Program
RE Industry Services	1. Review of applications; endorsement for registration of applications 2. Monitoring of RE contracts 3. Advisory Services to RE Developers on: • RE policy mechanisms/guidelines • Sea water Pump Storage (PS) Hydropower Plant • Rural electrification using micro-hydropower
Resource Development	1. Developmental Activities for Micro-hydropower • Commercialization thru Mini-Grid System • Rural electrification using micro-hydropower 2. JICA Optimization Study a. Identification of at least 50 potential sites b. Project packaging of JICA's optimization studies for hydropower; - Tendering/Bidding and Awarding of contracts - Construction and development activities - Commissioning and Operation 3. Sea water Pump Storage Hydropower Plant • Inventory of potential sea water PS facility
R, D&D	1. Sea water Pump Storage Hydropower Plant • Development of Sea water Pump Storage Plant - Project Packaging - Tendering/Bidding and Awarding of contracts - Construction and development 2. Establishment of Research Center • New technology and designs for hydropower • Redesign and Retrofitting Program
RE Technology Support	1. Development of local manufacturing capability for micro-hydropower equipment and controls 2. Establishment of standards ad best practices 3. Technology mentoring
Policy and Program Support-Related Activities	Developmental activities for Micro-hydropower • Formulation of Comprehensive Program • Inventory of projects for optimization

Source : NREP (2011-2030), DOE

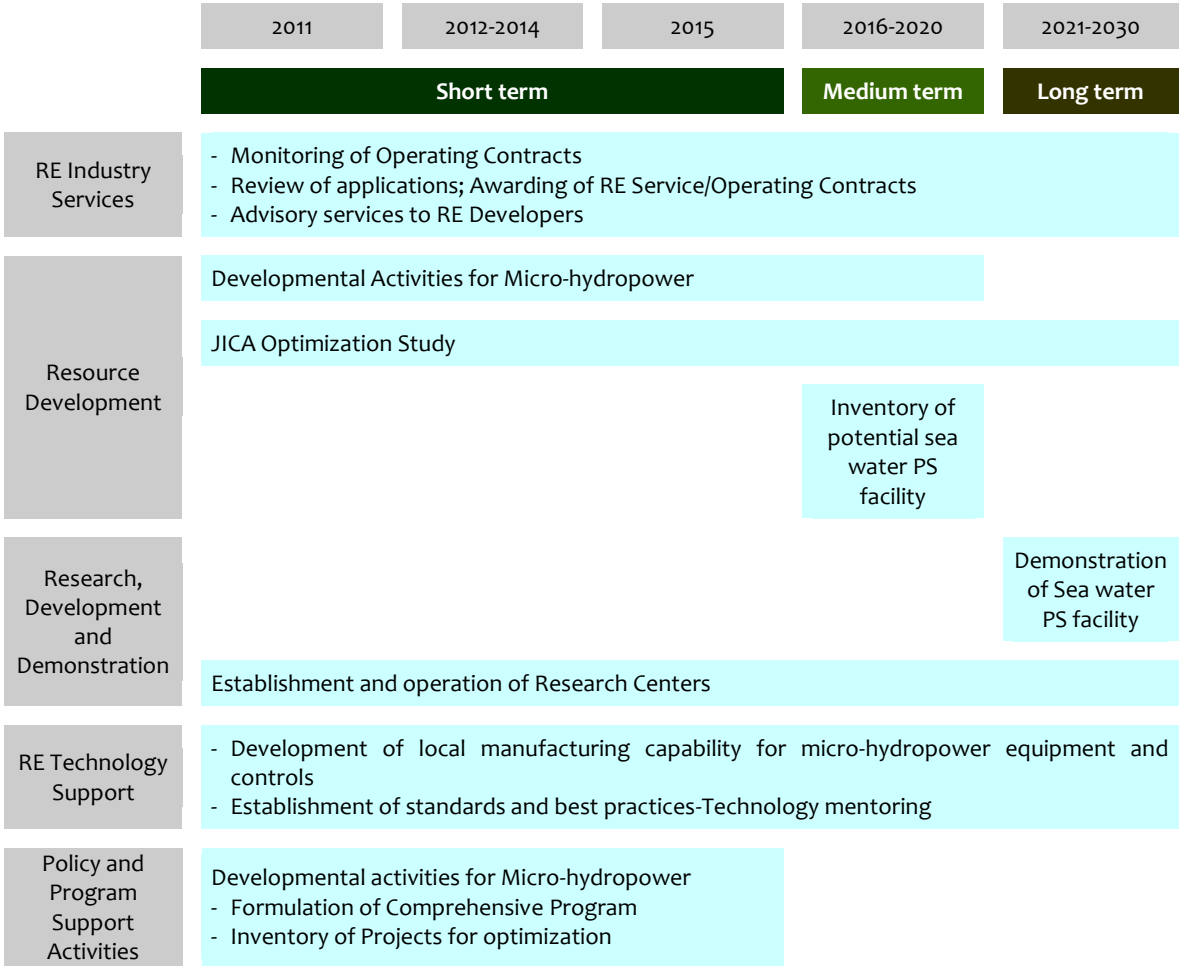


Fig. 3.1-1 Schedule of Hydropower Sector Sub-Program (2011-2030)

Source : NREP (2011-2030), DOE

3.2 CURRENT STATUS AND ISSUES OF HYDROPOWER DEVELOPMENT

3.2.1 Current Status of Development under the Renewable Energy Act

Deregulation of power sector was started in the Philippines in 2001, after the enactment of the EPIRA (Electric Power Industry Reform Act). Electric power development is now led by private enterprises, instead of government initiative. The state power authority, NPC (National Power Company), was privatized, selling out its assets (70% of total was projected). During the power crisis of the 1990s, the promotion of IPPs (Independent Power Producers) was orchestrated with such measures as government guarantees, which succeeded in attracting foreign investment. However, such promotional measures led to soaring power tariffs and a deterioration of the NPC's financial status. Revoking the measures increased investor risks, and, as a result, power development lead by private enterprise has not grown as anticipated. The government promulgated the Renewable Energy Law in December 2008, aiming to promote the use of RE and to stabilize power supply. The law intends to attract private investors to new RE development projects utilizing geothermal, hydropower, wind power, PV (Photovoltaic), biomass and wave power by introducing promotional measures such as preferential tax treatment, exemption from import tax, etc.

RE related-bills are being crafted by the government and the mood for investment in RE is catching on. As of September 2011, the total awarded number of RE projects under the Renewable Energy Law was 237 and its total capacity was about 5,243 MW.

In particular, hydropower development is attracting investor interest and there have been over 341 applications. Among such applications, 124 projects were examined and awarded by the DOE. Service contracts for implementing feasibility studies of potential sites and conversion contracts for existing hydropower plants are included in the total amount. The number of service contracts for Feasibility Study (F/S) is 107 for a total capacity of 822 MW. Table 3.2-1 gives a summary of awarded hydropower potential sites. Developers of hydropower projects consist of private investors, PNOC (Philippine Oil Company), ECs (Electric Cooperatives), LGUs (Local Government Units), etc. and around 85% of the developers are private investors.

The number of potential sites for F/S under application is 211 with a total capacity of 2,300 MW. A summary is given in Table 3.2-2.

Table 3.2-1 Summary of Awarded Hydropower Potential Projects for Implementation of F/S

Size	Number	Installed Capacity (MW)
Less than 10MW	87 (16)	280.6 (40.4)
10MW - 100MW	20 (1)	541.1 (70.0)
More than 100MW	0 (0)	0 (0)
Total	107 (17)	821.7 (110.4)

Location	Number	Installed Capacity (MW)
Luzon	50 (11)	418.2 (103.4)
Visayas	22 (1)	172.3 (1.2)
Mindanao	35 (5)	231.2 (5.9)
Total	107 (17)	821.7 (110.4)

( ): Awarded RE conversion contract for existing hydropower plants

Source : DOE Portal site as of September 8, 2011

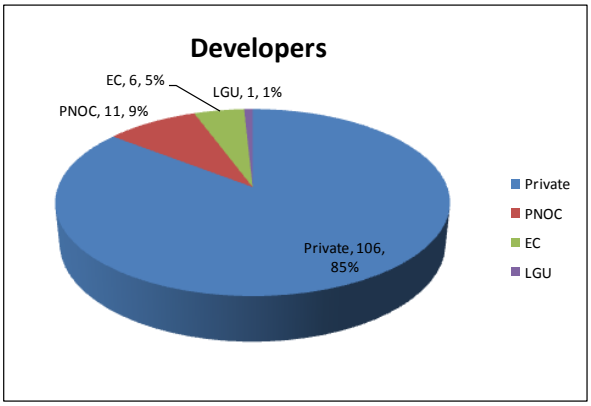


Fig.3.2-1 Hydropower Developers Awarded Service Contracts for Implementation of F/S

Table 3.2-2 Summary of Hydropower Potential Projects under Application for F/S

Size	Number	Installed Capacity (MW)
Less than10MW	176 (2)	613.4 (8.9)
10MW - 100MW	29 (0)	531.4 (0.0)
More than 100MW	6 (4)	1,165.0 (1,292.0)
total	211 (6)	2,309.8 (1,300.9)

Location	Number	Installed Capacity (MW)
Luzon	137 (5)	1,728.5 (1,292.9)
Visayas	4 (0)	6.0 (0.0)
Mindanao	70 (1)	575.3 (8.0)
total	211 (6)	2,309.8 (1,300.9)

( ): under-application RE conversion contract for existing hydropower plants

Source : DOE Portal site as of September 8, 2011

3.2.2 Issues on Promoting Hydropower Development

Under the RE Law promulgated in 2009, various RE energy policy mechanisms such as the FIT (Feed-in-Tariff) system, RPS (Renewable Portfolio Standards) and Green Energy Option Program, and incentives for RE energy projects and activities such as preferential treatment on taxes and the establishment of funds for project financing are being developed as government policy in order to promote and accelerate the development and utilization of emerging RE resources in the country.

The FIT system is a scheme that involves the obligation on the part of electric power industry participants to source electricity from RE generation at a guaranteed fixed price for a given period of time. The determined period that a fixed tariff is to be paid is not less than 10 years. The FIT system shall be adopted for electricity generated from RE resources such as biomass, ocean, run-of-river hydropower, solar and wind.

The priority purchase, transmission of, and payment for such electricity are made by the grid system operators. Application of the FIT is to be conducted in compliance with RPS.

In September 2011, the ERC (Energy Regulatory Commission) announced that, in a series of public hearings, a fixed tariff of 6.15 PhP/kWh for run-of-river hydropower, 7 PhP/kWh for biomass, 17.65 PhP/kWh for ocean energy, 10.37 PhP/kWh for wind and 17.95 PhP/kWh for ground-mounted solar were proposed. However, fixed tariffs have not yet been determined as

of January 2012. Other rules and mechanisms for the full implementation of the FIT system are to be weighed by the ERC in consultation with the NREB (National Renewable Energy Board).

The purpose of RPS is to contribute to the growth of the RE industry by diversifying energy supply and to help address environmental concerns of the country by reducing greenhouse gas emissions.

RPS shall be imposed on electric power industry participants such as generators, distribution utilities, or suppliers, and serve on-grid areas.
Rules under RPS shall be decided by the NREB, in accordance with appropriate government agencies and in accordance with the NREP.

The RPS rate shall be increased by at least 1% of its annual energy demand within 10 years from enforcement of the RPS. All electric power industry participants mandated to comply with the RPS rules shall increase their share of RE in their portfolio annually by at least 1% or by an annual rate to be determined.

After an FIT is decided, it is assumed that RE development will be accelerated by private developers.
On the other hand, regarding RPS, a draft was produced in March 2011, but no progress has been seen since.
It was planned to approve FIT and RPS in 2010, but these systems are still under discussion as of February 2012. These systems are important for making investment decisions and are expected to determine appropriate electricity rates.

Also, the Policy and Program Support Component Work Program was proposed in the NREP issued in June 2011, as given in Table 3.2-3.

According to the NREP, an estimated investment of about 15,100 million USD (2,800 USD/kW) is required to achieve the targeted hydropower capacity of 5,400 MW (310 candidate sites) by 2025. The funding required for HEP development shall be prepared by private developers by means of various financing. So, it is quite difficult for HEP projects to go according to the plan and schedule described in the NREP since private developers have yet to make a decision on project implementation.

The required initial investment for HEP development is huge and the recovery period of investment is long, so own-funding and finance resources are key points for investment. In case of small-scale hydropower projects, it is possible for domestic developers, including ECs, LGUs and banks, to invest in those projects. A large amount of investment is required for large-scale, reservoir-type and pumped storage HEPs in order to meet an additional capacity of 5,400 MW by 2030. However, it is quite difficult for private developers to invest in such large-scale projects in the Philippines. As one possible approach, a PPP (Public-Private Partnership) is viewed as effective.

Recently, from a viewpoint of power composition on Mindanao Island, the installed capacity of HEP is more than 50% of the total capacity, while the capacity of oil thermal power is 31% and coal thermal power 12%. During the dry season, the power output of HEP plants is lowered considerably and, as a result, power shortages often occur.

There is abundant HEP potential on Mindanao Island and HEP is an important targeted RE resource. The targeted HEP capacity in Mindanao for 2030 is 2,309 MW, which is about 80% of the forecasted peak demand of 3,493 MW. The ratio of HEP is rising higher.

The Mindanao grid is isolated at present and it is difficult to balance supply and demand on the island, so it is necessary to connect the grid between Luzon and Mindanao for effective power utilization.

Table 3.2-3 Policy and Program Support Component Work Program

Type of Activity	Work Program
Policy and Support	1. Establishment and implementation of Renewable Energy Policy Mechanisms • Renewable Portfolio Standard (RPS) - Rules promulgation - Implementation • Feed-in-Tariff - FIT rates; FIT All - Implementation • RE Market - Framework establishment - Rules for the operation of RME under WESM - Implementation • RE Registrar - PEMC to operationalize RE Registrar - Implementation • Green Energy Option Program (GEOP) - IRR for the Program - Implementation • Net Metering - Formulation of Rules - Public consultations - Rules promulgation - Implementation • Fiscal Incentives (e.g., tax credit, tax rebates, cash incentives of RE developers for missionary electrification, etc.) - Formulation of guidelines - Implementation • Transmission and Distribution System Development • Incentives for Renewable Energy Host Communities/LGU's - Formulation of Rules - Implementation • Formulation of Rules on Off-grid RE Development 2. Administration of Renewable Energy Trust Fund (RETF) • Formulation of mechanism for fund transmittal to DOE • Guidelines in utilization • Promulgation 3. Continuous monitoring and review of implemented RE Policies • Recommendations for possible amendments, if any, to RE Policy Mechanisms implemented 4. Impact Assessment of RE Policies and mechanisms implemented
Program Support	1. Operationalization of RE One-Stop-Shop • Integrated RE services from concerned government agencies • Integration of Web based RE Systems Infrastructure, and Database • Automated RE applications 2. RE Information Exchange • Web based RE applications • RE database modification and updating 3. Development and implementation of an integrated RE IEC Plan 4. Periodic review of National Renewable Energy Program (NREP) • Development of M&E mechanism • Consultation with concerned groups • Implementation • Capacity addition assessment (off-gird/on-grid) 5. Oversight on performance/operations of ARECs 6. Collaboration with relevant organizations 7. Market assessment for new or emerging RE; support to sub-program development, as may be necessary

Source : NREP (2011-2030), DOE

3.3 OPERATING CONDITIONS OF EXISTING POWER STATIONS

3.3.1 Current Operating Conditions of Hydropower Stations in the Philippines

Current generation capacity classified by fuel type in the Philippines (as of April 2010) is shown in the figure below. The total power generation capacity by HEP is about 3,290 MW, 21% of the national total (according to data in "List of Existing Plants. APR 2010" by the DOE Power Planning Division).

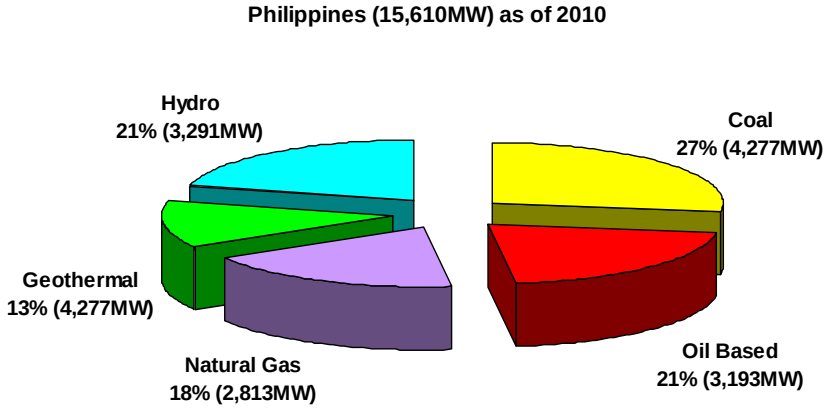


Fig. 3.3-1 Output Capacity of Power Plants by Fuel Type (2010)

The distribution of the capacity over the locations is as follows. About 75% of the total generating capacity is concentrated in Luzon, while Visayas and Mindanao almost equally share the rest. The hydropower capacity of Luzon (2,280 MW) accounts for 70% of the total national HEP capacity (3,291 MW). About 60% (988 MW) of total capacity is borne by HEP in Mindanao. On the other hand, HEP accounts for only 1% (13 MW) in Visayas.

