Department of Energy
The Republic of the Philippines

FINAL REPORT

THE STUDY PROJECT
ON
RESOURCE INVENTORY
ON HYDROPOWER POTENTIAL
IN
THE PHILIPPINES

March 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

NEWJEC INC.

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SUMMARY

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1. BACKGROUND AND OBJECTIVE OF THE STUDY

1.1 Background and Objective of the Study

The objective of this study is to organize and review the current inventory database and establish a new database by identifying new HEP (Hydro Electric Power) potential sites by map study, conducting site verifications of prospective new HEP potential sites among selected sites, and setting priorities for potential projects to facilitate yen loans, other official financing and also private investment. At the same time, this database will be helpful towards planning projects that could be eligible for financing as an EDP (Environmental Development Project) with a Japanese yen loan provided by JICA (Japan International Cooperation Agency) to DBP (Development Bank of the Philippines) and will increase the effectiveness of the EDP. Technology will be transferred in this study in the form of investigative methods for planning HEP projects, HEP generation technology, and O&M (Operation and Maintenance) of the database of HEP resources.

1.2 Contents of the Study and Target Area

Based on discussions with the DOE (Department of Energy), components of the study were revised to the following six (6). The flow chart of this study is shown in Fig. 1-1.

I. Confirmation of Detailed Project Scope
II. Map Study, Priority Ranking and Site Verifications of New HEP Potential Sites
III. Collection and Review of Database of Existing HEP Resources
IV. Development of the Database, Preparation of an O&M Manual and Facilitation for Promoting Utilization for HEP Resources
V. Facilitation of Financial Planning for Attractive HEP Projects
VI. Holding Workshops (for Training) and Seminars

The following works was executed according to the scopes based on discussion with DOE.

(1) Discussion and Confirmation of the Scope of Work
(2) Collection and Evaluation of the Existing Database of HEP Resources
(3) Update, Assessment and Upgrade of the Existing Database of HEP Resources
(4) Map Study of New HEP Potential Sites
(5) Priority Ranking of New HEP Potential Sites
(6) Site Reconnaissance of New HEP Potential Sites
(7) Development of the Database and Preparation of an Operation & Maintenance Manual
(8) Facilitation of Utilization of the Database of HEP Resources
(9) Identification of Target HEP Projects for Financial Assistant Program
(10) Facilitation of Financial Planning for Attractive HEP Projects
(11) Implementation of Training Workshops and Seminars

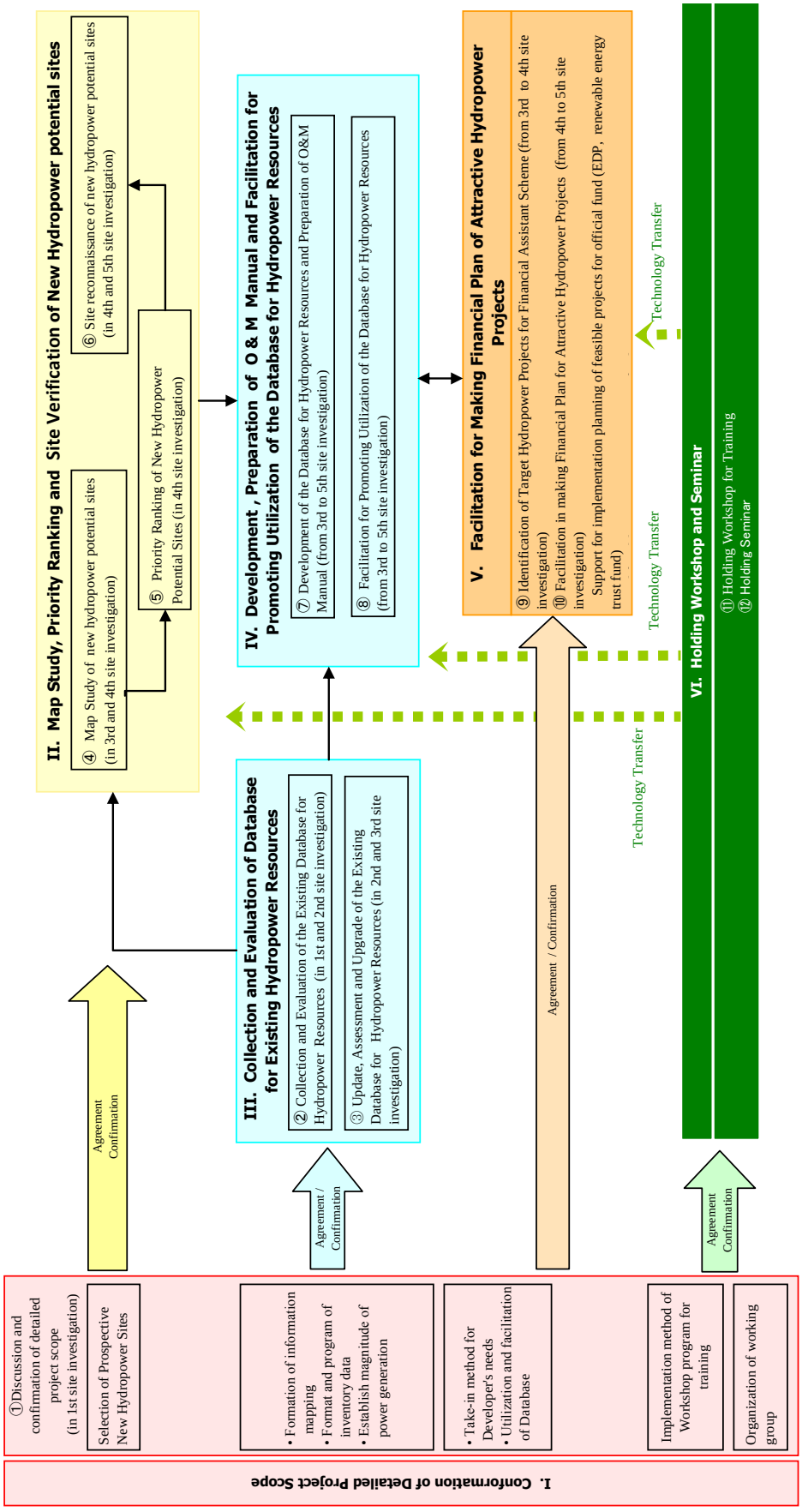
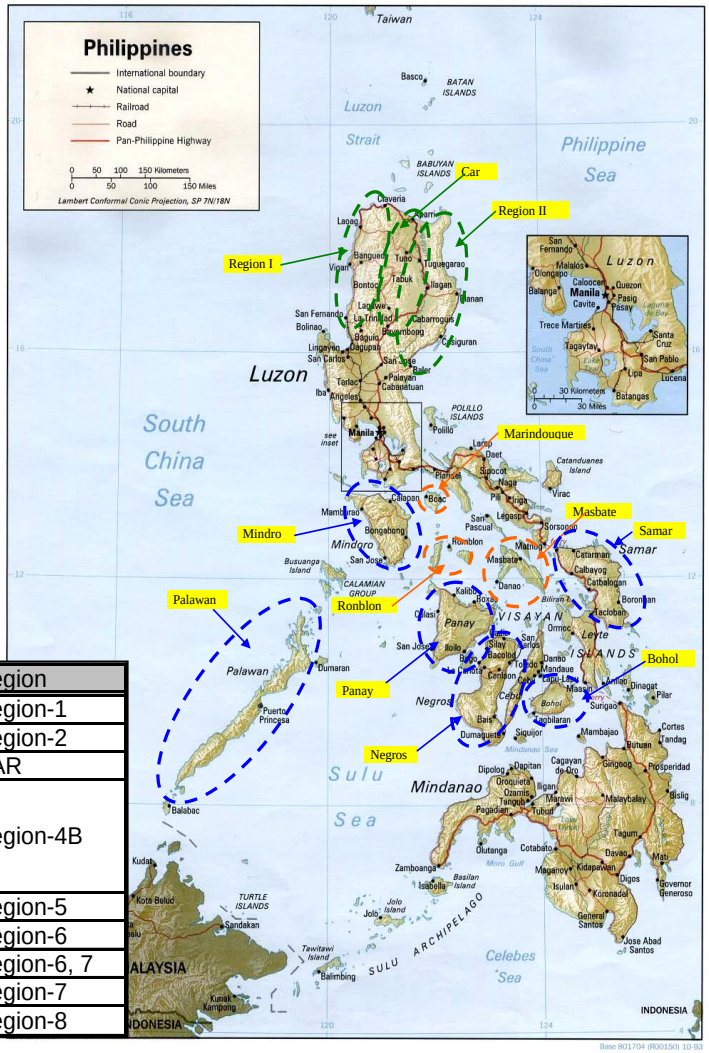


Fig. 1-1 Framework of Overall Study

The target area is the entire Philippines. The selected areas where new HEP potential sites were identified (new additional scope) are the following 9 islands, i.e. Mindoro, Masbate, Marinduque, Romblon, Panay, Bohol, Negros, Palawan and Samar and 3 regions, i.e. CAR, Region I and Region II as sown in Fig. 1-2.

In this study, 7 (seven) site visits were executed from March 2010 to March 2012. The following technical assistance has been implemented in this study for sustained and continuous use of the database of HEP resources by the HOEMD (Hydropower and Ocean Energy Management Division) of the REMB (Renewable Energy Management Bureau), DOE, who is in charge of HEP of RE (Renewable Energy) in order to be useful towards increasing work efficiency and providing information to stakeholders for the promotion of HEP development.

Technical training for a HEP project
Training in operation, maintenance and facilitating the utilization of the database of HEP resources
Facilitation of information provision through seminars on the promotion of HEP development



	No.	Island	Region
3 Region	0	Luzon	Region-1
			Region-2
			CAR
9 Island	1	Mindoro	Region-4B
	2	Marinduque	
	3	Ronblon	
	4	Palawan	
	5	Masbate	Region-5
	6	Panay	Region-6
	7	Negros	Region-6, 7
	8	Bohol	Region-7
	9	Samar	Region-8

Fig.1-2 Selected Areas Where New Hydropower Sites were identified

2. SURVEY FOR NEW HYDROELECTRIC POWER POTENTIAL SITES

2.1 Methodology and results of map study

The Survey for New HEP Potential Sites in this study serves to identify new HEP sites by map study, to conduct site verifications at selected prospective potential sites and to set priorities for potential projects to facilitate the promotion of yen loans, other official financing and also private investment. HEP potential sites surveys to be conducted in Visayas and North Luzon areas as a part of this study as shown in Fig. 1-2. Existing 1/50,000 scale topographic maps and existing runoff data are used in this study to make preliminary development plans.

Basic condition on map study is as follows:

1) In the case of duplication, existing facilities and other existing HEP potential sites than the awarded HEP potential sites and applying HEP sites by private sector are identified as new HEP potential sites in this survey.
2) The run-of-river, poundage and reservoir types of HEP generation are adopted.
3) The target scale of power generation is mainly mini-HEP potential sites of 101 kW to 10 MW. However, promising sites, even if having the scale over 10 MW, shall be the target of this study.
4) 1/50,000 topographic maps established by the NAMRIA is used for the map study.
5) Discharge-duration curves of relevant regional zones developed in this study are used for the target HEP potential sites.

As the result of map studies conducted on this project, a total of 252 HEP potential sites (run-of-river: 222 sites, reservoir and poundage: 30 sites) were identified and shown in Fig. 2-1.

Region	Island	Total
CAR	Luzon	59 (7)
REGION 1		
REGION 2		
REGION 4-B	Mindoro	36 (6)
	Marinduque	10 (1)
	Romblon	17 (1)
REGION 5	Masbate	2 (0)
REGION 6	Panay	40 (1)
	Negros	42 (7)
REGION 7	Bohol	6 (0)
REGION 8	Samar	40 (8)
	Total	252 (30)

( ) : Reservoit / Pondage type

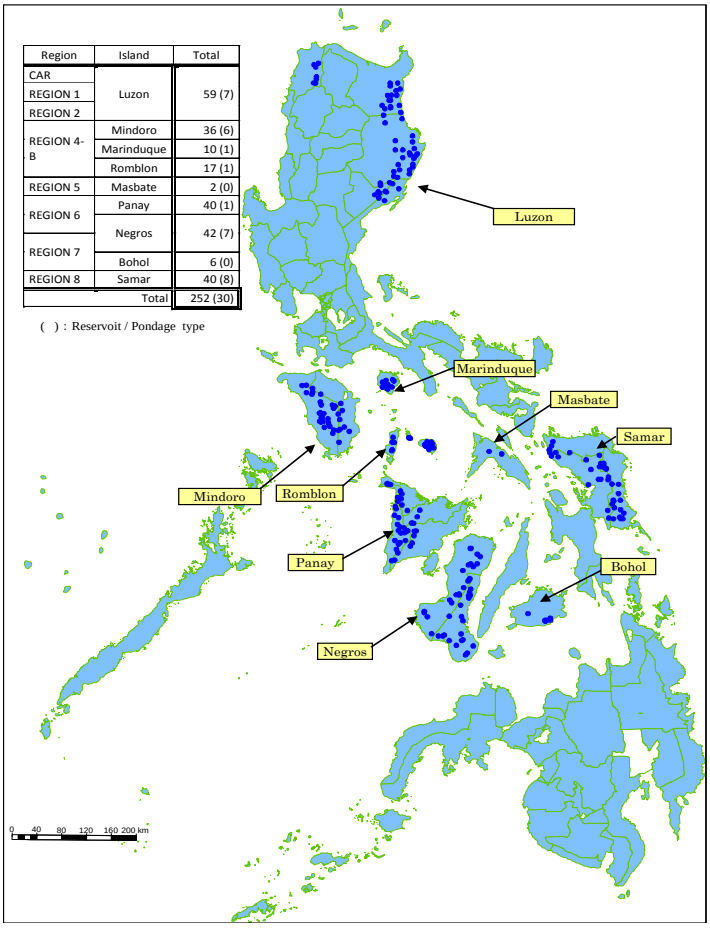


Fig. 2.1 252 HEP Potential Sites identified by Map Study

2.2 Preliminary Construction Cost Estimates

The quantity formulas for civil works and hydraulic equipment (steel pipes, gates, screens etc.) that are estimated from past records of HEP projects and based on appropriate parameters of each structure are used. The said formula is prepared for HEP potential study in Japan. The unit costs applied to this study are estimated based on the unit costs of past F/S

(Feasibility Study), detailed designs, etc. in the Philippines and Southeast Asian countries. Preliminary construction costs are estimated by means of multiplying preliminary quantities by preliminary unit costs.