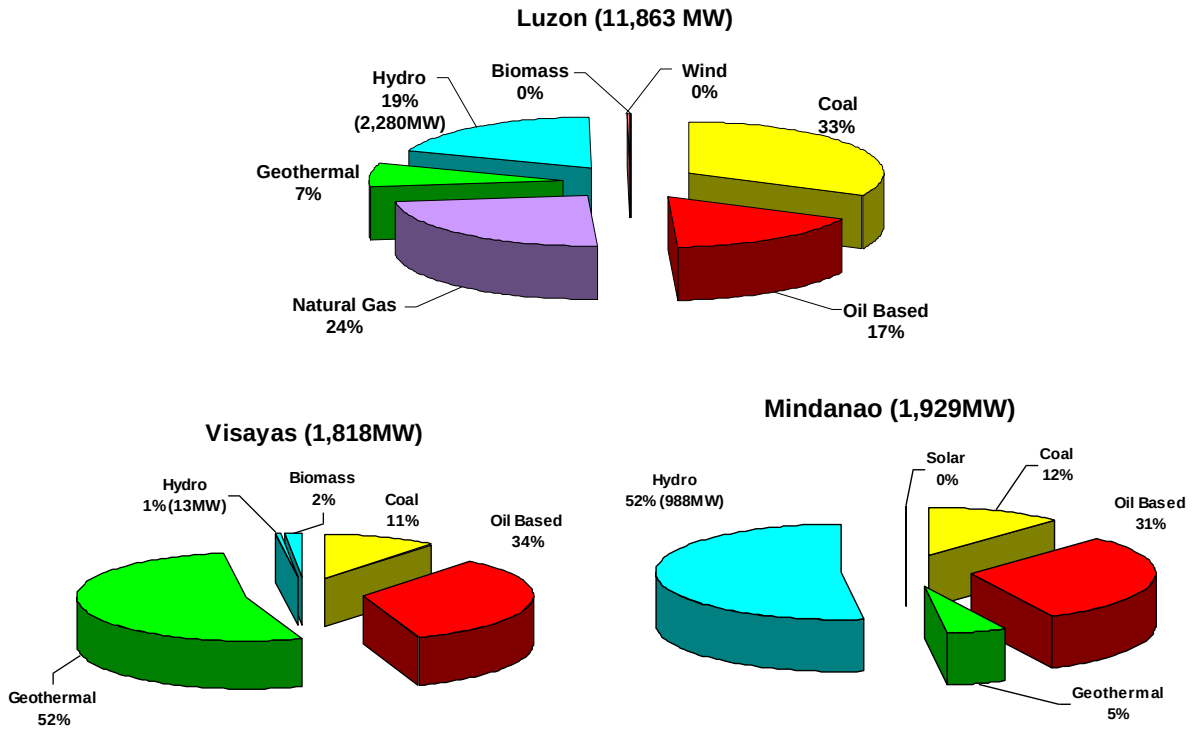


Fig. 3.3-2 Output Capacity of Power Plants by Fuel Type in Three Regions (2010)

Operating conditions of the HEP plants were investigated, using the operation data collected and accumulated by the REMB (Renewable Energy Management Bureau, DOE) and DOE Power Planning Division.

The REMB is monitoring power plants of a capacity below 10 MW, that is, power plants of small to medium scale, and data is collected and accumulated there. Hydropower plants of a capacity over 10 MW are monitored by the DOE Power Planning Division. (According to new law, all power plant monitoring will be done by the REMB.) The main purpose of the REMB's work is monitoring and filing of data. The REMB is not able to go beyond the collection of data to grasp the current state of each power plant including accidents and faults/troubles, due to the massive amount of data and lack of manpower. For some plants, information as such operation outage time of the plant is recorded, but for most power plants, only the generated energy is reported.

The HEP plants under operation in the Philippines are shown in the table below according to data of the DOE in March 2010 (according to "updated existing HYDRO new format March 2010" received from the REMB).

Table 3.3-1 Summary of Number and Output Capacity of Hydropower Plants by Scale

		Number of P/S	Total Capacity
Micro	(less than 100kW)	130	1,050 kW
Mini	(less than 1,000kW)	24	12,715 kW
Middle Size	(less than 10,000kW)	29	79,550 kW
Large	(not less than 10,000kW)	21	3,222.000 kW
TOTAL		**204**	**3,315,315 kW**

As a result of advancing the privatization of HEP plants, only 11 plants HEP plants are operated by the NPC now with a total capacity of 1,240 MW, which is 34% of the total national HEP capacity.

The number of HEP plants and total output by owners after privatization are shown below.

Table 3.3-2 Summary of Number and Output Capacity of Private Hydropower Plants

Developer's Name	Number of HEP Plants	Capacity	Notes
CBK Power Company Ltd.	4	754 MW	
SN Aboitiz Power Inc.	3	535 MW	
San Roque Power Corp.	1	345 MW	
First Generation Holdings Corp.	1	102 MW	
Hedcor Inc.	3	93 MW	
NIA	2	156 MW	Casecnan, Baligatan HEPs
Korean Water Recourse Development Inc.	1	246 MW	Angat HEP
NPC-PSALM	8	982 MW	
ECs, Others		81 MW	

3.3.2 Current Problems of Hydropower Plants

Seasonal variations inherent in hydropower are large in the Philippines; the ratio of generating power in the dry season to the rainy season is almost 1:3.

Output records differ for power plants by period. There is also a difference when the rainy and dry seasons are every year, which makes the estimation of seasonal variations of HEP plants unreliable. Roughly estimated seasonal variations in generated power of HEP plants are shown in the table below (recorded periods of the HEP plants fall between 2004 and 2009).

Monthly generated power records of 47 HEP plants among a total of 74 HEP plants monitored by the REMB were used in this estimation.

Table 3.3-3 Variation of Monthly Output of HEP Plants

(unit: MWh)

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
				Min						Max	
319	303	222	217	146	238	242	284	373	409	452	416

The following figures show the variation in monthly power generation of HEP plants in three regions. The Luzon region has large-scale reservoir type HEP plants (San Roque, Magat, Anguat, etc.). The Mindanao region has a series of Agus HEP plants and Pulangui HEP plants, which are, however, not included here. Generated power tends to fall in the period between March and May.

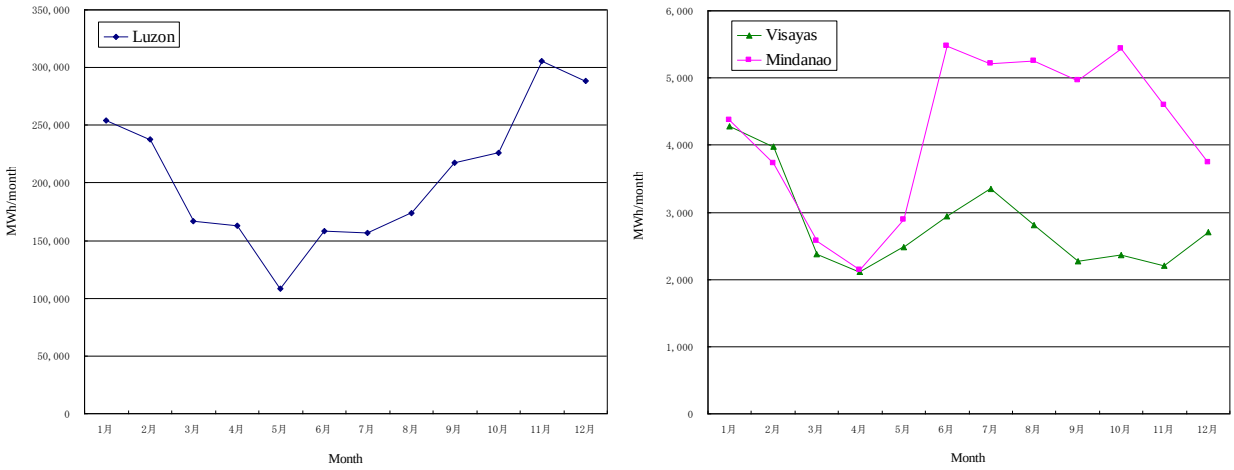


Fig. 3.3-3 Variation in Monthly Output of HEP Plants in Three Regions

The following figures show monthly power generation of run-of-river type HEP plants and large-scale reservoir type HEP plants in Luzon.

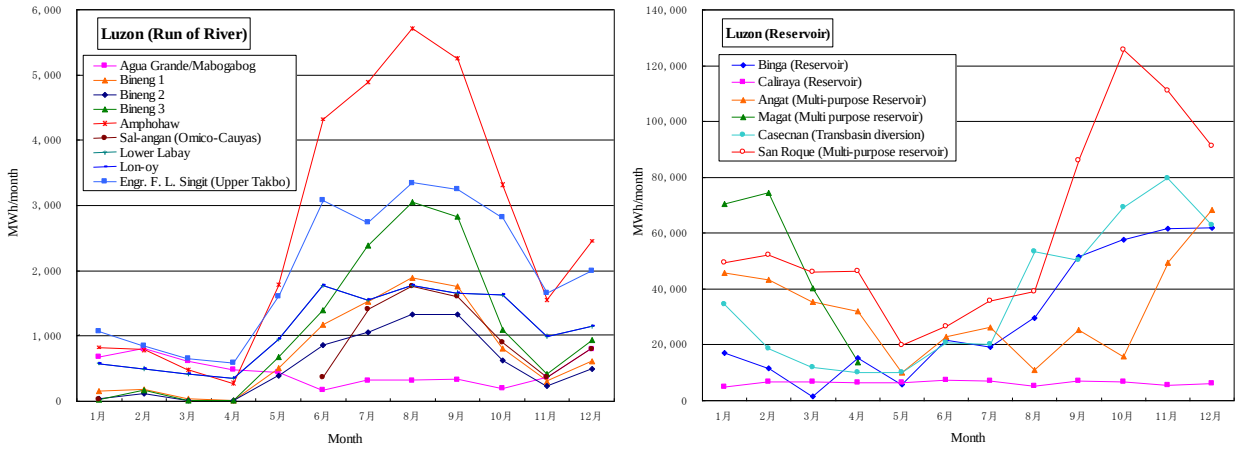


Fig. 3.3-4 Monthly Generated Energy of Run-of-River Type and Reservoir Type HEP Plants in Luzon

The following figures show monthly power generation of HEP plants in the Visayas and Mindanao Regions.

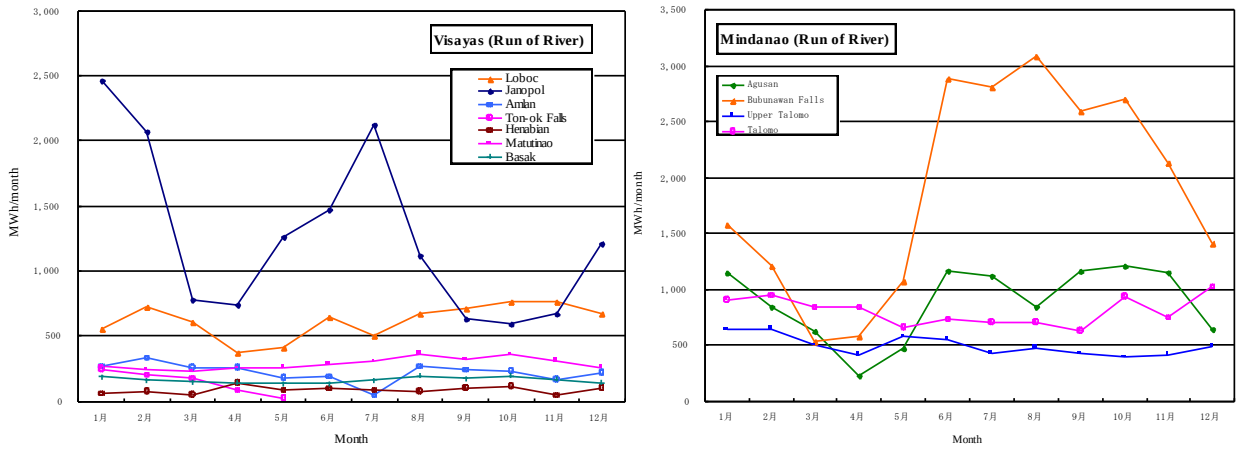


Fig. 3.3-5 Monthly Generated Energy of Run-of-River Type HEP Plants in Visayas and Mindanao

The following figures show plant factors of run-of-river type HEP plants evaluated for one year records. Plant factors are lower than desirable. The large difference in river flow between the rainy and dry seasons seems to be attributable to larger plant size and lower plant factors.

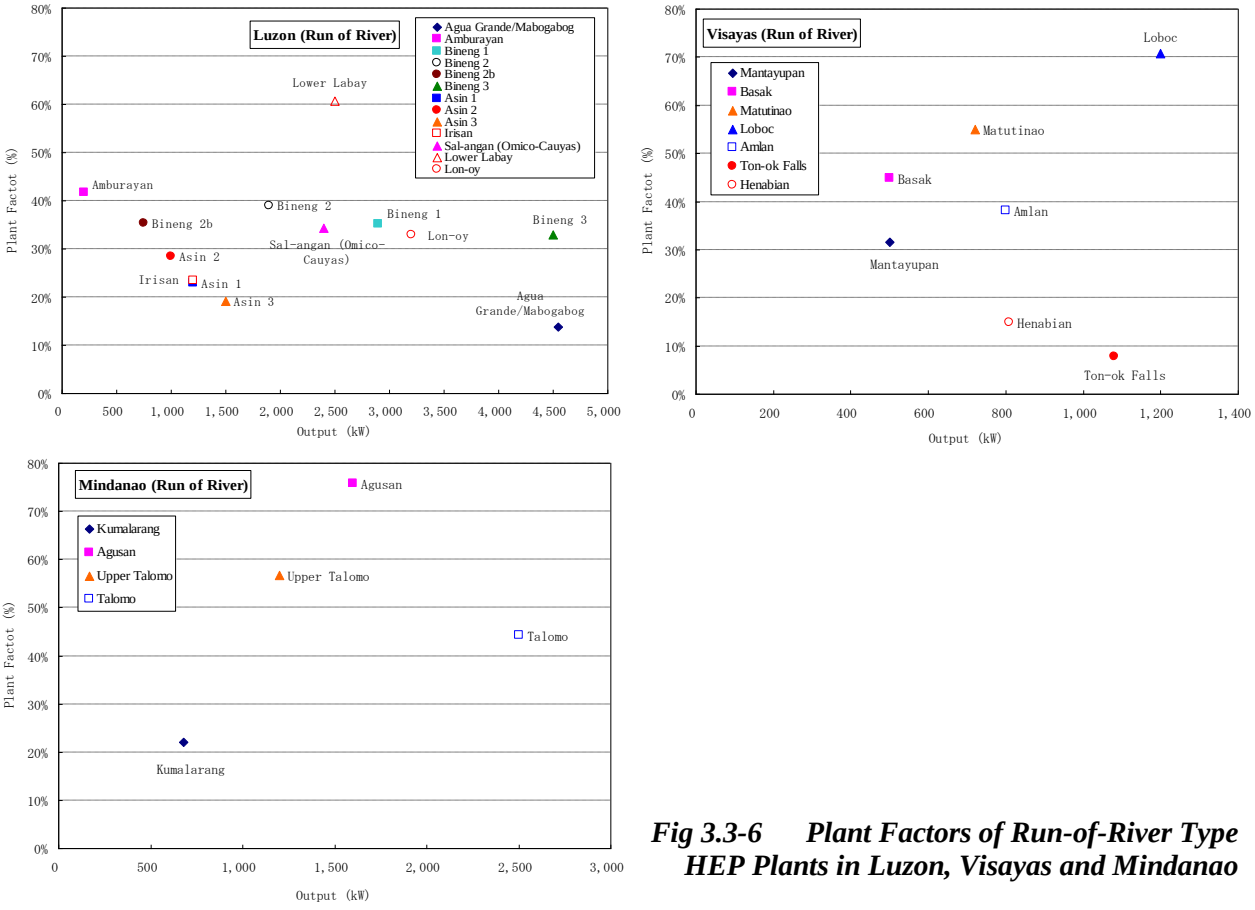


Fig 3.3-6 Plant Factors of Run-of-River Type HEP Plants in Luzon, Visayas and Mindanao

3.4 METEOROLOGICAL AND HYDROLOGICAL FEATURES

3.4.1 Regional Features and Climatological Regions[1], [2]

(1) Administrative Regions and Water Resource Regions

The Philippines are administratively divided into 14 regions and 3 autonomous regions, NCR (National Capital Region), CAR (Cordillera Administrative Region), ARMM (Autonomous Region in Muslim Mindanao). The WRRs (Water Resource Regions) generally correspond to the existing administrative regions, except for Ilocos, Cagayan, Central Luzon and Northern Mindanao where there are minor deviations dictated primarily by hydrological boundaries. For examples of the exception, the CAR is divided into WRR-1 and WRR-2, and the NCR belongs to WRR-4.

(2) Climatological Regions

The Philippines has a tropical climate. At sea level, temperatures rarely fall below 27°C. The country experiences an average temperature ranging from 28°C to 36°C and humidity varies from 70% to 85% depending on the time of year. Interior valleys and leeward sides of islands tend to be warmer, while mountain slopes and peaks and windward sides of islands tend to be cooler.

Rainfall averages about 2,030 mm a year, with more precipitation in coastal plains than in sheltered inland valleys. In the western part of the country, the rainy season occurs during the summer monsoon, from May to November, when the wind blows from the southwest; the dry season occurs during the winter monsoon, from December to April, when the wind blows from the northeast. In contrast, the eastern side of the country receives most of its rainfall during the winter monsoon and has no true dry season.

The classification of climate is basically based on rainfall characteristics rather than temperature variations. The rainfall variability, topography and air stream direction define the climate at different parts of the country. As shown in the next page figure, the various areas in the Philippines are thus characterized by four types of climates, which are based on dry and wet seasons induced by minimum or maximum rain periods, according to the Corona Climate Classification.

Type I : Two pronounced seasons, dry from November to April, wet during the rest of the year

Type II : No dry season with a very pronounced maximum rainfall period from November to January

Type III : Seasons are not very pronounced with a relatively dry season from November to April and a wet season during the rest of the year

Type IV : Rainfall more or less evenly distributed throughout the year

1 "Preliminary Study Report on Water Resource Development for Metropolitan Manila in the Philippines," JICA, 2001

2 "Local Authorities in the Philippines," CLAIR (Council of Local Authorities for International Relations), 1998

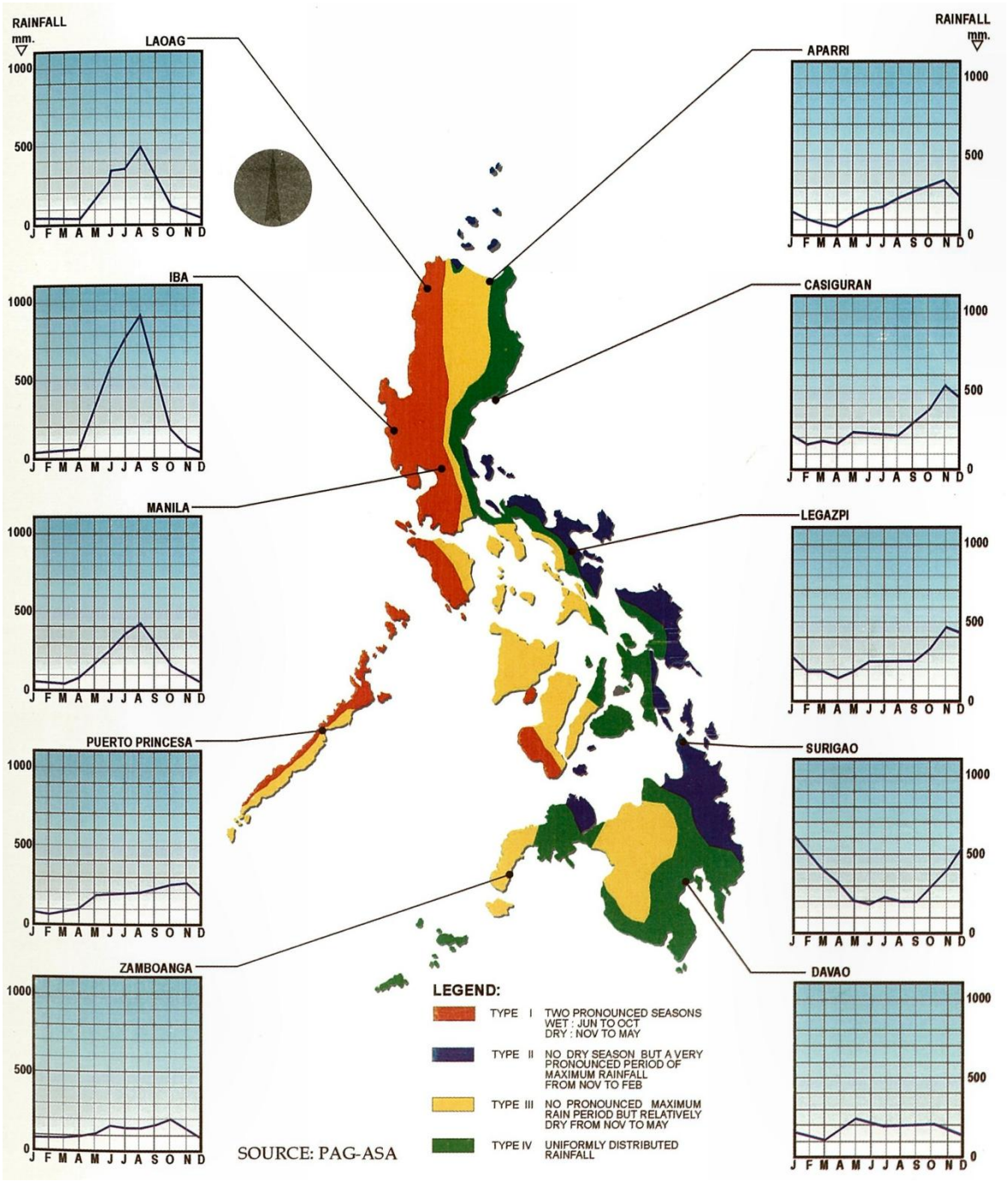


Fig. 3.4-1 Climate Regions in the Philippines

Source: Philippine Atmosphere, Geophysical and Astronomical Services Administration (PAGASA) "Climate Map of the Philippines"

(3) Water Resource Regions

For purposes of comprehensive planning of water resources development, the former NWRC (National Water Resources Council), now the NRWB (National Water Resources Board), divided the Philippines into 12 WRR, as shown in the figure below. Major considerations taken into account in this regionalization are hydrological boundaries defined by physiographic features and homogeneity in climate of the different parts of the country.

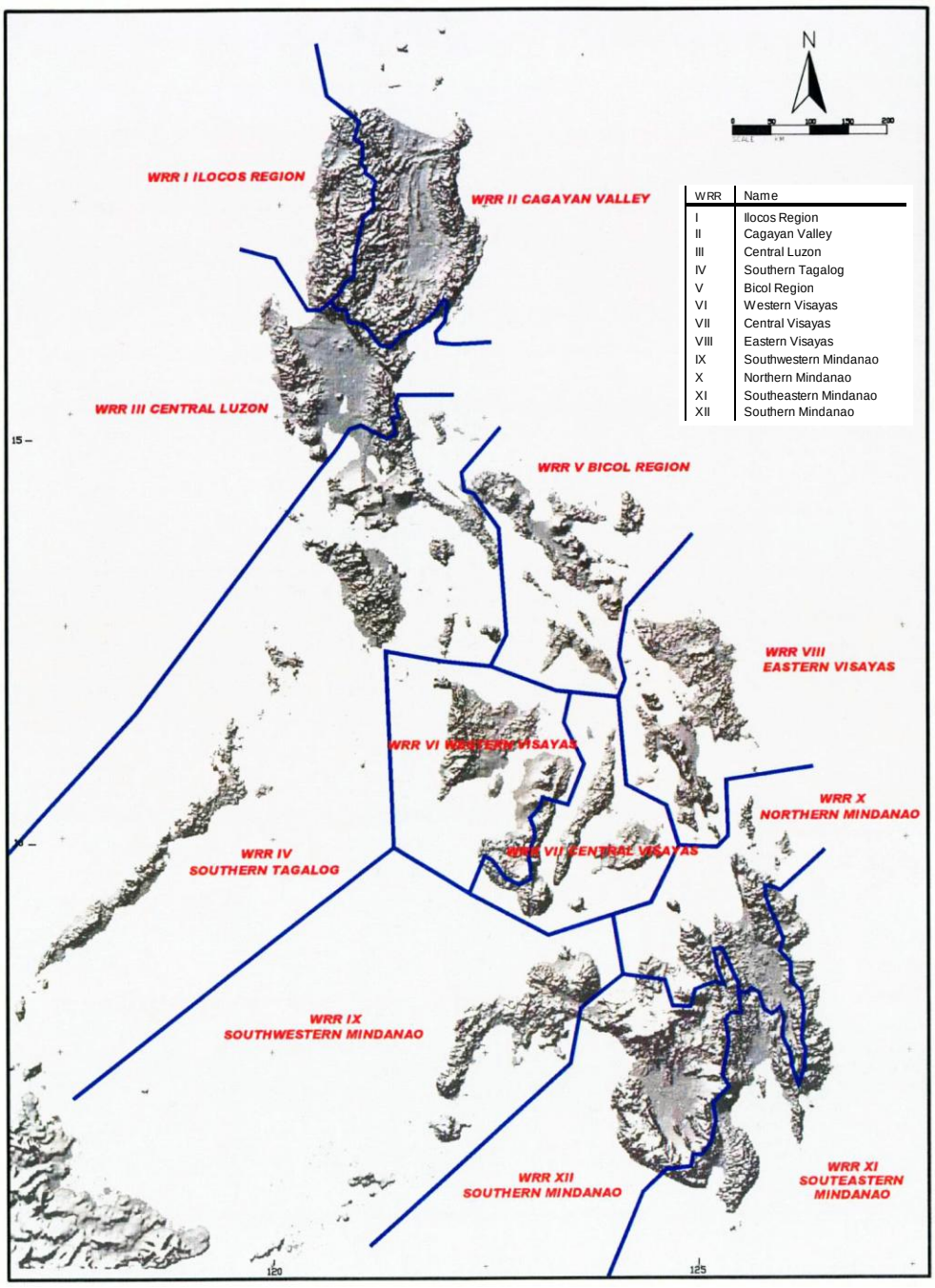


Fig. 3.4-2 Water Resource Regions in the Philippines

Source: "Study on Flood Control Project Implementation System for Principal Rivers in the Philippines," JICA, 2004

3.4.2 Impact of Climate Variation and Change

Changes in the quantity and timing of precipitation and river runoff have a number of effects on hydroelectric power. Therefore, the impacts of climate variation and changes on precipitation are reviewed in this section.

(1) Global Effects of El Niño/ La Niña

One of the greatest impacts of climate variation on the Philippines is brought about by El Niño/La Niña. El Niño/La Niña is also called El Niño-Southern Oscillation because the fluctuations in ocean temperatures during El Niño and La Niña are accompanied by even larger-scale fluctuations in air pressure between the western and eastern tropical Pacific known as the "Southern Oscillation." El Niño represents the warm phase of the El Niño/Southern Oscillation cycle, and is sometimes referred to as a "Pacific warm episode." El Niño episode occurs in the Pacific basin every 2 to 9 years and the sea-surface temperature in the east-central equatorial Pacific Ocean is warmer than normal during this episode. On the other hand, La Niña refers to the periodic cooling of ocean surface temperatures in the central and east-central equatorial Pacific. La Niña represents the cool phase of the El Niño/Southern Oscillation cycle, and is sometimes referred to as a "Pacific cold episode."

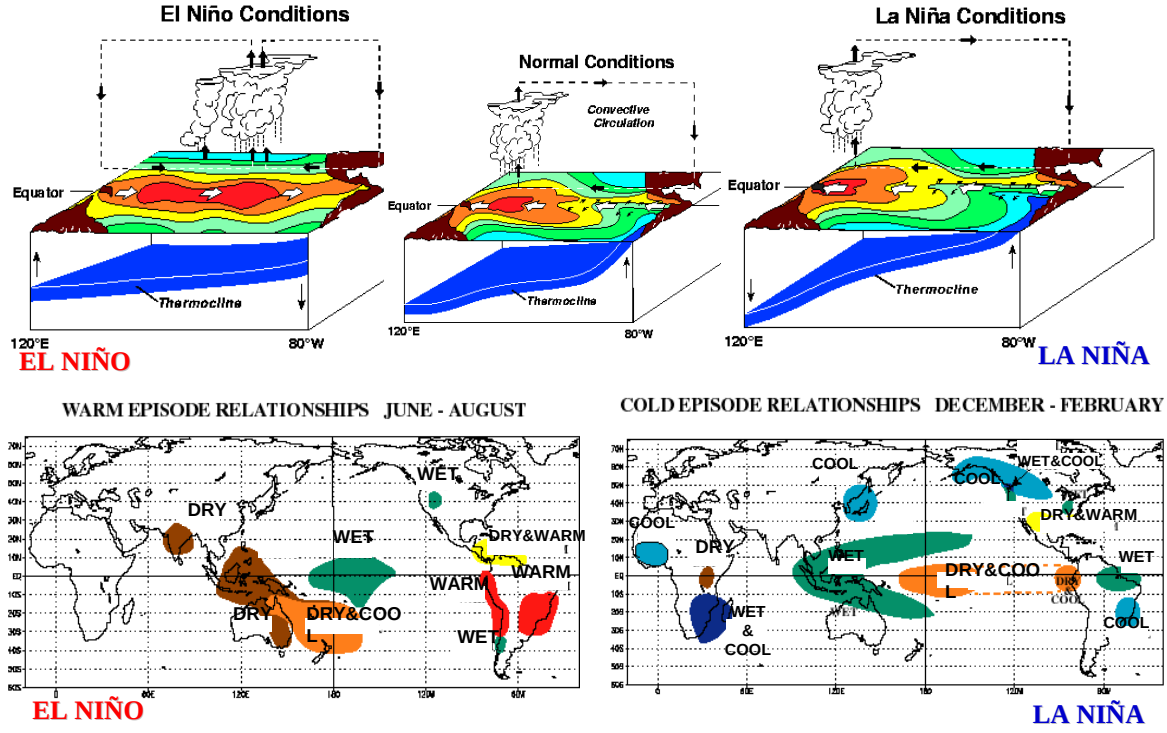


Fig. 3.4-3 Global Effects of El Niño/La Niña

Source: NOAA, http://www.cpc.noaa.gov/products/analysis_monitoring/ensocycle/enso_cycle.shtml

(2) Impacts of El Niño / La Niña on the Philippines

The impacts of El Niño/La Niña are shown bellow. Generally, El Niño brings drier weather conditions and La Niña brings wetter weather conditions.

Table 3.4-1 General Influences of El Niño/La Niña on Philippine Climate

During El Niño Episode	During El Niño Episode
1) Weak monsoon activity - Delayed onset of the rainy season - Early termination of the rainy season - Occurrence of isolated heavy rainfall in short duration 2) Weak tropical cyclones activity - Tropical cyclones follow tracks further off the Philippines - Less number of tropical cyclones entering the Philippine Area of Responsibility 3) Below normal rainfall 4) Above normal air temperature … Drier weather conditions	1) Moderate to strong monsoon activity - Increased cloudiness and widespread rains - Near normal to early onset of the rainy season 2) Moderate to strong tropical cyclones activity - Near normal cyclone tracks (near and/or crossing the country) - Near-to above normal cyclone occurrences - Rain-effective cyclones 3) Above normal rainfall 4) Near-to bellow normal air temperatures … Wetter weather conditions

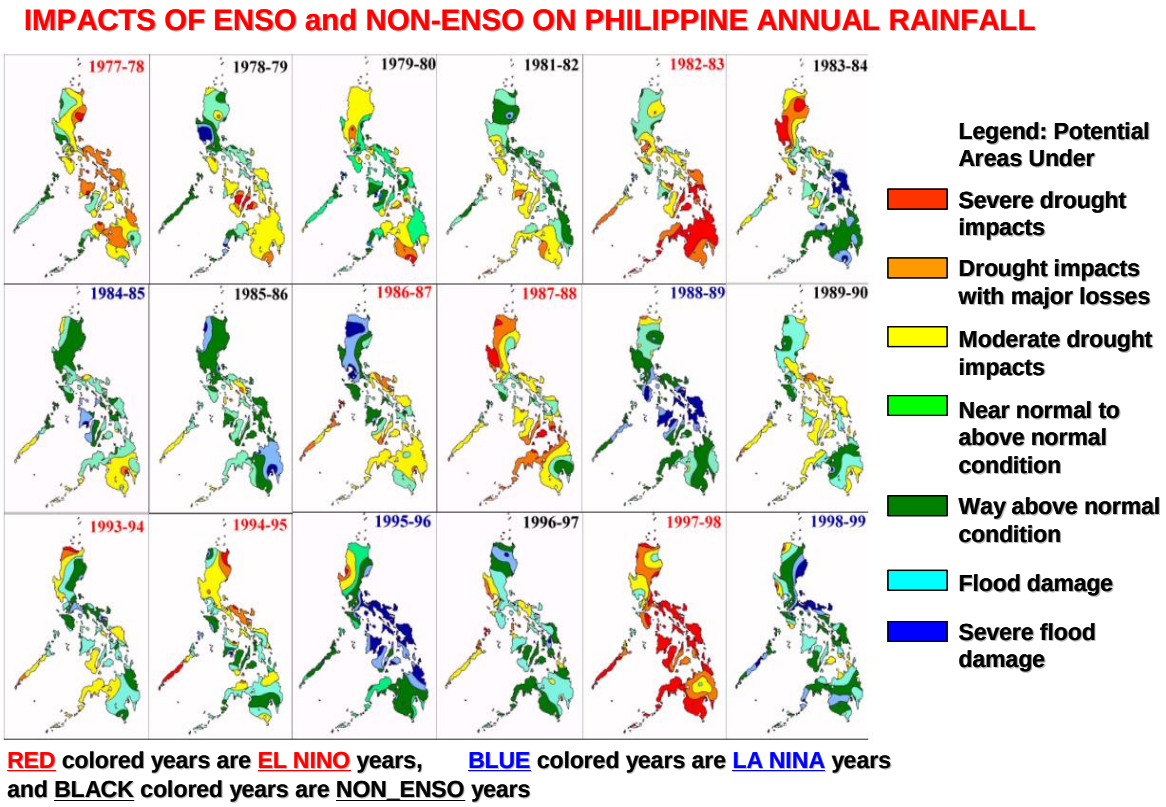


Fig. 3.4-4 Impacts of El Niño/ La Niña on Philippine Annual Rainfall

Source: PAGASA

(3) Impacts of Climate Change (Global Warming Effect)[3]

In the Fourth Assessment Report released, the IPCC (Intergovernmental Panel on Climate Change) concluded that warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.