The price of water Turbines and generators can be estimated by price approximation based on past price results in the preliminary study stage. This price is adjusted according to the current market prices abroad. The preliminary prices of other electro-mechanical items such as control equipment, overhead traveling cranes, switchgear and sometimes including inlet valves are considered as 30% of the total of the turbine and generator prices. The unit costs of transmission lines are estimated by referring to unit costs per km by the NGCP. The unit cost includes civil works such as the foundation of towers, assembling of towers, and installation of towers.
Direct costs (preparatory works, environmental mitigation, civil works, hydraulic equipment, electro-mechanical equipment, transmission/distribution lines) and indirect costs (management costs, engineering service fee, various taxes, contingencies, interest during construction) are calculated as total construction cost.

2.3 Screening of Identified Potential Sites and Results

The screening of identified HEP potential sites is conducted from the viewpoints of economic criteria, accessibility and social environmental assessment. Through this screening, 50 potential sites are extracted as site reconnaissance candidates among 252 identified sites.

Table 2-1 Evaluation of Screening

kWh Unit Cost (US$)	Point	Road Extension (km)	Point
< 0.9	10	< 5 km	0
0.9 - 1.2	9	5 – 10 km	−1
1.2 - 1.5	8	10 – 15 km	−2
1.5 - 1.8	7	15 – 20 km	−3
> 1.8	6	> 20km	−4

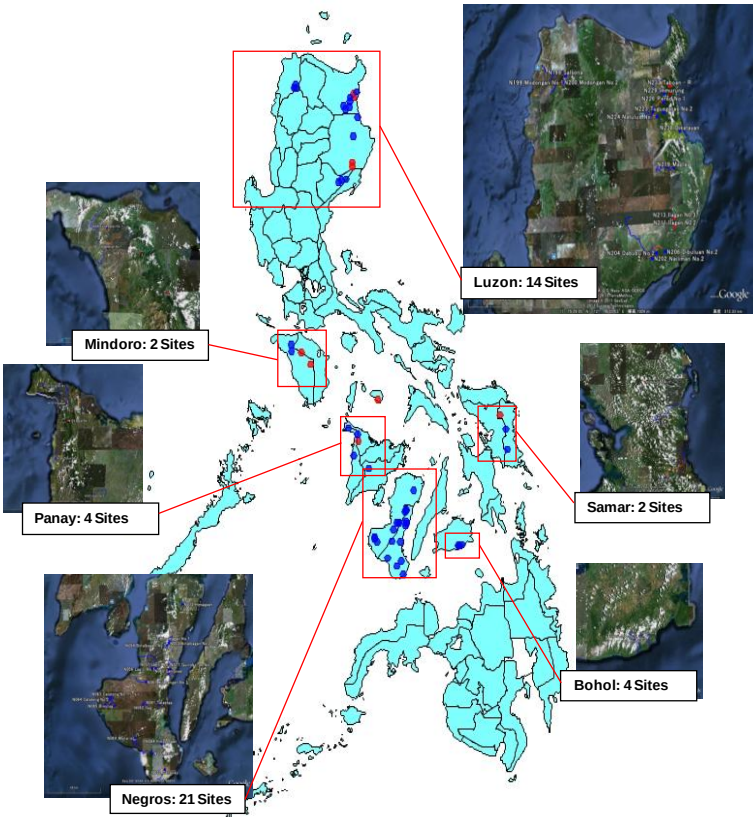
Environmental Impact Assessment Factors	Point
Nature conservation areas existence	Run-of-river: −1 Reservoir and Pondage: −4
Volcanic activities in 30 km radius	−1
Local residents existence	Run-of-river: 0 Reservoir and Pondage: −4

2.4 Method and Results of Site Reconnaissance

The objective of site reconnaissance is to confirm site conditions of major structures of HEP potential sites and to improve the accuracy of the results from the map study. Especially, it is most important to obtain a reliable head and river flow at the site, which are basic factors for HEP generation planning. Also, it is important to confirm the required distance of access roads and the length of transmission / distribution lines because the accuracy of this data is not sufficient in the course of map studies. In addition, water utilization such as existing irrigation facilities, water supply facilities and general uses, existence of precious fauna and flora, resources for tourism, inhabitancy by indigenous people and so on shall be confirmed as to whether or not those conditions constitute serious problems for the implementation of HEP projects.

9 sites of the 50 priority sites were canceled due to inaccessibility and safety of the surrounding area. Instead of these sites, alternatives sites had been selected, and site

reconnaissance were conducted accordingly. Hereby, the results of site reconnaissance at 47 sites were obtained. Based on discharge data of sites or same river systems, duration curves are corrected or newly prepared. The obtained information is reflected in the map study, and preliminary studies of 47 sites are re-conducted.



Region	Island	Run-of-River	Reservoir / Pondage	Cancelled	Sub Total
CAR	Luzon	11	3	4	14
REGION 1					
REGION 2					
REGION 4-B	Mindoro	2	0	2	2
	Romblon	0	0	1	0
REGION 6	Panay	4	0	1	4
	Negros	20	1	0	21
REGION 7	Bohol	4	0	0	4
REGION 8	Samar	2	0	1	2
Sub Total		43	4	9	Total 47

Fig. 2-2 Promising 47 Potential Sites where site reconnaissance was carried out

2.5 Financial Analysis for Promising Potential Projects

Preferential tax treatment under the Renewable Energy Law, financial conditions under DBP EDP and provisional FIT (Feed-in-Tariff) shall be taken into consideration in economical and financial analyses. One of calculation results of EIRR (Economical Internal Rate of Return) and FIRR (Financial Internal Rate of Return) are given in Fig. 2-3.

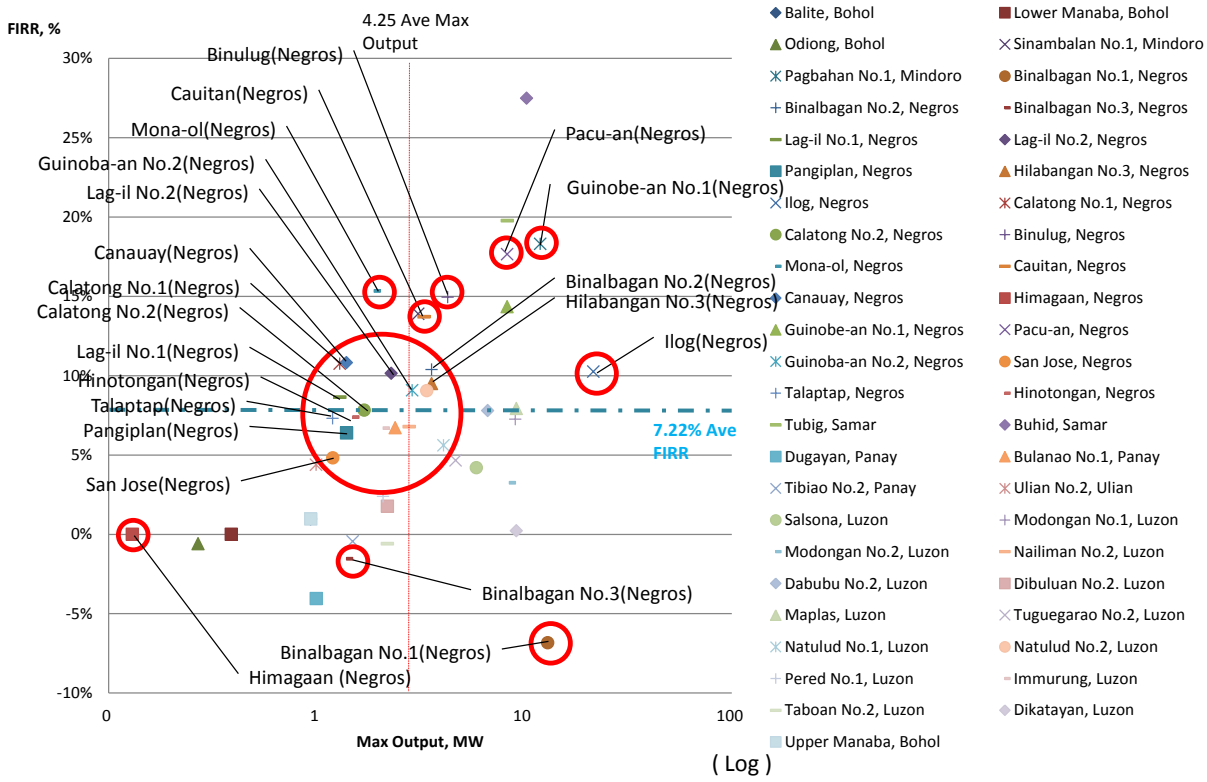


Fig. 2-3 Sample of Financial Analysis Result

3 MEASURES TO PROMOTE MINI-HYDROPOWER PROJECTS AND ISSUES TO BE CONSIDERED

3.1 Impact of Renewable Energy Laws on the Profitability of Mini-hydro Projects

The two main impacts on profitability of mini-HEP are FIT and fiscal incentives.

The FIT system provides the mini-HEP priority connection to the grid for electricity generated and pays a fixed tariff for electricity produced from each type of RE over a fixed period. The NREB (National Renewable Energy Board) seeks to adopt 6.15 PhP/kWh (as of September 2011) for 20 years in the case of a run-of-river HEP plant. However, such FIT have not yet approved by ERC. Fiscal investment incentives of R.A. No.9513 are shown in Table 3-1.

Table 3-1 Tax Incentives regarding "Renewable Energy Act of 2008" (R.A. No.9513)

Fiscal incentives	Explanations
1) Income Tax Holiday (ITH)	7 years from the start of operation
2) Net Operating Loss Carry Over (NOLCO)	The first 3 years from the start of commercial operation shall be carried over as a deduction from gross income for the next 7 consecutive taxable years immediately following the year of such loss.
3) Tax Credit on Domestic Capital Equipment and Services	
4) Corporate Tax Rate	After 7 years of ITH, all RE Developers shall pay a corporate tax of 10% on its net taxable income as defined in the NIRC of 1999.
5) Special Realty Tax Rates on Equipment and Machinery	Less than 1.5 % of the original cost less accumulated normal depreciation (= Net worth)

Source: BOI (Board of Investments)

3.2 Major Financial Mechanisms Provided by Financial Institutions

Interest rates for EDPs are in a relatively disadvantageous position compared to competing private banks regardless of the fact that fixed and long-term financing are offered, because they go by market rates as of 2011. In addition, time is needed for complying with the checklist required from the DBP and certification procedures.

DBP loans (EDP) have advantages in terms of a fixed interest rate and a relatively longer period of repayment (5 years grace and 15 years repayment), compared to private financial institutions (2 years of grace and 10 years repayment). However, in last half year, private banks such as BPI (Bank of the Philippine Islands), BDO (Banco de Oro Unibank), Metrobank, Security bank etc. and Land bank, , have become strongly interested in investing in small HEP projects.

It is necessary to confirm the position of EDPs in the portfolio of business risks and project actors during the mini-HEP project. EDP loans should focus on projects with some risk yet less competitive with private banks and mini-HEP projects of public institutions (because the interest rate risk is small).

3.3 Financial Evaluation of the Mini-hydro Projects Using Financial Models

This model is linked with 3 financial statements to note the B/S (Balance Sheet), I/S (Income Statement) and C/F (Cash Flow), and it automatically calculates FIRR from input preconditions. Overages and shortages are adjusted in the retained earnings reserve in the B/S.

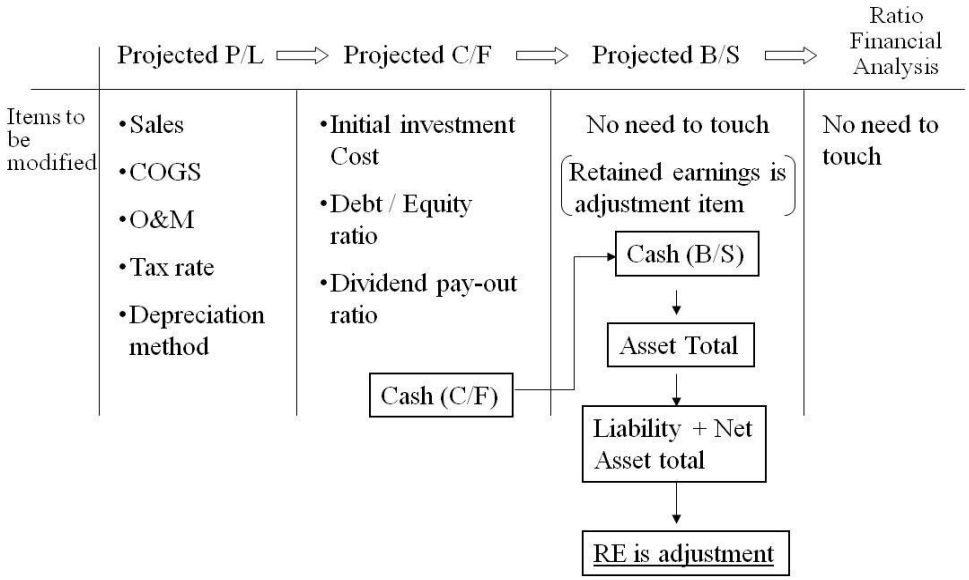


Fig. 3-1 Financial Model

Simulation using the model mentioned above (Fig. 3-1) is done in some cases. Table 3-2 below shows the major assumptions made in sensitivity analysis.