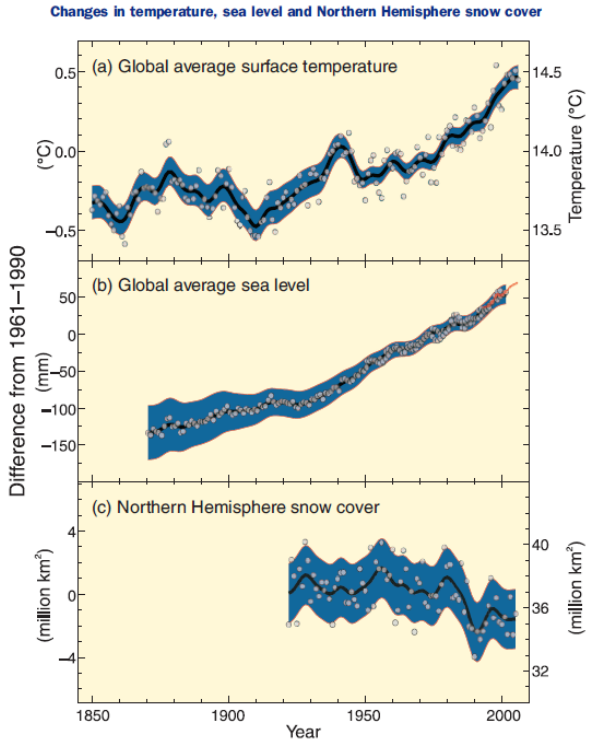


Fig. 3.4-5 Observed Changes in Global Surface Temperature, Global Average Sea Level, and Northern Hemisphere Snow Cover

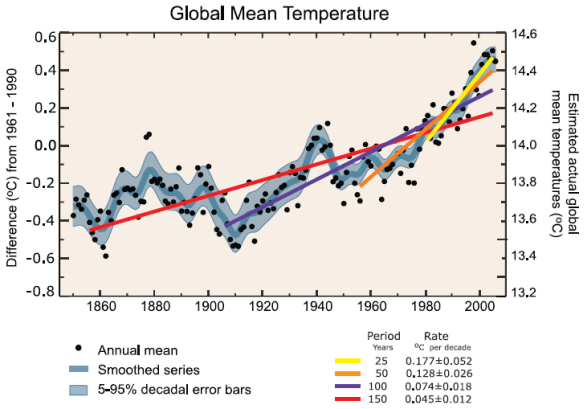


Fig. 3.4-6 Global Mean Temperature (Difference from 1961 - 1990)

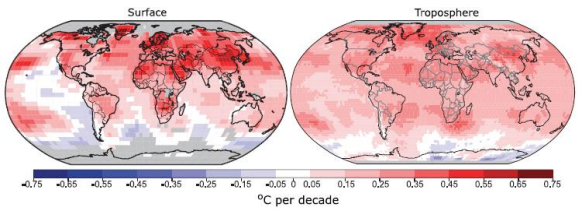
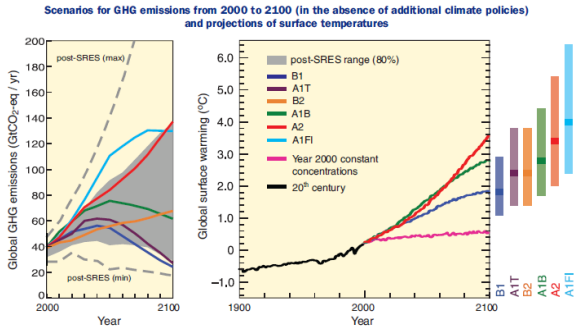


Fig. 3.4-7 Patterns of Linear Global Temperature Trends from 1979 to 2005

Continued emissions of GHG (Greenhouse Gas) at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would likely to be larger than those observed during the 20th century.

Projected climate change and its impacts in Asia are shown below.

- By the 2050s, freshwater availability in Central, South, East and Southeast Asia, particularly in large river basins, is projected to decrease.



Case	Temperature change (°C at 2090-2099 relative to 1980-1999)[a, d]		Sea level rise (m at 2090-2099 relative to 1980-1999)
	Best estimate	*Likely* range	Model-based range excluding future rapid dynamical changes in ice flow
Constant year 2000 concentrations[b]	0.6	0.3 – 0.9	Not available
B1 scenario	1.8	1.1 – 2.9	0.18 – 0.38
A1T scenario	2.4	1.4 – 3.8	0.20 – 0.45
B2 scenario	2.4	1.4 – 3.8	0.20 – 0.43
A1B scenario	2.8	1.7 – 4.4	0.21 – 0.48
A2 scenario	3.4	2.0 – 5.4	0.23 – 0.51
A1FI scenario	4.0	2.4 – 6.4	0.26 – 0.59

Fig. 3.4-8 Scenarios for GHG from 2000 to 2100 and Projections

3 Climate Change 2007 Synthesis Report, IPCC

- Coastal areas, especially heavily populated mega delta regions in South, East and Southeast Asia, will be at greatest risk due to increased flooding from the sea and, in some mega deltas, flooding from the rivers.

- Climate change is projected to compound the pressures on natural resources and the environment associated with rapid urbanization, industrialization and economic development.

- Endemic morbidity and mortality due to diarrheal disease primarily associated with floods and droughts are expected to rise in East, South and Southeast Asia due to projected changes in the hydrological cycle.

(4) Impacts of Climate Change on the Philippines[4]

The Philippines are highly vulnerable to the impacts of tropical cyclones: flooding, high winds, storm surges and landslides. As shown in the right figure, annual mean temperature of the Philippines tends to be increasing. However, there is no trend in the total number of annual tropical cyclones or rainfall pattern.

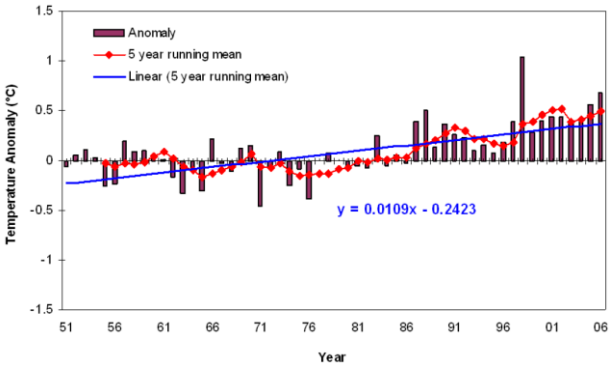


Fig. 3.4-9 Observed Mean Annual Temperature Anomalies in the Philippines

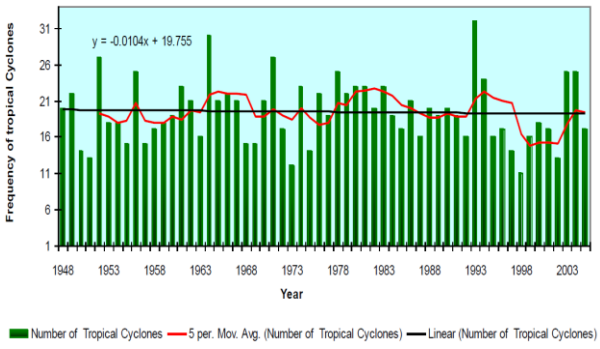


Fig. 3.4-10 Annual Number Tropical Cyclones in the Philippines

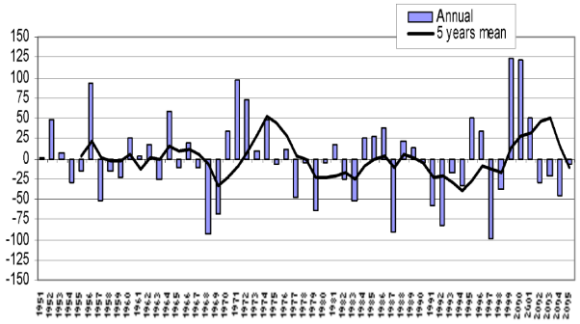


Fig. 3.4-11 Anomaly of Annual Philippine Rainfall with Normal Base Period 1961-1990

4 Climate Change Issues and Related Extreme Weather Conditions, DOST-PCIERD (Department of Science and Technology, Philippine Council for Industry and Energy Research and Development), 2009

3.5 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS FOR HYDROPOWER DEVELOPMENT

Environmental and social considerations for hydropower development are described in this section. An assessment system for environmental and social considerations in the Philippine is discussed in Section 3.5.1 and environmental impact assessment for hydropower development in Section 3.5.2.

3.5.1 Assessment System for Environmental and Social Considerations[5, 6]

(1) Environmental Impact Statement System

PD (Presidential Decree) No.1151, which was issued on June 6, 1977 and commonly known as the Philippine Environmental Policy, is the first policy mentioning the necessity of the EIS (Environmental Impact Statement) system in the Philippines (Section 4). Then, the Philippine EIS system was formally established on June 11, 1978 by virtue of PD No.1586.

PD No.1586 stipulates that ECPs (Environmentally Critical Projects) and projects within ECAs (Environmentally Critical Areas) require the submission of an EIS, and the proponents are not allowed to undertake or operate any part of such ECPs or projects within ECAs without first securing an ECC (Environmental Compliance Certificate).

After that the EIS system has undergone several improvements by continuously introducing new features and requirements, and now the EIS system is operated based on the DENR (Department of Environment and Natural Resources) Administrative Order No.37, 1996 Series (DAO 96-37).

When it deemed necessary to carry out an environmental impact assessment, the proponent should prepare and submit an EIS to the DENR's EMB (Environmental Management Bureau) and EMPAS (Environmental Management and Protected Areas Services). (Address for submission varies according to the kind of project.) The EIS is then examined by the standing committee of the EMB, and once approved, the DENR's commissioner issues an ECC. After the ECC is issued, the proponent can proceed to the next stage, which is to apply for approvals of other concerned governmental organizations or local government organizations, and then start the project.

Also, DENR Administrative Order No. 2003-30 (DAO 03-30), Implementing Rules and Regulations for the Philippine EIS System in 2003 and Revised Procedural Manual for DAO 03-30 in 2007 were established to define the details.
Regarding small HEP projects, Republic Act No. 9513 commonly known as the "Renewable Energy Act" came into effect in 2008 for development, utilization and promotion of commercial use of RE resources. Section 14 of Chapter 6 prescribes environmental compliance for RE. All activities of research, development, usage, and operation of RE are to be implemented according to environmental regulations established by the DENR and other related government agencies.

5 S.1.1 Existing IEE Checklist, Master Plan Study of Power Development In Palawan Province Republic of the Philippines Final Report (Technical Background Report), Japan International Cooperation Agency, September 2004

6 6.1.1 Environmental Assessment System, Chapter 6 Impact by Project Implementation, CDM Study Report in 2007 for Emission Free Community Program in Bohol Island of the Philippines, CDM/JI Project Study, Environmental & Urban Planning, Research and Consulting, March 2008

(2) Competent Authorities of Environmental Impact Assessments

The DENR, established in 1987, plays a major role in the environmental management of the Philippine at present. Especially the EMB, an internal organization of the DENR, prepares policy-oriented environmental management plans, manages control orders and procedural rules, and prepares technical guidelines. There are 16 local EMB offices in the Philippines executing environmental decrees. The EIA (Environmental Impact Assessment) Division, which is an internal department of the EMB, operates the EIS system, and the each local office has a contact for the operation.

(3) Projects Subject to Environmental Impact Assessment

In the EIS system, projects and undertakings in the Philippines are judged as to whether they are subject to the EIS system based on the following criteria.[7]

Table 3.5-1 Criteria for Projects Subject to the EIS System

	Item	Check Item
A	Characteristics of project or contracted venture	● Scale of project ● Characteristics of cumulative impact: Comparison with other projects ● Use of natural resources ● Volume of produced wastes and residuals ● Risk of environmentally hazardous substances and accidents
B	Location of project	● Critical area: Biologically important location or protected area ● Compliance with land use approved or according to national laws ● Relative abundance, quality, and recoverability of nature resources in the area (Including tolerance of environmental impacts)
C	Characteristics of potential impacts	● Geographic scope of impact and pollution scale ● Impact scale and complexity ● Possible level, period, frequency, and reversibility of impact

Projects subject to the EIS system are classified to the following four (4) categories.

Category A : Environmentally Critical Projects (ECPs)
Category B : Projects implemented in Environmentally Critical Areas (ECAs)
Category C : Projects for environmental improvement (not included in category A or B)
Category D : Projects that do not cause environmental aggravation

For the projects classified as category A or B, the proponents should carry out an EIA and prepare a report to obtain an ECC after examination. For the projects classified as category C, the proponents should submit a project summary to obtain a CNC (Certificate of Non-Coverage), which certifies that it is not a project subject to EIA. As for the projects classified as category D, the proponents should obtain a CDC. Also, additional environmental protection measures may be required by the EMB for categories C and D.

The 4 ECP categories and other categories, as in Section 3.5.1, (5) have been established by Declaration No.2146 (1981) and No.803 (1996). The technical definitions are described in the implementation procedure manual by the EMB.

[7] The Philippines Business Handbook, The Japanese Chamber of Commerce and Industry of the Philippines, Inc., 2006

Table 3.5-2 Category List of ECP and ECA

A. List of ECPs	
- As declared by Proclamation No. 2146 (1981)	
1	Heavy Industries – Non-ferrous Metal Industries, Iron and Steel Mills, Petroleum and Petro-chemical Industries including Oil and Gas, Smelting Plants
2	Resource Extractive Industries – Major Mining and Quarrying Projects, Forestry Projects (Logging, major wood processing projects, introduction of fauna [exotic animals] in public and private forests, forest occupancy, extraction of mangrove products, grazing), Fishery Projects (Dikes and fishpond development projects)
3	Infrastructure Projects – Major Dams, Major Power Plants (Fossil-fueled, nuclear-fueled, hydroelectric or geothermal), Major Reclamation Projects, Major Roads and Bridges
- As declared by Proclamation No. 803 (1996)	
4	All golf course projects
B. List of ECA Categories – As declared by Proclamation No. 2146 (1981)	
1	All areas declared by law as national parks, watershed reserves, wildlife preserves, sanctuaries
2	Areas set aside as aesthetic potential tourist spots
3	Areas that constitute the habitat of any endangered or threatened species of Philippine wildlife (Flora and fauna)
4	Areas of unique historic, archaeological, or scientific interests
5	Areas that are traditionally occupied by cultural communities or tribes
6	Areas frequently visited and / or hard-hit by natural calamities (Geologic hazards, floods, typhoons, volcanic activity, etc.)
7	Areas with critical slopes
8	Areas classified as prime agricultural lands
9	Recharged areas of aquifers
10	Water bodies characterized by one or any combination of the following conditions: Tapped for domestic purposes, within the controlled and / or protected areas declared by appropriate authorities, which support wildlife and fishery activities
11	Mangrove areas characterized by one or any combination of the following conditions: With primary pristine and dense young growth, adjoining mouth of major river systems, near or adjacent to traditional productive fly or fishing grounds, areas that act as natural buffers against shore erosion, strong winds and storm floods, areas on which people are dependent for their livelihood.
12	Coral reefs characterized by one or any combination of the following conditions: With 50% and above live coralline cover, spawning and nursery grounds for fish, that act as natural breakwater of coastlines

(4) Implementation Procedure of EIA

EIA investigation is for evaluating the environmental impact in each stage of a project cycle. It is defined by Administrative Order No.42 (AO42) that EIA investigations should be implemented at the same time of project planning or F/S.

1) Screening

Screening is carried out to judge whether the planned project is subject to the Philippines EIS system. If it is, the necessary documents for application and other required items should be reviewed.

2) Scoping

Details of the environmental impact analysis are planned based on regulations. The most critical issue/impact of the project is identified, and then the scope of basic information

necessary for evaluation and mitigation is defined. At the same time, the necessity of an ERA (Environmental Risk Assessment) is considered. Public scoping for local residents and technical scoping by an independent EIA committee are carried out in the presence of the EMB. The result is recorded in the official scoping checklist signed by the study team members, which is subject to approval of the EMB director.

3) EIA study and preparation of report

The EIA study includes alternatives and characteristics of the project environment, determinations and predictions of environmental impacts, and evaluations of impact scale, and draws up mitigation measures for impacts, and environmental management and monitoring plans. The cost estimation and enlisting of organization support are also included. Then, the study findings are summarized in an EIA report according to EMB regulations.