Table 3-2 Financial Model Simulation Major Assumptions (Project)

Project size	1,895KW
Total project cost	188,838,000(peso), 2,162USD/KW
Project life	30 years
Plant factor	60%

Table 3-3 Sensitivity Analysis Cases and Results

	Original case (No FIT)	Case1 (FIT with private bank)	Case2 (FIT with DBP Loan)	Case3 (FIT with DBP Loan/decrease in LF)	Case 4 (FIT with DBP Loan/cost overrun 20%)	Case 5 (FIT with DBP Loan/cost overrun (20%) & decrease in LF
Tariff	4.5 (Peso/kWh)	5.5(Peso/kWh) (1-20 years) After 20 years 4.5 (Peso/kWh)	5.5(Peso/kWh) (1-20 years) After 20 years 4.5 (Peso/kWh)	5.5(Peso/kWh) (1-20 years) After 20 years 4.5 (Peso/kWh)	5.5(Peso/kWh) (1-20 years) After 20 years 4.5 (Peso/kWh)	5.5(Peso/kWh) (1-20 years) After 20 years 4.5 (Peso/kWh)
Load factor	60%	60%	60%	40%	60%	40%
KW cost	2,146 USD	2,146 USD	2,146 USD	2,146 USD	2,575 USD	2,575 USD
Corporate tax rate	7 years ITH 0% After 7years 10%	7 years ITH 0% After 7years 10%	7 years ITH 0% After 7years 10%	7 years ITH 0% After 7years 10%	7 years ITH 0% After 7years 10%	7 years ITH 0% After 7years 10%
Finance (Loan)	9% 2years grace 10years repayment period	9% 2years grace 10years repayment period	EDP Loan 9%, 5 years grace 15 year repayment period	EDP Loan 9%, 5 years grace 15 year repayment period	EDP Loan 9%, 5 years grace 15 year repayment period	EDP Loan 9%, 5 years grace 15 year repayment period
FIRR (30 years)	10.05%	14.78%	14.67%	4.5%	10.7%	0.55%

4 USE AND FACILITATION OF HYDROPOWER RESOURCE DATABASE

4.1 Outline of the Database System

The basic conditions required of the database to provide information from the DOE on HEP potential sites and to promote HEP development to mainly private developers/investors in the future are shown below.

- Centralizes management of HEP existing sites and potential sites all over the Philippines.
- Categorizes sites by data source, development progress and developers, etc.
- Easy to update or add data on HEP existing sites and potential sites
- Easy to search, sort or present data of each HEP site
- Easy to comprehend and effectively use in presentations with visualized GIS (Geographic Information Systems) data
- Various data for planning and design on HEP such as topography and hydrology

Major Outputs of the database areas below;

(1) Location map of HEP potential sites on a river system map all over the Philippines
(2) Location map of HEP potential sites on 1/50,000 scale topographic map
(3) Summary table of new HEP potential sites
(4) Preliminary plan around the new HEP potential site and profile along the waterway and penstock
(5) List of basic outlines for HEP potential sites
(6) River profiles of the river system for HEP potential sites
(7) Site reconnaissance reports for new HEP potential sites
(8) 3-D Bird's-eye view of new HEP potential sites

4.2 Functions and Structures of the Database System

HRD (Hydropower Resource Database) was developed on basis of Arc GIS (GIS software with general versatility developed by ESRI Inc.) and Microsoft ACCESS. This system consist of 3 components; "GIS data (Shape files)", "Core Data (Database Files)", and "Relevant Data (Program Data)". A conceptual view of the system structure and data structure are shown below.

The data stored in HRD is shown in Table 4-1.

(1) Core data : Various information of HEP resources was integrated into the centralized database.

(2) GIS data : HEP potential site data (location, layout), Grid facilities (routes of transmission lines and location of substations), Infrastructure (roads and bridges), Hydrology (river lines, river basin areas, river system, location of rainfall gauging stations and river flow gauging stations, water resources regions corresponding to relevant discharge-duration curves), Electricity demand area (boundaries of ECs (Electric Cooperatives) and PIOUs (Private Investor-Owned Utilities), social environmental information (nature conservation areas), geological information (geological map, distribution map of active faults and trenches, distribution of active volcanoes), administrative boundaries for Regions, Provinces, Municipalities, and Barangays, topographic

data (SRTM and 1/50,000 topographic maps) were prepared.

(3) Program data : Program data files display relevant data on discharge-duration curves, river profiles, longitudinal waterway layout, site reconnaissance reports, 3D bird's eye views and project information.