4) Review and evaluation of EIA report

The EMB examines the compliance with minimum requirements determined in the process of scoping, and then an independent board consisting of experts appointed by the EMB (in the case of PEIS (Programmatic Environmental Impact Statement)/EIS based applications) or a technical committee consisting of internal experts of the EMB (in the case of IEE (Initial Environmental Examination) based applications) reviews the EIA report. After that, the EMB reviews the comments given in the EIA committee and public hearings, and makes recommendations on a decision, and the chief of the EIA committee approves and signs the EIA Review Committee recommendations including subjects beyond the EMB's authority. The entire EIA screening and evaluation process is summarized in the RPR (Review Process Report) prepared by the EMB. Tentative decisions are also included in this report.

5) Decision-making

The relevant approving/deciding organization prepares a draft of the EIA evaluation and decision report, and issues an ECC, CNC, or denial notice. Once approved, the ECC is issued for a project subject to the EIS system, and a CNC for a project not subject to the EIS system. The ECC is forwarded to the related local municipal governments or government agencies, where their evaluation processes follow.

6) Monitoring, validation and evaluation/audits

The proponent's actions are monitored against its commitments to the ECC, environmental management and monitoring plans. And, whether the project's impacts are actually prevented or mitigated is confirmed.

The EIA procedure up to examination and approval varies according to the kind of project, but can be illustrated in general as shown in Fig. 3.5-1.

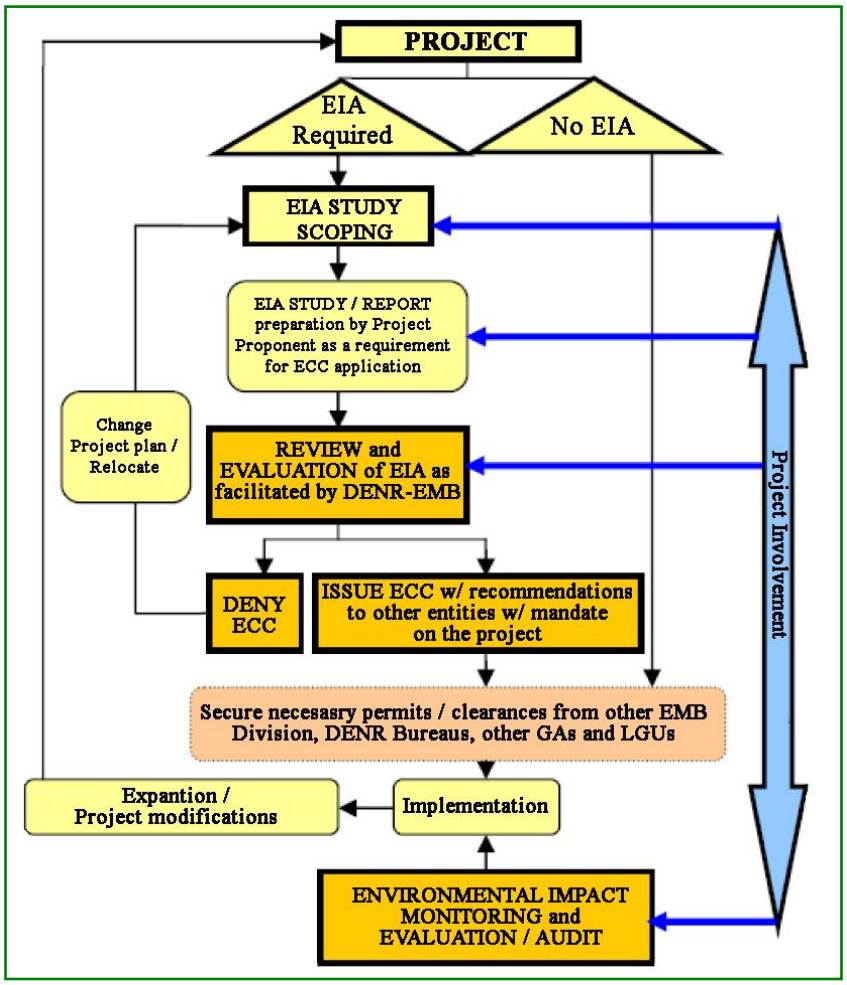


Fig. 3.5-1 Philippines EIA Procedure Flowchart

Activities in the EIA procedure in the figure above fall into the steps of the project cycle as shown below.

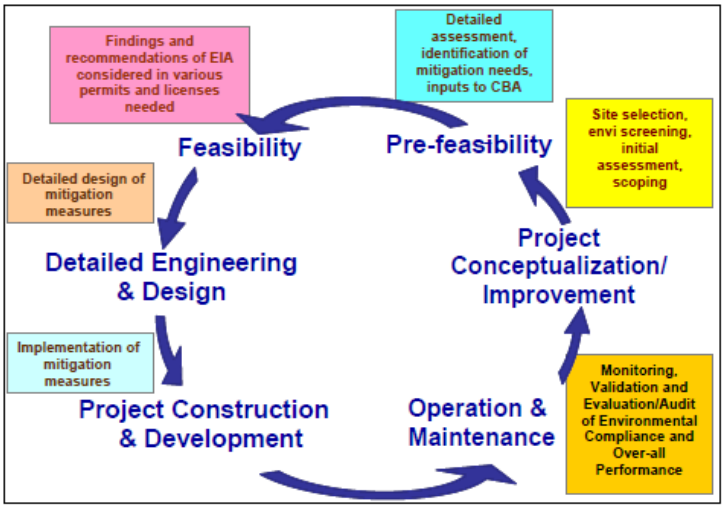


Fig. 3.5-2 Philippines EIA Procedure

(5) Contents of EIA Report

The following classifications within the EIS system are defined in Proclamation No. 2146, 803 and A042 separately from the above mentioned classifications.

Group I : ECP to be implemented in ECA or NECA (Non-ECA)

Group II : NECP (Non-ECP) to be implemented in ECA
Additional projects classified as Group II are defined in Declaration No. 2146. (Table 3.5-3)

Group III : NECP to be implemented in NECA

Group IV : Several projects to be implemented in several areas (ECA or NECA)

Group V : Unclassified project (Project not falling into any group: Using new technology with unpredictable environmental impact)

And, it is further segmented, as in Table 3.5-4, according to the kind of project. The required report and competent organization vary according to each category. (Table 3.5-5) There are 7 types of reports depending on the group.

Table 3.5-3 Additional Projects Classified as Group II

1.	Agriculture industry	9.	Pipeline projects
2.	Buildings, storage facilities and other structures	10.	Textile, wood and industries
3.	Chemical industries	3.5	Tourism industry
4.	Cottage industries	12.	Transport terminal facilities
5.	Demonstration and pilot projects	13.	Waste management projects
6.	Environmental enhancement and mitigation projects	14.	Water supply, irrigation or flood control projects
7.	Food and related industries	15.	Treasure hunting in NIPAS areas
8.	Packaging materials and miscellaneous products industries	16.	Wildlife farming or any related projects as defined by PAWB

Table 3.5-4 Detailed Classification of Project

Main Project Groups	Description	Project Sub-groups		
		New	Existing with ECC but with Proposal for Modification or Resumption of Operation	Operating Without ECC
I	Single ECP in ECA or NECA	I-A	I-B	I-C
II	Single NECP in ECA	II-A	II-B	II-C
III	Single NECP in NECA	III-A	Not applicable	Not applicable
IV	Co-located Projects in either ECA or NECA	IV-A	IV-B	IV-C
V	Unclassified Projects	V-A	Not applicable	Not applicable

Table 3.5-5 Project Group, IEA Report, Competent Organization, Application Terms, etc. (1)

PROJECT GROUPS/SUB GROUPS		APPLIED TO	DOCUMENTS REQUIRED FOR ECC/CNC APPLICATION	DECISION DOCUMENT	PROCESSING RESPONSIBILITY (ENDORSING OFFICIAL)	DECIDING AUTHORITY	MAX TIME TO GRANT OR DENY ECC APPLICATION (Working Days)
I: Environmentally Critical Projects (ECPs) in either Environmentally Critical Area (ECA) or Non-Environmentally Critical Area (NECA)	I-A: New	Single Projects	Environmental Impact Statement (EIS)	ECC	CO: EIAMD Chief / EMB Director	EMB Director / DENR Secretary	120 days
	I-B: Existing Projects for Modification or Re-start up(subject to conditions in Annex2-1c)	Single Projects	Environmental Performance Report and Management Plan (EPRMP)	ECC	CO: EIAMD Chief / EMB Director	EMB Director / DENR Secretary	90 days
	I-C: Operating without ECC	Single Projects	Environmental Performance Report and Management Plan (EPRMP)	ECC	CO: EIAMD Chief / EMB Director	EMB Director / DENR Secretary	90 days
II: Non-Environmentally Critical Projects(NECPs) in Environmentally Critical Area (ECA)	II-A: New	Single Projects	Environmental Impact Statement (EIS)	ECC	RO: EIAMD Chief	EMB RO Director	60 days
			Initial Environmental Examination Report (IEER)	ECC	RO: EIAMD Chief	EMB RO Director	60 days
			Initial Environmental Examination Checklist (IEEC)	ECC	RO: EIAMD Chief	EMB RO Director	30 days
			Project Description Report (PDR)	ECC	RO: EIAMD Chief	EMB RO Director	15 days
	II-B: Existing Projects for Modification or Re-start up(subject to conditions in Annex2-1c)	Single Projects	Environmental Performance Report and Management Plan (EPRMP)	ECC	RO: EIAMD Chief	EMB RO Director	30 days
	II-C: Operating without ECC	Single Projects	Environmental Performance Report and Management Plan (EPRMP)	ECC	RO: EIAMD Chief	EMB Director	30 days

Table 3.5-5 Project Group, IEA Report, Competent Organization, Application Terms, etc. (2)

PROJECT GROUPS/SUB GROUPS		APPLIED TO	DOCUMENTS REQUIRED FOR ECC/CNC APPLICATION	DECISION DOCUMENT	PROCESSING RESPONSIBILITY (ENDORSING OFFICIAL)	DECIDING AUTHORITY	MAX TIME TO GRANT OR DENY ECC APPLICATION (Working Days)
III: Non-Environmentally Critical Projects(NECPs) in Non-Environmentally Critical Area (NECA)	III-A1: New(Enhancement Mitigation Projects)	Single Projects	Project Description Report(PDR) (Required)	CNC	CO: EIAMD Chief	EMB Director	15 days
					RO: EIAMD Chief	EMB RO Director	15 days
	III-A2: New(All other Grp II Project Types/Sub-Types(in NECA)	Single Projects	Project Description Report(PDR) (AT OPTION OF PROPONENT)	CNC	CO: EIAMD Chief	EMB Director	180 days
					RO: EIAMD Chief	EMB RO Director	60days
IV: Co-located Projects	IV-A: New	Co-located Projects majority of which are Group I Projects	Programmatic Environmental Impact Statement (PEIS)	ECC	CO: EMB Director	DENR Secretary	120 days
		Co-located Projects majority of which are Group II Projects	Programmatic Environmental Impact Statement (PEIS)	ECC	RO: EIAMD Chief	EMB RO Director	60 days
	IV-B: Existing Projects for Modification or Re-start up of Co-located Projects	Co-located Projects majority of which are Group I Projects	Programmatic Environmental Performance Report and Management Plan (PEPRMP)	ECC(new) / ECC Amendment	CO: EIAMD Chief	EMB Director / DENR Secretary	120 days
		Co-located Projects majority of which are Group II Projects	Programmatic Environmental Performance Report and Management Plan (PEPRMP)	ECC(new) / ECC Amendment	RO: EIAMD Chief	EMB RO Director	60 days
	IV-C: Operating without ECC	Co-located Projects majority of which are Group I Projects	Programmatic Environmental Performance Report and Management Plan (PEPRMP)	ECC(new) / ECC Amendment	CO: EMB Director	DENR Secretary	120 days
		Co-located Projects majority of which are Group II Projects	Programmatic Environmental Performance Report and Management Plan (PEPRMP)	ECC(new) / ECC Amendment	RO: EIAMD Chief	EMB RO Director	60 days

Table 3.5-5 Project Group, IEA Report, Competent Organization, Application Terms, etc. (3)

PROJECT GROUPS/SUB GROUPS	APPLIED TO	DOCUMENTS REQUIRED FOR ECC/CNC APPLICATION	DECISION DOCUMENT	PROCESSING RESPONSIBILITY (ENDORSING OFFICIAL)	DECIDING AUTHORITY	MAX TIME TO GRANT OR DENY ECC APPLICATION (Working Days)
V: Unclassified Projects	V-A: New	Project Description Report(PDR) (Required)	CNC or Recommendation on Final Grouping and EIA Report Type	CO: EIAMD Chief	EMB Director / DENR Secretary	15 days
				RO: EIAMD Chief	EMB RO Director	
IF THE MODIFICATION DOES NOT REQUIRE A PEPRMP OR EPRMP BASED ON ANNEX 2-1C, THE FOLLLOWING APPLY:						
Request for Minor ECC Amendment	Single Projects with Applicable Modifications listed in Annex 2-1c	Letter Request	ECC Amendment	CO: EIAMD Review and Evaluation Section or Division Chief	EIAMD Chief /EMB Director	7 days
				RO: EIAMD Review and Evaluation Section Chief	EIAMD Chief	
Request for Major ECC Amendment	Single Projects with Applicable Modifications listed in Annex 2-1c	Letter Request and/or Updated Project Description or Update of other selected portions of the EIA Report (e.g. Baseline or impact assessment or EMP on the areas of amendment only)	ECC Amendment	CO: EIAMD Review and Evaluation Section or Division Chief	EMB Director /DENR Secretary	30 days
				RO: EIAMD Review and Evaluation Section Chief	EMB RO Director	

(6) EIA Status

The Philippine EIS system is supplementary and complementary to other environmental laws. Executing an EIA at the initial stage of a F/S of a project could lead to identification of potential issues or environmental impacts, and the corrective actions taken thereafter could meet the environmental regulations in the project area or requirements for application of other legal organizations. Also, through the EIS, it is possible to appropriately deal with issues not provided for in the existing rules. For example, the establishment of a green zone is not required by any environmental law, but in the EIS system, it is required for the ECC as a contract obligation and commitment to the DENR of the project proponent.

The final decision on whether the project can move forward or not is given by the local government controlling the project area or the governmental organization that has the authority of promoting a program in the sector (for example, the DOE for an energy project or the MGB (Mines and Geosciences Bureau, DENR) for a mining project). The results of the EIA study are used as suggestions and recommendations for making a decision on project approval.

Notice No. 2007-08 issued by the DENR in July 2007 defines the ECC/CNC as guidance for other organizations or local governments, and stipulates the following.

- Any approval and/or permission by other governmental organizations and local governments are not issued during the application for an ECC or CNC.
- Study results and recommendations of the EIA are forwarded to the governmental organizations concerned, and incorporated in the decision-making prior to issue of permission/ approval under their own authority.
- Issuing an ECC or CNC for a project in the EIS system does not exempt the project proponent from their obligations to obtain approval and permission from other governmental organizations.

3.5.2 Environmental Impact Assessment for Small Hydropower Development[8]

(1) Outline of EIS System

According to DENR Administrative Order No. 37(DAO 96-37), in order to secure an ECC, proponents of ECPs are required to submit an EIS report. On the other hand, proponents of projects within ECAs are generally required to submit an IEE report. It has been pointed out that an IEE is a form of an EIS. The basic differences between these two documents are the depth and extent of the data required. An EIS is submitted to the EMB and an IEE is submitted to the concerned Regional Office of the EMB.

An EIS report may be prepared instead of an IEE report for proposed projects within ECAs at the discretion of the proponent in certain cases or upon an order from the Regional Executive Director.

The projects and undertakings subject to the EIS system are defined as “any activity, regardless of scale or magnitude, which may have significant impact on the environment” in DAO 96-37. Not all projects and undertakings are subject to the EIS system. In the case that a project is not subject to the EIS system, a CNC may be issued upon request from a proponent.

[8] S.1.1 Existing IEE Checklist, Master Plan Study of Power Development In Palawan Province Republic of the Philippines Final Report (Technical Background Report), Japan International Cooperation Agency, September 2004

For selected projects of relatively small scale, an IEE checklist report has been developed by the DENR. The IEE checklist report is a simplified form, instead of the standard EIS document, designed to assist the proponents. The list of projects covered by the IEE checklist is defined by the EMB Memorandum Circular No.01, 2000 Series. The Memorandum Circular also defines format and contents of the IEE checklist, as well as ECC procedure for a project to which an IEE checklist is applicable.

In this study, based on the review of the existing IEE checklist report, an environmental checklist for the study of the small HEP development plan is assessed. (refer to Section 5.7.2 Basic Concepts of Preparing an Environmental Checklist by Oneself)

(2) Definition of Power Facilities and Related Facilities in EIS System

Power facilities and related facilities defined as the ECPs by DAO 96-37 are as follows.

- Major dams with storage volumes equal to or exceeding 20 million m^3
- Geothermal plants, waste-to-energy facilities, thermal power plants with capacities equal to or exceeding 10 MW
- Hydropower plants with capacities equal to or exceeding 10 MW
- Power barges with a total capacity in excess of 32 MW

In addition, a MOA (Memorandum of Agreement) on EIS processes for energy-related facilities was signed between the DENR and DOE in 1999. This MOA defines the kinds and scales of projects for all facilities that are not subject to the EIS system. Also, the projects subject to the EIS system are classified into following three categories: IEE checklist required, IEE report required, and EIS report required.