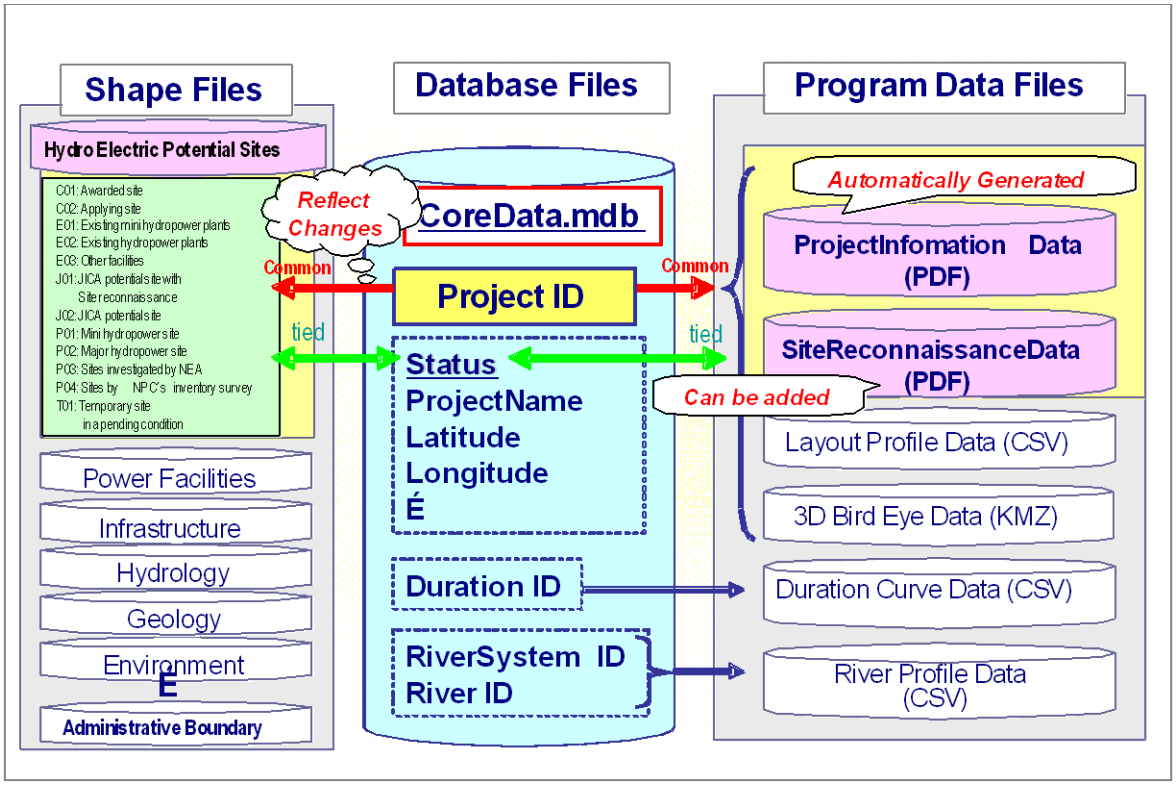


Fig. 4-1 Conceptual View of Data Structures and Relations

Table 4-1 Basic Data List to Be Stored in Database

No.	Data Item	Supplement	Source
1. Existing Water Facilities			
1-1	Existing hydropower plants	72 sites	DOE
1-2	Existing dams/weirs/reservoirs	46 sites	DPWH
2. Hydropower Potential Sites			
2-1	Potential sites awarded by DOE	124 sites	DOE
2-2	Potential sites applying by DOE	244 sites	DOE
2-3	Existing potential sites	Potential sites of mini : 94 sites Potential sites of major : 60 sites Potential sites by NEA : 905 Potential sites by NPC : 145 Potential sites by JICA for Palawan : 7 sites Potential sites by JBIC for Ifugao : 3 sites	DOE DOE NEA NPC JICA JBIC
2-4	New potential sites found by JICA study	252 sites (inside of project area)	This Study
2-5	Project layout	Layout of power facilities (dam, intake, headrace, powerhouse, penstock, etc.)	This Study
2-6	Additional information of site reconnaissance	Access road/Survey trail/Survey waypoint	This Study
3. Power facilities			
3-1	Location of transmission lines and substations (existing, under construction or consideration)	Only approximate location	NGCP
3-2	Substations	Only approximate location	NGCP
3-3	Location of high-voltage distribution lines (existing, under construction or consideration)	Only approximate location	NGCP
4. Topography			
4-1	Topography map	1/50,000 map image (whole land)	NAMRIA, DPWH
4-2	SRTM-DEM	Whole land	USGS
5. Infrastructure			
5-1	Roads and bridges	National highways (DPWH)	DPWH
6. Hydrology			
6-1	River network (water system map) / river lines / basin boundary / longitudinal profile	1/50,000 map image	DPWH, This study
6-2	Observation point of rainfall	Location and observation period (34 sites)	PAGASA
6-3	Observation point of discharge	Location and observation period	DPWH
6-4	Water resource region	Whole land	JICA
6-5	Climate region	Whole land	PAGASA
6-6	Annual rainfall distribution	Whole land	PAGASA
7. Electricity Demand Area			
7-1	EC (Electrification Cooperative)	Only approximate location	NEA
7-2	Private Power Distribution Company	Only approximate location	NEA
8. Social environment			
8-1	Environmental protected area	Whole land	DENR
9. Geology			
9-1	Active volcanoes	Whole land (Point & buffer area)	PHIVOLCS
9-2	Active faults	Whole land	PHIVOLCS
9-3	Geological map	Large area map	MGB
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)	DPWH

DPWH : Department of Public Works and Highway
NEA : National Electrification Administration
NPC : National Power Corporation
NGCP : National Grid Corporation of the Philippines
NAMRIA : National Mapping and Resource Information Authority, DENR
USGS : United States Geological Survey
PAGASA : Philippine Atmosphere, Geophysical and Astronomical Services Administration, DOST
DENR : Department of Environment and Natural Resources
PHIVOLCS : Philippine Institute of Volcanology and Seismology, DOST
MGB : Mines and Geosciences Bureau, DENR
JICA : Japan International Cooperation Agency
JBIC : Japan Bank for International Cooperation

4.3 Database Functions

Information of GIS layers such as potential sites, hydrological information, infrastructure information, environmental information, and topographic maps can be displayed on the initial screen of HRD system. Target potential sites can be searched by various searching conditions.

Project information, River profiles, discharge-duration curves, waterway profiles, site reconnaissance reports and 3D bird's eye view can be displayed on project information screen as shown in Fig. 4-2.

The maintenance function for updating and adding is equipped with three (3) types of operations: "Add new," "Update" or "Delete" as shown in Fig. 4-3.

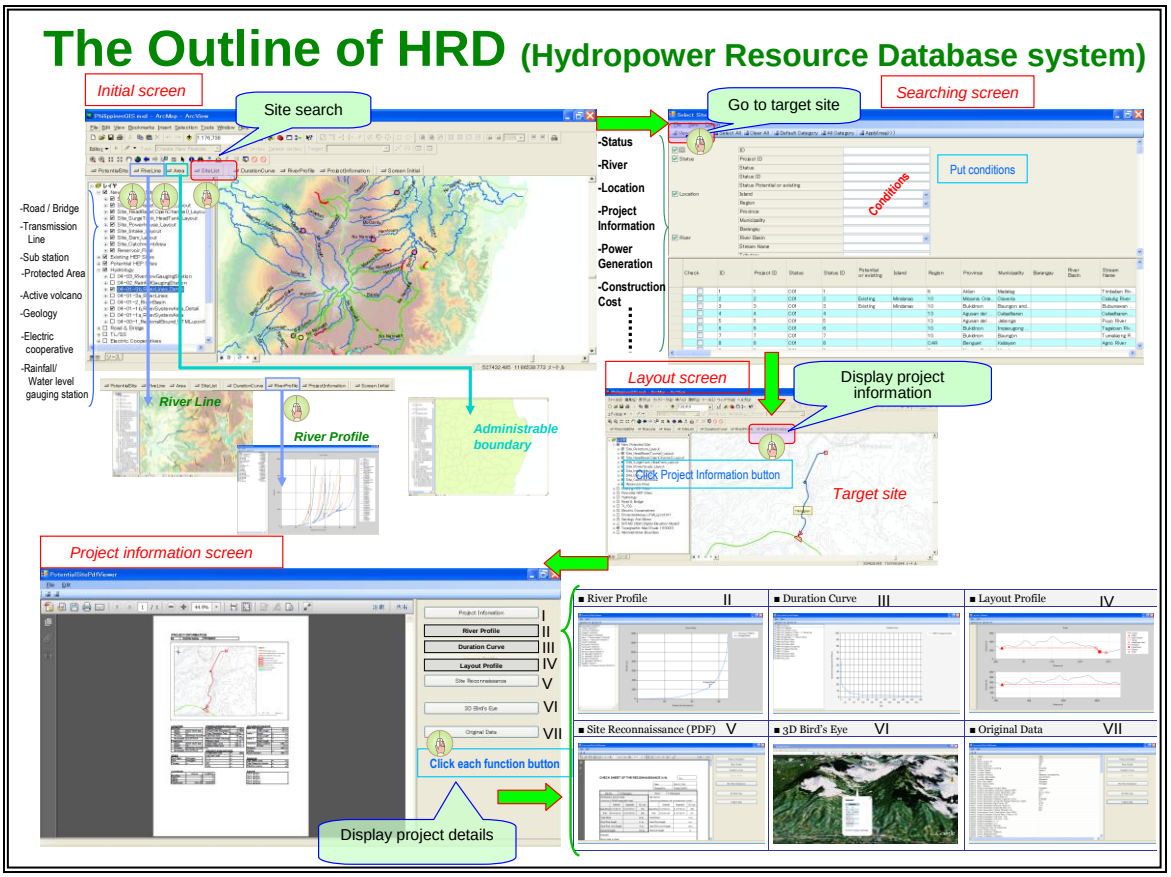


Fig. 4-2 Outline of the Database (Image of Obtaining Project Information)

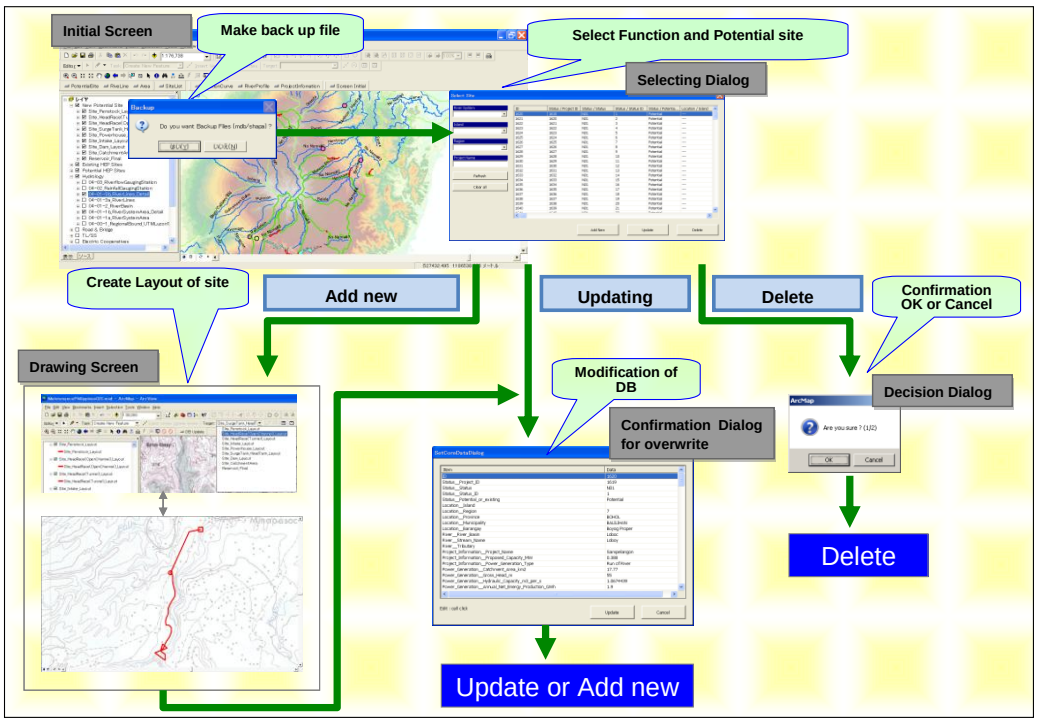


Fig. 4-3 Outline of the Database (Image of Updating Project Information)

4.4 Database Operation and Maintenance

The following three divisions, HOEMD (Hydropower and Ocean Energy Management Division, DOE), TSMD (Technical Service and Management Division, DOE) and ITD (Information Technology Division, DOE) coordinate and play each a role in the operation, maintenance and management of the HRD system. The roles of each division are described below.

(1) HOEMD (Hydropower & Ocean Energy Management Division)

- HRD system operation and maintenance
- Update of RE-contracts information
- Supervision from registration and development to operation of HEP
- Data provision of HEP projects to developers
- Establishment of an information desk
- Face-to-face service for developers
- Facilitation of new potential sites identified by JICA study
- Holding of seminars

(2) TSMD (Technical Service Management Division)

- Technical assistance for facilitation of new identified sites and management of RE-contracts information
- Preparation of documents for data provision

(3) ITMS (Information Technology Management Services)

- Technical assistance for Arc GIS operation and management of the HRD
- Update of documents on the DOE website

5 CONSIDERATION OF DATABASE USE AND FACILITATION

5.1 Considerations into the Basic Policy

It is expected that HRD (Hydropower Resource Database) developed in this study will be used in the DOE to upgrade information on HEP potential sites, develop a GIS (Geographic Information Systems) database, enable searching and centralized management, and to provide information on HEP development to investors.

The utilization strategy of the database to be developed in this study is to fulfill the purpose described above.

1) Information provision through the website
2) Establishment of an information desk for HEP development
3) Distribution of printed HEP related information
4) Provision of HEP development information by seminars, etc.

Generally, a HEP development project requires a long time to recover investment, because of the huge initial investment. For this reason, fund procurement, evaluations of project finances, etc. will be key points of investment strategies. In this regards, it is effective to provide related information to investors from the private sector, ECs, LGUs (Local Government Units), etc.