In relation to the energy facilities mentioned in this MOA, Table 3.5-6 shows a summary of selection and classification of power facilities and related facilities. According to this MOA, only power plants with capacities equal to or less than 1 MW, and substations and switchyards (up to 220 kV) are classified as not being subject to the EIS system. RE, hydropower, and power barges with capacities equal to or less than 10 MW are classified as the projects requiring an IEE checklist.

In case that the entire province is classified as ECAs, zoning is adopted (e.g. Palawan Province), the classifications of Table 3.5-6 are not applicable directly. Although transmission lines are classified as projects that require an IEE checklist in Table 3.5-6, an EIS report was prepared and submitted to the EMB in the case of the Palawan backbone transmission line project.

Table 3.5-6 Documents Required by the EIS System for Power Facilities as to the Kind and Scale in MOA between DENR and DOE

Project	Not Covered by the EIS System*	To Be Covered by the EIS System		
		Requiring and IEE Checklist	Requiring an IEE Document	Requiring an EIS Document
General	➢ Studies (seismic surveys, gravity surveys, geoscientific and geophysical surveys, feasibility studies, etc.) and development activities that don't involve significant earth moving and ecological/vegetative disturbance activities using mechanical equipment that affect the environment ➢ All demonstrations and pilot energy projects, with capacity less than or equal to 1 MW (meeting DENR and Local Government requirements)			➢ Any energy project that requires significant mechanical earth moving and ecological/ vegetative disturbance activities
Renewable Energy (Solar, wind, waste, biogas, tidal power, geothermal)		➢ Capacity from greater than 1 to 10 MW		➢ Capacity greater than 10 MW
Hydropower Plants		➢ Capacity from greater than 1 to 10 MW ➢ Or with less than 20 million m^3 water impoundment		➢ Capacity greater than 10 MW ➢ Or water impoundment greater than 20 million m^3
Thermal power Plants			➢ Bunker, diesel-fired and natural gas-fired with capacity less than or equal to 10 MW	➢ Capacity greater than 10 MW
Power Barges		➢ Capacity from greater than 1 to 10 MW	➢ Capacity equal to 10 up to 32 MW	➢ Capacity greater than 32 MW
Power Transmission Systems and Substations		➢ Power transmission system and substations	➢ Submarine cables	

* Projects that are not subject to the EIS system may be issued a Certificate of Non-Coverage (CNC) by the EMB or DENR regional office upon request from the proponent. There is no need for the proponent to prepare an IEE or EIS to secure the ECC.

Source: Study team (based on DENR-DOE MOA on Streamlining of EIS Processes for Energy Projects)

3.5.3 Other Environmental Impacts

(1) Consideration for Indigenous People

The Philippines are comprised of more than 100 ethnic groups of differing cultures and languages. On October 29, 1997, then President Fidel V. Ramos signed into Law R.A. 8371, the IPRA (Indigenous Peoples Rights Act), specifically to protect and promote the rights of indigenous people and their cultural communities. In this act, it has been decided to establish the NCIP (National Commission on Indigenous Peoples) focusing on the following issues to protect the rights and wishes of indigenous people.

1) Settlement and land of indigenous people
2) Independent governance and delegation of authority
3) Social recognition and human rights
4) Dignity of culture

The settlements and lands of indigenous people have been already investigated and mapped for the entire Philippines. Blank areas show there re no indigenous communities or lands of indigenous people.

The responsibilities and authority of the NCIP are defined by R.A.8371 and the 2006 FPIC (Free and Prior Informed Consent) Guidelines[9]. The definition in R.A.8371 is as follows.

"Chapter III DELINEATION AND RECOGNITION OF ANCESTRAL DOMAINS"

Section 59 Certification Precondition - All department and other governmental agencies shall henceforth be strictly enjoined from issuing, renewing, or granting any concession, license or lease, or entering into any production-sharing agreement, without prior certification from the NCIP that the area affected does not overlap with any ancestral domain. Such certificate shall only be issued after a field-based investigation is conducted by the Ancestral Domain Office of the area concerned: Provided, That no certificate shall be issued by the NCIP without the free and prior informed and written consent of the ICCs/IPs concerned: Provided, further, That no department, government agency or government-owned or -controlled corporation may issue new concession, license, lease, or production sharing agreement while there is pending application CADT (Certification of Ancestral Domain Title): Provided, finally, That the ICCs/IPs shall have the right to stop or suspend, in accordance with this Act, any project that has not satisfied the requirements of this consultation process."

Also, in the 2006 FPIC Guidelines, the FPIC process of the NCIP is shown as in Fig. 3.5-3.

Land use fees could be required for CADT (Certification of Ancestral Domain Title), such as annual royalty fees of 0.005 PhP/kWh and an additional 0.005 PhP/kWh every 5 year paid to ICCs (indigenous cultural communities) / IPs (indigenous peoples). Proponents should pay continuous attention to such fees after development, as well as secure permission or approval including the necessary time and funding (MOA for Irisan hydropower).

[9] Free and Prior Informed Consent (FPIC) Guidelines of 2006, NCIP Administrative Order No.1 Series of 2006

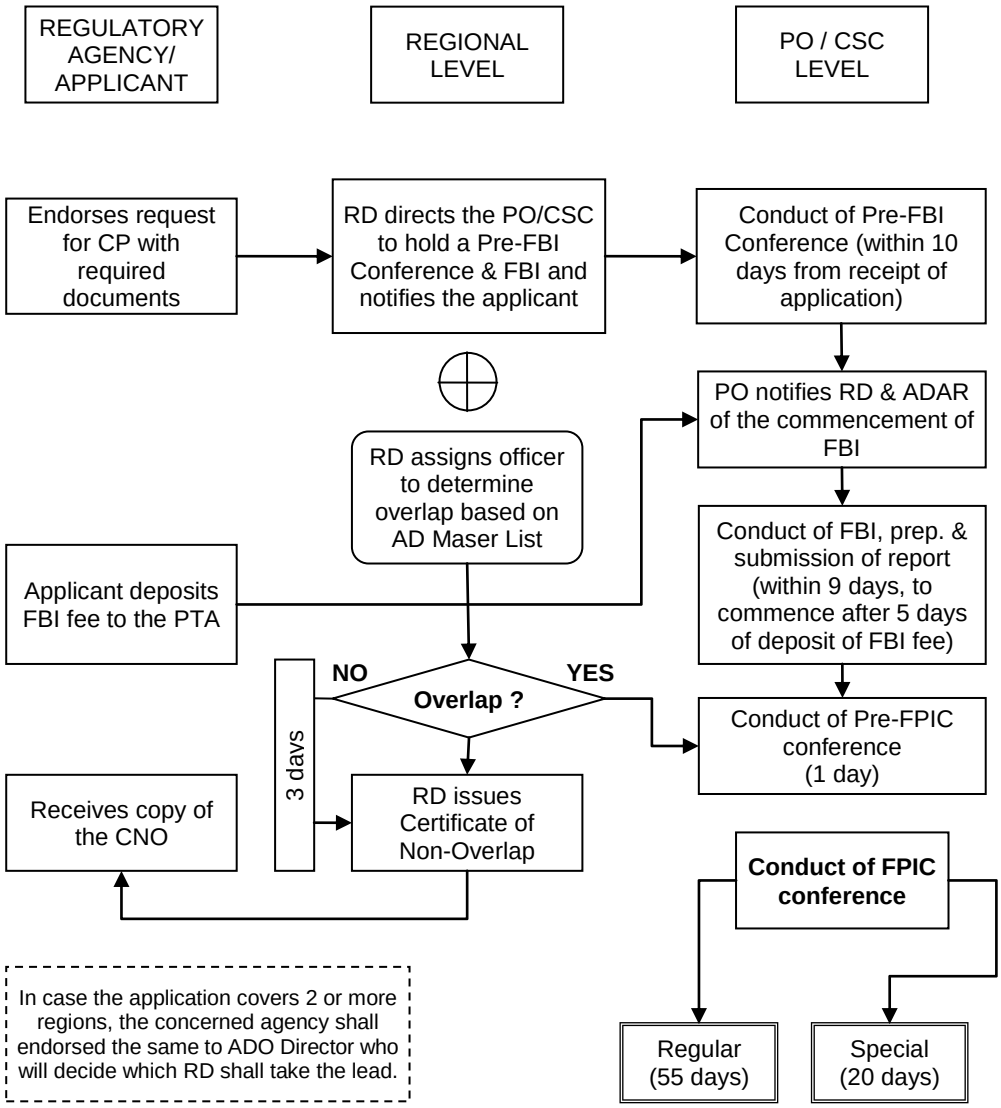


Fig. 3.5-3 FPIC Process of the NCIP

(2) Water Rights

1) General information on water rights

Hydropower water rights are not the subject of the EIS system, as they are administered by The NWRB (National Water Regulatory Board) on the central government level and by LWD (Local Water Districts) on the regional level. Maintenance discharge or release flow shall be discussed between the proponent and LWD.

The NWRB is the leading government agency in the Philippine water sector, tasked with policy-making, regulatory and quasi-judicial functions. The NWRB is responsible for ensuring the optimum exploitation, utilization, development, conservation and protection of the country's water resources, consistent with the principles of Integrated Water Resource Management.

The NWRB's functions and responsibilities are three-fold.

- Formulation and coordination of policies, programs and standards relating to the Philippine Water Sector
- Management and regulation for all water-related activities
- Regulation and monitoring of water utilities

The NWRB, composed of a representative from academia and 5 executive directors that are cabinet ministers, is chaired by the Secretary of DENR. Although independent insofar as its regulatory and quasi-judicial functions are concerned, the NWRB is under the administrative supervision of the DENR, as an attached agency.

The NWRB has following missions.

1. To ensure access to safe, adequate water supply and sanitation at acceptable rates and levels of service
2. To allocate sufficient water that will ensure food security and spur economic development of the country
3. To protect the water environment in order to preserve flow regimes, biodiversity and cultural heritage as well as the mitigation of water related hazards

The NWRB executes its water resource regulatory functions through its Water Rights Division, consisting of 4 sections namely:

- Permits Section;
- Evaluation Section;
- Complaints and Investigation Section, and;
- Litigation and Adjudication Section.

As a regulator of natural resources, the NWRB implements the provisions of Presidential Decree No. 1067, otherwise known as the "Water Code of the Philippines." Premised on the underlying principle that "all waters belong to the State", and "the State may allow the use or development of waters by administrative concession," the NWRB regulates and controls, on behalf of the government, the utilization, exploitation, development, conservation and protection of all water resources.

More specifically, the NWRB's functions as a resource regulator include the following.

- Issue/Suspend/Revoke/Approve transfer of water permits for the appropriation and use of waters.
- Declare waters not previously appropriated exempt from appropriation.
- Promulgate rules and declare the existence of control areas for the coordinated development, protection, and utilization of ground and surface waters.
- Establish minimum stream flows for rivers and streams, and minimum water levels for lakes as may be necessary for the protection of the environment, control of pollution, navigation, prevention of salt damage, and general public use.
- Issue permits for the development of streams, lakes or springs for recreational purposes.
- Issue permits for drilling of wells.

- Issue rules and regulations for reservoir operations.
- Approve the transfer of water from one river basin to another.
- Coordinate data collection, research and manpower development.
- Impose penalties for administrative violations.
- Impose and collect reasonable fees or charges for water resource development.
- Approve rules and regulations prescribed by other government agencies pertaining to the utilization, exploitation, development, control, conservation or protection of water resources.
- Adjudicate all disputes relating to the appropriation, utilization, exploitation, development, control, conservation and protection of waters.

The NWRB is also mandated, under Republic Act No. 9275, otherwise known as the "Clean Water Act," to designate water quality management areas, in coordination with DENR.

In the exercise of its resource regulatory functions, the NWRB is assisted by deputized agents all-over the country, which includes the:

- District Engineering Offices of the Department of DPWH (Public Works and Highways);
- Provincial Irrigation Engineering Offices of the NIA (National Irrigation Administration);
- Regional Managers of the NPC (National Power Corporation), and;
- General Managers of Water Districts.

2) Fees and charges

Pursuant to Executive Order No. 197 of 2000 and NWRB Resolution No. 0010-0305 dated March 21, 2005, the National Water Resources Board on its 29th Meeting approved the fees and charges for water utilization.

In hydropower projects, proponents have to pay the fees and charges every year according to water consumption. In the case of using over 50 l/min, the proponents have to pay a basic fee of 5,000 PhP and an additional 5.5 PhP/l/min. The proponents also have to pay fishery damage compensation. Penalties are specified for the failure to file reports or make payments.

3.6 CURRENT STATUS OF HYDROPOWER DEVELOPMENT ASSISTANCE IN THE PHILIPPINES BY INTERNATIONAL ORGANIZATIONS AND DONORS

The ADB (Asian Development Bank) has provided a project loan to Sixth Mindanao Power in 1995 and a grant to the RE and Livelihood Development Project for the Poor in Negros Occidental in 2004.

The World Bank (WB) has provided loans to the Binga HEP Project in 1957, Angat HEP Project in 1961, and Maria Christina HEP Project in 1962. In recent years, it provided a loan to BOHECO I Sevilla Mini-HEP in 2004.

Table 3.6-1 Hydroelectric Power Project Assistance by International Organizations in the Philippines

Organi-zation	Year	Project		Summary	Source
ADB	2004	Renewable Energy and Livelihood Development Project for the Poor	Grant	19 kW run-of-river micro hydro system in Negros Occidental	http://www.adb.org/Documents/Informatio n/Energy-for-All/Micro-Hydro.pdf http://www.adb.org/media/Articles/2004/5550_Philippines_energy_for_negros_occidental/
ADB	1979	Sixth Mindanao Power	Loan		http://www.adb.org/projects/project.asp?id =39743&p=phiproj
WB	2004	BOHECO I Sevilla Mini-HEP Project	Loan	Supply and installation of Sevilla Mini-Hydro Generating Units, consisting of two vertical generating units	http://www.devex.com/projects/38524?lang =ja
WB	1962	Maria Christina HEP Project (03)	Loan	Increase in capacity of the Maria Cristina Falls hydro station from 25 MW to 50 MW; and 2) performing minor river regulatory works and transmission	http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Proje ctid=P004411
WB	1961	Angat HEP Project (02)	Loan	1) Utilization of a high earth and rock filled dam for power production; 2) construction of a pressure tunnel to supply water to the primary powerhouse; and 3) construction of a secondary powerhouse to handle water flow.	http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Proje ctid=P004408
WB	1957	Binga HEP Project	Loan	Construction of a hydroelectric power station on Luzon Island. 1) Construction of four 25 MW generators; 2) construction of a rock filled dam with reservoir storage capacity; 3) construction of a 90 meter wide spillway to handle flood water; 4) construction of an underground powerhouse with surge chambers; and 5) construction of a pressure tunnel and tail tunnel to handle water flow	http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Proje ctid=P004407

Other assistances by bilateral organizations include the USAID (United States Agency for International Development) provided a loan guarantee for Gerphil Renewable Energy (small-scale HEP construction project) through the LGU-GC (Local Government Unit Guarantee Corporation) in 2008. The LGU-GC is a private financial institution that provides credit guarantees. Initially, although guarantees were limited to LGU, the guaranteed target has been widened to ECs, RE technology, RE developers, and large and medium-scale companies. The capital structure of the LGU-GC is: BAP (Bank Association of the Philippines) 38%, DBP (Development Bank of the Philippines) 37%, and ADB 25%. Currently, it provides credit guarantees to projects worth 4.8 billion PhP in total.

The framework of guaranteed funds, to which GEF (Global Environmental Facility) of the WB contributes funding and the LGU-GC operates as a program manager, is shown in Fig.3.6-1. As for a project guaranteed by the LGU-GC with its own fund, the USAID

provides a re-guarantee of 30% of the value in case the financial condition of the LGU-GC deteriorates and the LGU-GC cannot perform the guarantee. However, 70% of the remaining value is not covered in principle, and it can be a loss of the financial institution.

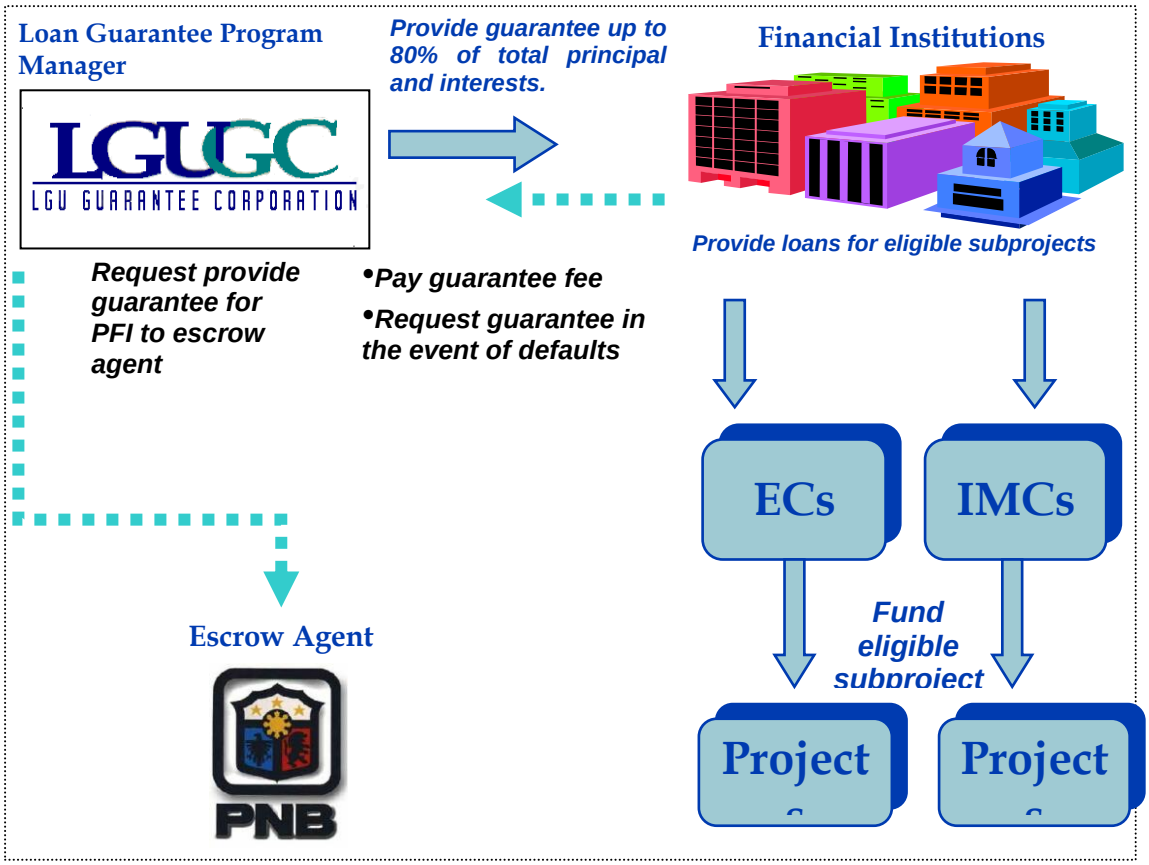


Fig. 3.6-1 Framework of Guarantee Program for ECs

Source : Ministry of Economic, Trade and Industry/ Mitsubishi Research Institute, Inc. (2004)

The following table summarizes the list of potential mini-HEP investment projects prepared by the Philippines Mini Hydro Division of GTZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) in coordination with the GTZ.

Table 3.6-2 Potential Mini-hydroelectric Power Investment: Philippines

Site Name	Location	Capacity (MW)	Cost(USD Mio)	Status (Currently)
Dapitan 1	Mindanao	3.8	5.1	ACE, Pre FS, 2,3
Dapitan 2	Mindanao	4.4	6.6	ACE, Pre FS, 2,3
Dapitan 3	Mindanao	3.6	5.4	ACE, Pre FS 2,3
Polondok	Mindanao	3	4.4	ACE, PMU, 1
Ingin	Mindanao	6	8.5	ACE, PMU, 1
Asin I/h	Luzon	1.5	2.1	PMU, 1
Asin II	Luzon	0.2	0.28	PMU, 1
Asin III	Luzon	1.1	1.54	PMU, 1
Balugbog	Luzon	0.65	0.91	PMU, 1
Irasan III	Luzon	1.4	1.96	PMU, 1
Palakpakin	Luzon	0.57	0.798	PMU, 1
Henabian	Visayas	0.81	1.134	PMU, 1
Aglubang	Mindoro Occident	13.6	30	AIJ, FS, 4,5
Alag	Mindoro Oriental	39.5	40	AIJ, FS, 4,5
Bongabong	Mindoro Oriental	38	43	AIJ, FS, 4,5
Buraboy	Mindoro Occident	3.2	12	AIJ, FS, 4,5
Calturian	Mindoro Oriental	19	24	AIJ, FS, 4,5
Dulangan	Mindoro Oriental	24	35	AIJ, FS, 4,5
Babuyan	Palawan	5.6	18	AIJ, FS, 4
Langogan	Palawan	6.8	16	AIJ, FS, 4
Tagoloan	Mindanao	68	175	Private Sector, FS, 4, 5
Catingas	Romblon	0.9	1.4	PFS
Kinanliman	Quezon	1.8	2.6	PFS
Lake Manit	Mindanao	22	30	Private Sector, FS, 4, 5
Isabela	Luzon	30	65	Private Sector, FS, 4, 5
Babunawan Falls	Baungon, Bukidn	7	9.8	PMHD/GTZ
Odiongan	Gingoog City, Mi	10	14	PMHD/GTZ
Liangan	Bacolod, Lanao d	10	14	PMHD/GTZ
Taguibo	Butuan City	7.24	10.136	PMHD/GTZ
Odiongan 3	Gingoog City	10	14	PMHD/GTZ
Pugu E	Agusan del Norte	6.8	9.52	PMHD/GTZ
Cawayan 2	Guinlajon	2.5	3.5	PMHD/GTZ
Bugtong Falls	Calbayog City	1.05	1.47	PMHD/GTZ
Langogan	Puerto Princesa	6.8	9.52	PMHD/GTZ
Culaman	River Sumilao	10	14	PMHDIGTZ
Siaton	Siaton	5.4	7.56	PMHD/GTZ
Tandik	New Bataan	5	7	PMHD/GTZ
Ibulao	Kiangan Hungdu	10	14	PMHD/GTZ
Uddiawan	Uddiawan	1.89	2.646	PMHD/GTZ
Iglobo	lgrabas	4	5.6	PMHD/GTZ
Bineng 4	Sablan	5	7	PMHD/GTZ
Babuyan	Palawan	5.6	7.84	PMHD/GTZ
Tigman River	Calabanga	2.4	3.36	PMHD/GTZ
Tablu I	Tampakan	0.5	0.7	PMHD/GTZ
Pampanga	RIS Rizal	1.04	1.456	PMHD/GTZ
Aliwagwag	Cateel	4.5	6.3	PMHD/GTZ
Kabacaan	Magpet	2	2.8	PMHD/GTZ
Pansian	Pansian	0.54	0.756	PMHD/GTZ
Salaza	Botolan	3.2	4.48	PMHD/GTZ
Magat	C Ramon	0.94	1.316	PMHD/GTZ
Lam alo	Tboli	6	8.4	PMHD/GTZ
Magat	F Cordon	0.66	0.924	PMHD/GTZ
Hitoma	Hitoma	2.4	3.36	PMHD/GTZ
Itbong	Buhi	0.75	1.05	PMHD/GTZ
Baracbac	Mangatarem	1.2	1.68	PMHD/GTZ
Man abot	Ambaguio	1.2	1.68	PMHD/GTZ
Tablu II	Tampakan	1.2	1.68	PMHD/GTZ
Dipalo	San Quintin	0.75	1.05	PMHD/GTZ

Legend: ACE: Identified by ACE. Invited PMU to participate, PMU: Identified by JAMP PMU
AIJ: Identified by PMU/ENTEC Team with the World Bank, PMHD/GTZ: Philippines Mini Hydro Division / GTZ
1. Identified, 2. Pre Feasibility Study, 3. Feasibility Study, 4. Potentially for Financing, 5. Priority for Financing Completion

Source : ASEAN Centre for Energy, http://www.aseanenergy.org/energy_sector/renewable_energy/philippines/phil_minihydro.htm

CHAPTER 4

BASIC DATA FOR HYDROOPWER RESOURCES DATABASE

CHAPTER 4 BASIC DATA FOR HYDROPOWER RESOURCES DATABASE

4.1 BASIC DATA AND INFORMATION

The basic data for hydropower resource database is shown below.

Table 4.1-1 Basic Data List to Be Stored in Database

No.	Data Item	Supplement	Remarks
1. Existing Water Facilities			
1-1	Existing hydropower plants	72 sites	GIS data (point)
1-2	Existing dams/weirs/reservoirs	46 sites	GIS data (point)
2. Hydropower Potential Sites			
2-1	Potential sites awarded by DOE	124 sites	GIS data (point)
2-2	Potential sites applying by DOE	244 sites	GIS data (point)
2-3	Existing potential sites	1,224 sites	GIS data (point)
2-4	New potential sites found by JICA study	252 sites (inside of project area)	GIS data (point)
2-5	Project layout	Layout of power facilities (dam, intake, headrace, powerhouse, penstock, etc.)	GIS data (line/polygon)
2-6	Additional information of site reconnaissance	Access road/Survey trail/Survey waypoint	GIS data (line/point)
3. Power facilities			
3-1	Location of transmission lines and substations (existing, under construction or consideration)	Only approximate location	GIS data (line)
3-2	Substations	Only approximate location	GIS data (point)
3-3	Location of high-voltage distribution lines (existing, under construction or consideration)	Only approximate location	GIS data (line)
4. Topography			
4-1	Topography map	1/50,000 map image (whole land)	Raster data
4-2	SRTM-DEM	Whole land	Raster data
5. Infrastructure			
5-1	Roads and bridges	National highways (DPWH)	GIS data (line / point)
6. Hydrology			
6-1	River network (water system map) / river lines / basin boundary / longitudinal profile	1/50,000 map image	GIS data (line)
6-2	Observation point of rainfall	Location and observation period (34 sites)	GIS data (point)
6-3	Observation point of discharge	Location and observation period	GIS data (point)
6-4	Water resource region	Whole land	GIS data (polygon)
6-5	Climate region	Whole land	GIS data (polygon)
6-6	Annual rainfall distribution	Whole land	GIS data (polygon)
7. Electricity Demand Area			
7-1	EC (Electrification Cooperative)	Only approximate location	GIS data (polygon)
7-2	Private Power Distribution Company	Only approximate location	GIS data (polygon)
8. Social environment			
8-1	Environmental protected area	Whole land	GIS data (polygon)
9. Geology			
9-1	Active volcanoes	Whole land (Point & buffer area)	GIS data (point/polygon)
9-2	Active faults	Whole land	GIS data (line)
9-3	Geological map	Large area map	GIS data (polygon)
10. Administrative Boundary			
10-1	Political boundaries (region, province, municipality, barangay)	GIS area data of municipality, results of the census in 2000 (population, number of households)	GIS data (polygon)

As for GIS (Geographic Information Systems) data for transmission line routes and substations, the NGCP (National Grid Corporation of the Philippines) did not agree to provide GIS data to the JICA (Japan International Cooperation Agency) study team for reasons of national security. Other data required for the preliminary study of potential sites was collected as shown in Table 4.1-2.

The below data is described in this chapter.

Table 4.1-2 Other Collected Data required for This Study

No.	Data item	Description	Source
1	River flow data*	Discharge-Duration curve	DPWH (Department of Public Works and Highway), etc.
2	Construction cost data	Unit price	Cost data from past study reports, etc.

*) Discharge-Duration curves are developed from daily river flow data from 1980-2000 observed in 120 river gauging stations in the study area.

4.2 BASIC DATA OF EXISTING WATER FACILITIES

4.2.1 Existing Hydropower Plants

Information of existing hydropower plants is one of the most important information for the hydropower resources database. Therefore, it is desirable to collect as much as possible. As described in the preceding Chapter 3, after enforcement of the EPIRA (Electric Power Industry Reform Act), existing hydropower plants larger than 10 MW are monitored by the DOE (Department of Energy) Power Planning Division, while other hydropower plants are monitored by the REMB (Renewable Energy Management Bureau). In the future, all monitoring will be implemented by the REMB. Basic data on existing hydropower plants provided by the DOE is categorized as shown in Table 4.2-1.

This data contains operating information such as annual generated power in addition to information on location and structures. This data is maintained by DOE staff. Information stored in this database varies widely by location, age and owner. Therefore, it is important to maintain the database with continuous updates.

Table 4.2-1 Existing Hydropower Plants

No.	Category	Number of Sites	Source
1	Existing Mini Hydropower Plants (~10MW)	55	DOE
2	Existing Hydropower Plants (10MW~)	19	DOE

4.2.2 Other Water Facilities than Hydropower Facilities

For hydropower development planning, it is important to identify data of other purpose dams in addition to hydropower dams, for efficient river use and to avoid overlapping facilities. Therefore, information on dams was collected from "Dams in the Philippines" edited by the NWRB (National Water Resources Board) and JICA in 2000 and the DPWH (Department of Public Works and Highway) who controls water resources in the Philippines. From these information sources, information on 47 water use facilities was obtained.

4.3 EXISTING HYDROPOWER POTENTIAL SITES

4.3.1 Basic Data on Existing Hydropower Potential Sites

In the existing database of hydropower resources which the DOE possesses at present, 94 sites of small scale hydropower development (100 kW ~ 10 MW) and 60 sites of large scale development (> 10 MW) have been registered. This database has been built with the data collected from related organizations of the Philippines and arranged by the DOE Mini-Hydro Division in February 2003 with USAID (United States Agency for International Development) and NRER (National Renewable Energy Laboratory, U.S. Department of Energy) funds. It covers data from the DOE, NPC (National Power Corporation), NEA (National Electrification Administration), NIA (National Irrigation Administration), PASSHYDRO (Philippine Association of Small Scale Hydropower, Inc.), HEDCOR (Hedcor, Inc.), MINDEVCO (Midevco Commercial Realty Corporation), CAPALCO (Cagayan Electric Power and Light Company, Inc.), MESCOR (MESCOR Inc.) and PEI (Preferred Energy Incorporated), and is arranged in Excel format as for the following items.

- Employer
- Purchaser of electric power
- Expected starting year of operation
- Type of power generation (run-of-river type, reservoir type)
- Name of river, Gross head, Catchment area, Discharge
- Output power
- Estimated annual power generation
- Plant factor
- Location information (Island, Area, State, Barangay, Latitude and longitude of intake point, Power distribution companies in supply area, union)
- Information of preparatory study (Study stage, Study date, Construction cost at the present of study, Internal Rate of Return, etc.)
- Status of permission and approval (Water usage right, Permission and procedure for environment, Approval by local government, Approval by indigenous people, etc.)
- Dam outline (Type, Height, Crest length, Active capacity)
- Waterway outline (Number, Length, Type, Material, Size)
- Information on hydropower plant (Unit number, Capacity, Type of turbine, Flow rate/head design, Type of generation, Rated capacity, etc.)
- Outline of transmission line (Specifications of substation, Transmission voltage/extension, Substation, Receiving power station)
- Extension of access road

The existing database, in which the DOE has collected and arranged hydropower potential sites that other agencies studied, involves the above 50 items and covers as many items as specifications for a hydropower potential site. However, it still has many blanks and, so, it can be hardly said that the existing database is perfect. Information on about 94 sites of small scale hydropower potential sites (100 kW ~ 10 MW) is summarized as follows.

- The location data can be recognized down to the city (municipality) level. However, latitude and longitude are unknown for 70% of the sites, so the location needs to be specified.

- Potential power output is unknown for 10 sites, energy and head, which are basic conditions of the project, are also unknown for 40% of the sites. And, drainage system and catchment area are unknown for 30 sites.

- Investment for study was made for 50 sites by the NEA, 5 sites by the NPC, 4 sites by the ECs (Electric Cooperatives), 3 sites by the DOE and 3 sites by others, while study investments are unknown for the remaining 30 sites.

- Construction costs have been estimated for about 69 sites and IRR (Internal Rate of Return) for about 45 sites, but the studied time is mentioned only for about 16 sites.

- Specifications are unknown for 50% of the construction facilities (dam, waterway) and 90% of the turbines and generation.

- The distance to transmission lines is unknown for 80% of the sites, while the distance from existing roads is unknown for 60% of the sites. These items have a big economical impact on projects.

- Social environmental permission and approval are mentioned for only about 10% of the sites. The information is limited and there is strong possibility that the limited information could seriously hamper projects.

The DOE intends to leverage the database for promoting investments by ECs and other developers. However, it is necessary to integrate and summarize information.

4.3.2 Existing Hydropower Potential Sites

In this study, in addition to the existing data described above, additional data was collected. Additional data was collected mainly from the NPC and NEA because they were in charge of hydropower development planning in the Philippines before the enforcement of the EPIRA in 2001. As a result, the data shown in the following table was collected.

Table 4.3-1 Collected Data for Existing Hydropower Potential Sites

No.	Data	Number of Sites	Description	Data Source
1	Potential sites by private sector (Signed)	124	Hydropower potential sites where developers applied for authorization for feasibility studies, and contracts were signed under EPIRA satisfying their financial and technical matters.	DOE
2	Potential sites by private sector (Not Signed)	244	Hydropower potential sites where developers applied for authorization for feasibility studies, and examinations in their financial and technical matters are undergoing under EPIRA.	DOE
3	Potential sites of mini hydropower (>100kW, <10MW)	94	List of potential sites (less than 10 MW) by DOE Mini-hydro Division in 2003. This data was collected from DOE, NPC, NPC-SPAG, NEA, NIA, PASSHYDRO, and HEDCOR.	DOE
4	Potential sites of major hydropower (>10MW)	60	List of potential sites (larger than 10 MW) by DOE Mini-hydro Division in 2003. This data was collected from DOE, NPC, NIA, PASSHYDRO, and HEDCOR.	DOE
5	Potential sites investigated by NEA	905	Hydropower potential sites investigated by NEA. Information is so limited (only output, head, discharge, and name of sites) that it is impossible to plot these locations on topographic maps.	NEA
6	Potential sites by NPC's inventory survey	145	Hydropower potential sites resulting from large-scale potential hydropower survey on Luzon island investigated by NPC in 1987.	NPC
7	Potential sites by JICA's master plan for Palawan	7	7 prospective small hydropower potential sites from 47 sites investigated by JICA's master plan study in 2004.	JICA
8	Potential sites by JBIC project in the Ifugao terrace paddy fields	3	3 hydropower potential sites from 13 sites investigated by JIBIC in 2004.	JICA

No.1 Potential sites by private sector (Awarded)

Hydropower potential sites where developers including private investors and public organizations applied for authorization for F/S (Feasibility Study), and contracts were awarded under the EPIRA after verifying financial and technical matters. These applications under the EPIRA began in 2009 and some of the F/S are undergoing.

In this data set, information on power houses is lacking, though there is enough information on owners.

No.2 Potential sites by private sector (Applying)

Hydropower potential sites where developers applied for authorization for F/S, and examinations of financial and technical matters are undergoing under EPIRA.

After these applications are accepted, these potential sites are promoted to No.1 data above. Hearing from DOE staff, information on many of these sites is inadequate for signing.

In this data set, information on power houses is lacking, though there is enough information on owners.

No.3 Potential sites of mini hydropower

The DOE Mini-hydro Division collected data for hydropower potential sites for the entire Philippines in 2003, and made lists of potential sites smaller than 10 MW. This information was collected from the DOE, NPC, NPC-SPUG (National Power Corporation Small Power Utility Group), NEA, NIA, PASSHYDRO, and HEDCOR.

In this data set, the amount of information varies from site to site.

No.4 Potential sites of major hydropower

The DOE Mini-hydro Division collected data for hydropower potential sites for the entire Philippines in 2003, and made lists of potential sites larger than 10 MW. This information was collected from the DOE, NPC, NIA, PASSHYDRO, and HEDCOR.
In this data set, the amount of information varies as in No.3 above.

No.5 Potential sites investigated by NEA

Hydropower potential sites where investigated by the NEA. Information is so limited (only output, head, discharge, and name of sites) that it is extremely difficult to identify locations on topographic maps. Furthermore, because of the existing survey report, study documents, etc. are not kept by the DOE and it is impossible to draw project layouts on topographic maps and recreate other basic parameters.

No.6 Potential sites by NPC's inventory survey

Hydropower potential sites resulting from a large-scale potential hydropower survey on Luzon Island investigated by the NPC in 1987. There are basic parameters of 145 selected sites.

No.7 Potential sites by JICA's master plan for Palawan

Seven prospective small hydropower potential sites where identified from 47 sites investigated in JICA's master plan study in 2004.

No.8 Potential sites by JBIC project in the Ifugao terrace paddy fields

Three hydropower potential sites selected from thirteen sites were investigated by the JBIC (Japan Bank for International Cooperation) study in 2004.

4.4 BASIC DATA ON EXISTING TRANSMISSION LINES

The following items were requested of the NGCP through the TRANSCO (National Transmission Corporation).

i. Transmission diagram (Grid diagram)
ii. Conductor type and size by Line
iii. Capacity of existing power stations and substations
iv. Location of above
v. Power flow record
vi. Construction cost
vii. Method for balancing supply and demand

According to the above request, the following data was obtained from the NGCP. Regarding the existing transmission line, GIS data could not be obtained. Therefore, GIS data of transmission lines and substations was prepared in this study by tracing the map of transmission lines stored for each voltage (69 kV, 115 kV, 138 kV, 230 kV and 500 kV).

Table 4.4-1 Data Related to Existing Transmission Lines

No.	Document Reference	Contents
1	Conductor size and type for each line	Name of transmission line, function (transmission or distribution), voltage, length and size, which are classified by region into North Luzon, South Luzon, Visayas and Mindanao.
2	Capacity of existing substation, switchgear	Tables showing the number of main transformers and the substation capacity of each substation
3	Power flow	Power flow in each Luzon, Visayas and Mindanao
4	Construction cost per km	Construction cost of transmission line for each voltage (69 kV, 115 kV, 138 kV, 230 kV and 500 kV) and each kind of cable (US$ portion, PHP portion and total)
5	Method for balancing supply and demand	Explanation about how to balance supply load and demand
6	Ancillary service procurement plan, March 2006	Document regarding ancillary service

Fig. 4.4-1 Transmission Lines in the Philippines

4.5 BASIC TOPOGRAPHIC DATA

In this study, 1/50,000 scale topographic maps published by the NAMRIA (National Mapping of and Resource Information Authority, DENR) DENR (Department of Environment and Natural Resources) and SRTM (Shuttle Radar Topography Mission) data were collected as topographic data.

4.5.1 Topographic Map of 1/50,000 Scale

The NAMRIA is the central agency of the government under the DENR responsible for integrated surveys, mapping, charting, oceanography, aerial photography, remote sensing, management of resource information and research development.
The Philippine topographic map (711 series) scale of 1:50,000 was originally published by the US Army Service from compiled aerial photographs taken in 1947-1953, with information from the Bureau of Coasts and Geodetic Surveys, the US Army Map Series 711 and DPWH.
The Universal Transverse Mercator and Clarke Spheroid 1866 Luzon datum were used in map projection. The maps were printed in 10' × 15' map intervals. Elevation is expressed in 20-meter contour line intervals.

Table 4.5-1 Topographic Map Scale 1:50,000

	711 Series	701 Series	NTM Series (PNTMS*)	Remarks
Size	38cm × 53cm	61cm × 76cm	61cm × 76cm	The 711 Series was compiled from aerial photographs taken in 1947-1953. The 701 Series was produced using 1979 aerial photographs. At present, the 701 series of the NAMRIA covers Luzon Island only, replacing the Series 711 maps. The NTMS will eventually replace the S711 & S701 maps, as it covers the whole Philippines in 672 sheets.
Coverage				
Luzon	466 sheets	144 sheets	26 sheets	
Visayas	189 sheets	0 sheets	41 sheets	
Mindanao	316 sheets	0 sheets	9 sheets	
Total number of sheets	971 sheets	144 sheets	76 sheets	

*PNTMS: Philippine National Topographic Map Series

Source: "TOPOGRAPHIC MAP," NAMRIA Products and Services, 1987

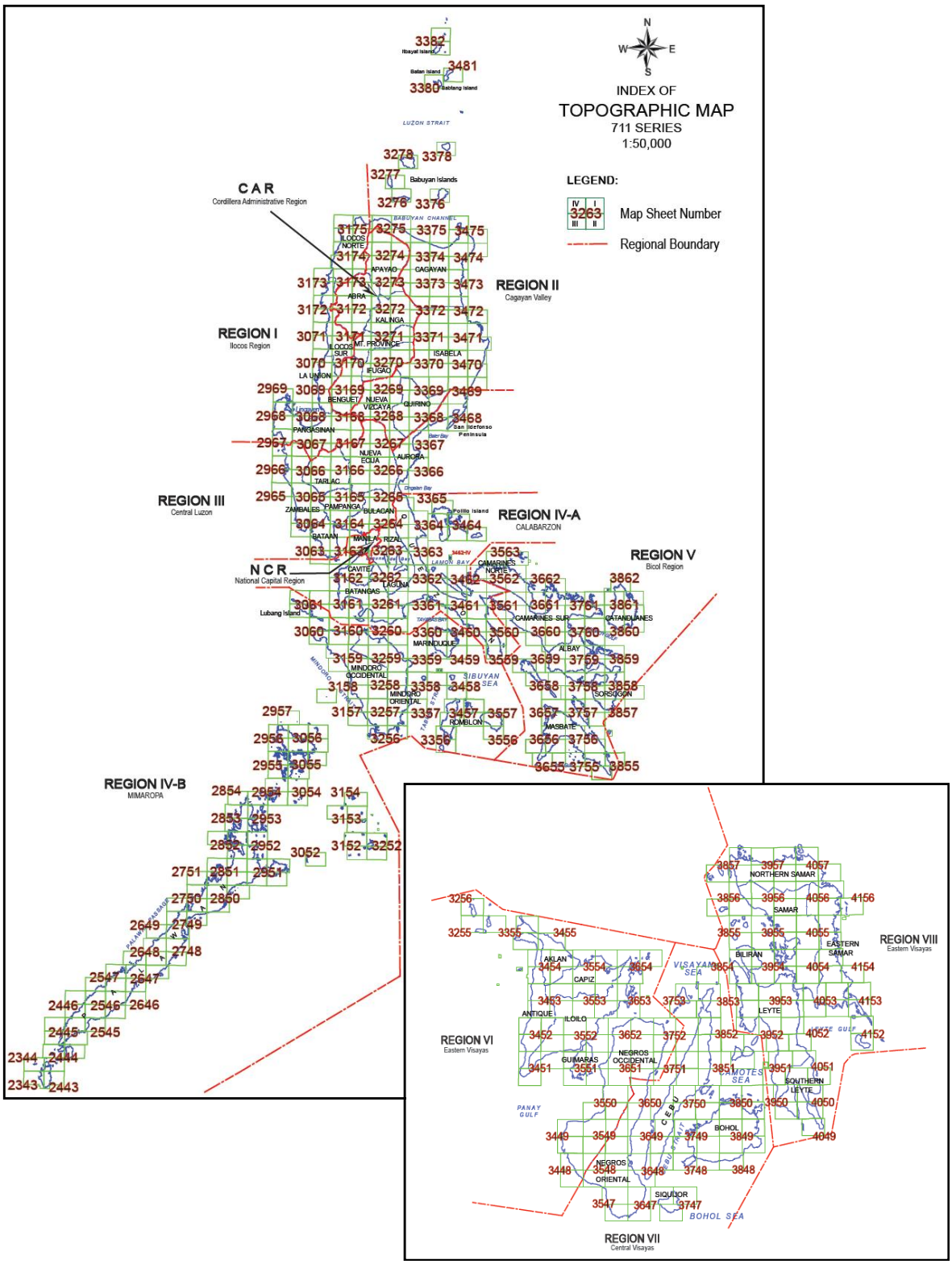


Fig. 4.5-1 Index of 1/50,000 Topographic Map

Source: "TOPOGRAPHIC MAP," NAMRIA Products and Services, 1987

The basic information of the 711 Series is old, but there is no other topographic map that covers the whole country in the same standard. Furthermore, there are 1:50,000 scale topographic maps in JPG format at the FCSEC (Flood Control Sabo Engineering Center, DPWH) data library. Therefore, this 711 Series was adopted in this study. A sample of the 1/50,000 topographic maps introduced into the GIS is shown below.

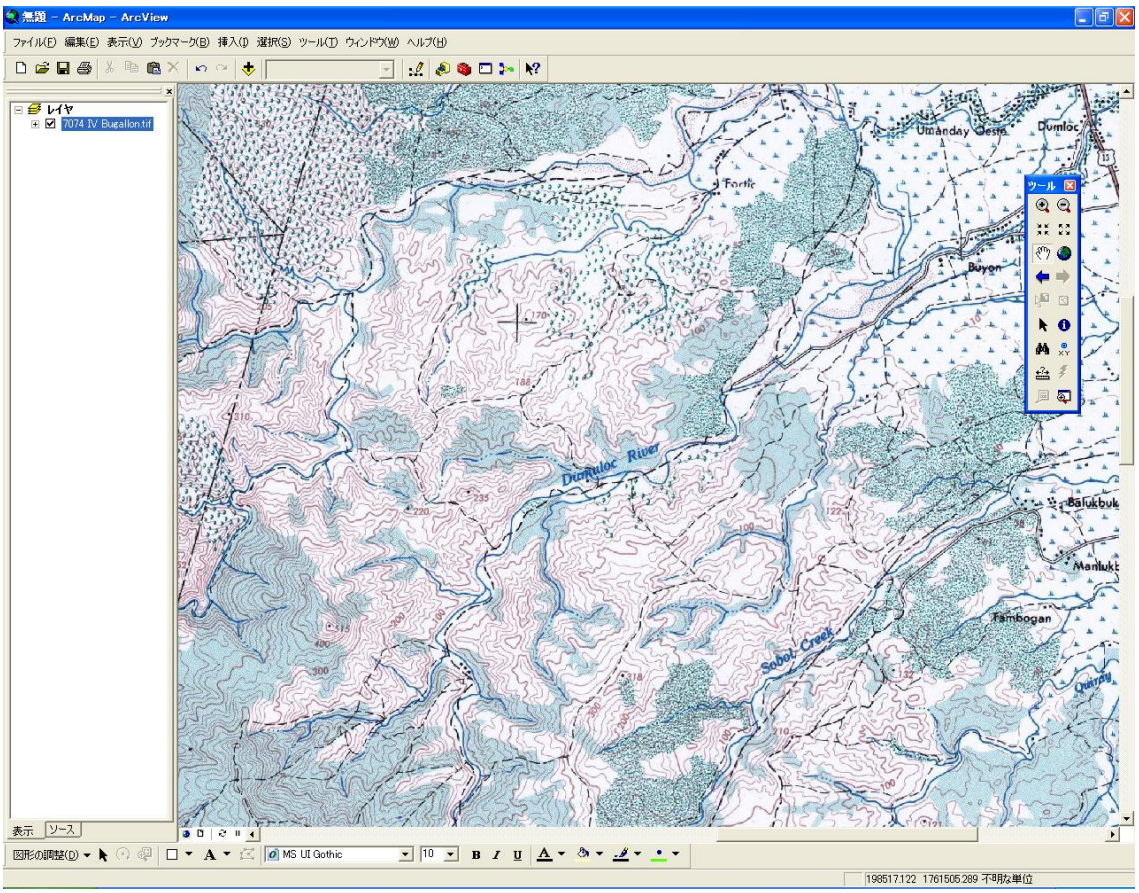


Fig. 4.5-2 Sample of 1/50,000 Topographic Map Introduced into the GIS

4.5.2 SRTM (Shuttle Radar Topography Mission) Data

The SRTM obtained elevation data on a near-global scale to generate a digital topographic database of Earth. The SRTM consisted of a specially modified radar system that flew onboard the Space Shuttle Endeavour during an 11-day mission in February of 2000.

The SRTM is an international project spearheaded by the National Geospatial-Intelligence Agency and the National Aeronautics and Space Administration.

The resolution of the cells of the source data is three-arc-second (approximately 90-meter). A sample image of the SRTM data is shown below.

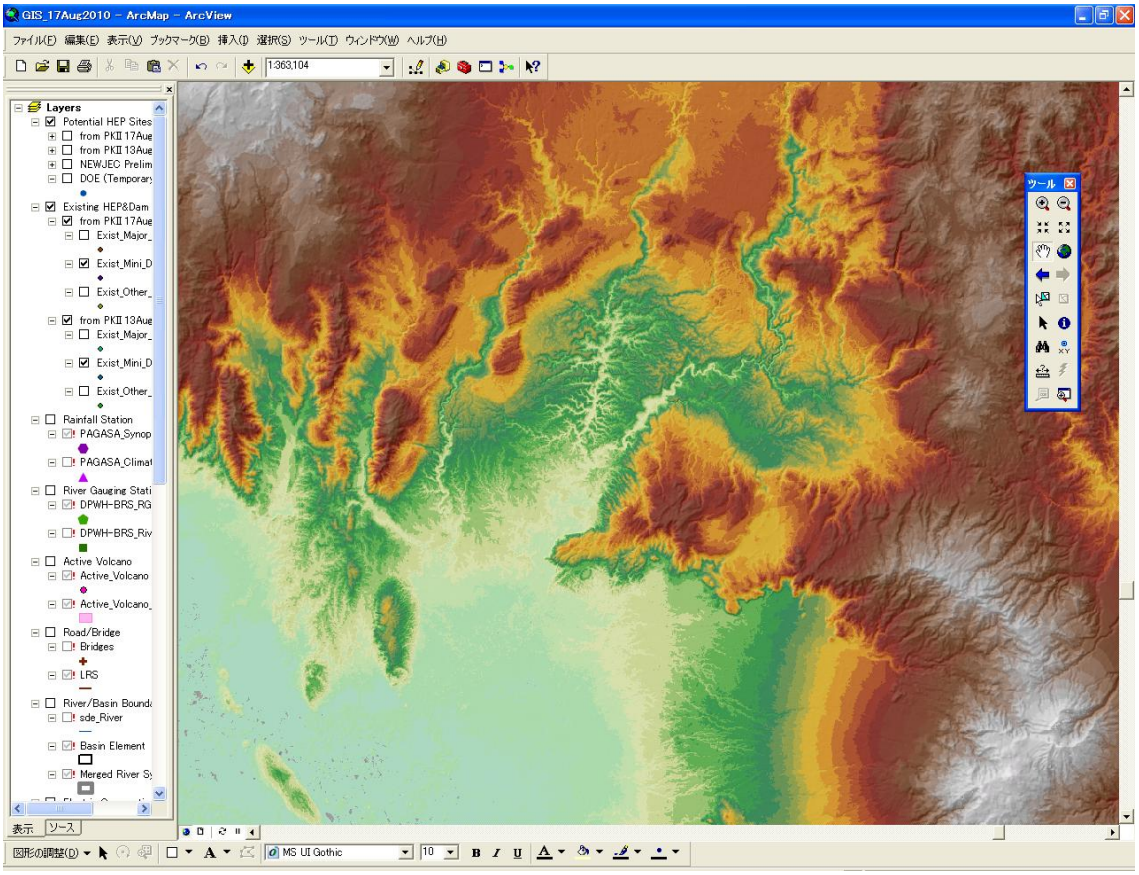


Fig. 4.5-3 Sample of SRTM Topographic Data

Source: Downloaded from USGS (United States Geological Survey) webpage "http://dds.cr.usgs.gov/srtm/version2_1/"