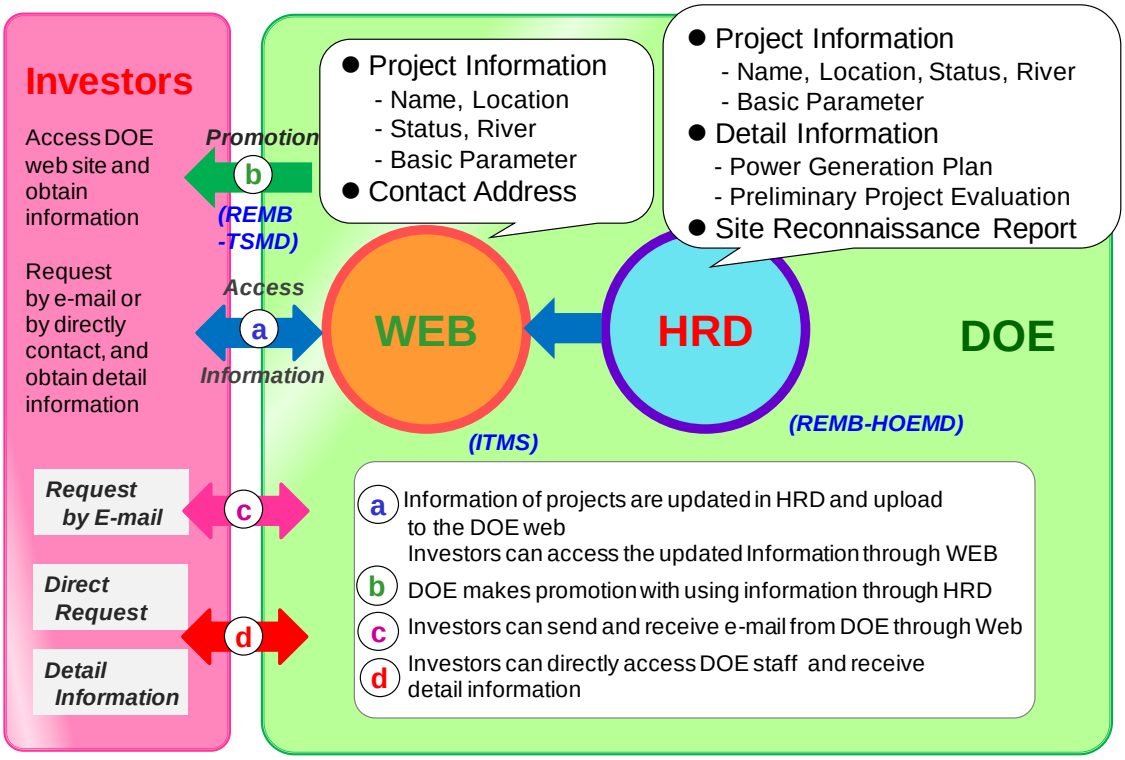


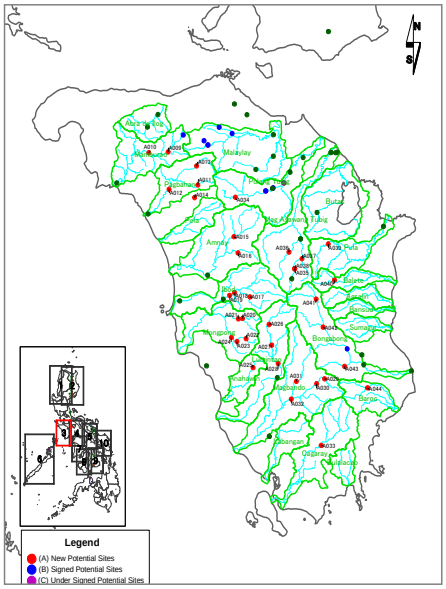
Fig. 5-1 Proposal of Utilization of HRD System

5.2 Methods for Data Provision

The study team has discussed with the DOE staff about data provision for HEP projects. Based on these discussions, it was agreed that information / data should be disclosed to developers via the DOE website and face-to-face services. Basically, information/data disclosed on the website will be basic and general. This information/data can be prepared by utilizing basic functions of HRD.

Basically, information/data disclosed on the website will be basic and general (project name, location, river system / basin, basic parameters), information relevant to river system (location of HEP potential sites and existing water resource facilities on river system map) and contact information of HOEMD staff.

On the other hand, upon request from developers, the information desk staffed by the HOEMD will provide information/data related to the relevant project to developers. Information provided by face-to-face services is 1) Detailed information on HEP potential sites and 2) site reconnaissance results etc.



Region	Province	Municipality	Project Name	River System	River Name	Project Status	Max Output (MW)	Type	Rank
Region-04B	Occidental Mindoro	-	Aglubang No.1	Magasawangtubig	Aglubang	New_Potential	1.40	Run of River	C
Region-04B	Occidental Mindoro	-	Aglubang No.2	Magasawangtubig	Aglubang	New_Potential	0.70	Run of River	C
Region-04B	Occidental Mindoro	-	Bongabong No.1	Bongabong	Bongabong	New_Potential	0.70	Run of River	C
Region-04B	Oriental Mindoro	-	Pagbahan No.2	Pagbahan	Pagbahan	New_Potential	1.80	Run of River	C
Region-04B	Oriental Mindoro	-	Balanaan No.1	Bugsanga	Bugsanga	New_Potential	0.60	Run of River	C
Region-04B	Oriental Mindoro	-	Cagaray	Cagaray	Cagaray	New_Potential	0.60	Run of River	C
Region-04B	Oriental Mindoro	-	Catuiran No.1	Catuiran	Catuiran	New_Potential	0.60	Run of River	B
Region-04B	Oriental Mindoro	-	Pula	Magasawangtubig	Aglubang	New_Potential	0.30	Run of River	C
Region-04B	Oriental Mindoro	-	Balete	Magasawangtubig	Aglubang	New_Potential	0.50	Run of River	C
Region-04B	Romblon	-	Binaya-an	Binaya-an	Binaya-an	New_Potential	5.70	Reservoir	C
Region-04B	Romblon	-	Cantingas No.1	Cantingas	Cantingas	New_Potential	0.70	Run of River	C
Region-04B	Romblon	-	Cantingas No.2	Cantingas	Cantingas	New_Potential	6.50	Run of River	C
Region-04B	Romblon	-	Cantingas No.3	Cantingas	Cantingas	New_Potential	7.70	Reservoir	A
Region-04B	Romblon	-	Cambajao	Cambajao	Cambajao	New_Potential	1.60	Run of River	C
Region-04B	Romblon	-	Lumbang	Lumbang	Lumbang	New_Potential	0.60	Run of River	C
Region-04B	Romblon	-	Agbalit	Canloay	Agbalit	New_Potential	2.30	Run of River	C
Region-04-B	Occidental Mindoro	Victoria	Aglubang	-	Aglubang River	Large_Potentia	13.60	Run-of-River	-
Region-04-B	Oriental Mindoro	Naujan	Dulangan 2	-	Dulangan River	Mini_Potential	1.00	-	-
Region-04-B	Oriental Mindoro	Baco	Dulangan	-	Dulangan River	Large_Potentia	24.00	Run-of-River	-
Region-04-B	Oriental Mindoro	Bongabong	Bongabong	-	Bongabong River	Large_Potentia	28.00	Run-of-River	-
Region-04-B	Oriental Mindoro	Naujan	Catuiran	-	Catuiran River	Large_Potentia	18.00	Run-of-River	-
Region-04-B	Oriental Mindoro	San Teodoro	Alag	-	Inabasan River	Large_Potentia	39.50	Run-of-River	-
Region-04-B	Oriental Mindoro	Baco	Dulangan Hydroelectric Power Project	-	-	Signed	18.00	-	-
Region-04-B	Oriental Mindoro	Baco	Linao-Cawayan HEP (Lower Cascade)	-	-	Signed	2.10	-	-
Region-04-B	Oriental Mindoro	Baco	Linao-Cawayan HEP (Upper Cascade)	-	-	Signed	2.10	-	-
Region-04-B	Oriental Mindoro	Bongabong	Bongabong HEP	-	-	Signed	10.00	-	-
Region-04-B	Oriental Mindoro	San Teodoro	Alag HEP	-	-	Signed	20.00	-	-
Region-04-B	Oriental Mindoro	Naujan	Catuiran Hydroelectric Power Project	-	-	Applying	8.00	-	-
Region-04-B	Oriental Mindoro	Naujan	Catuiran (Upper Cascade) Hydroelectric Power Project	-	-	Applying	8.00	-	-
Region-04-B	Oriental Mindoro	Naujan	Cantakoy Hydroelectric Power Project	-	-	Applying	8.00	-	-
Region-04-B	Oriental Mindoro	San Teodoro	Inabasan Hydroelectric Power Project	-	-	Applying	10.00	-	-
Region-04-B	Palawan	Brooke's Point	Cabinbin	-	Cabinbin River	Mini_Potential	0.80	-	-
Region-04-B	Palawan	Puerto Princesa	Babuyan	-	Babuyan River	Mini_Potential	5.60	Reservoir	-
Region-04-B	Palawan	Puerto Princesa	Langogan	-	Langogan River	Mini_Potential	6.80	Run-of-River	-

Fig. 5-2 Information on HEP Potential Sites disclosed through DOE Web Site

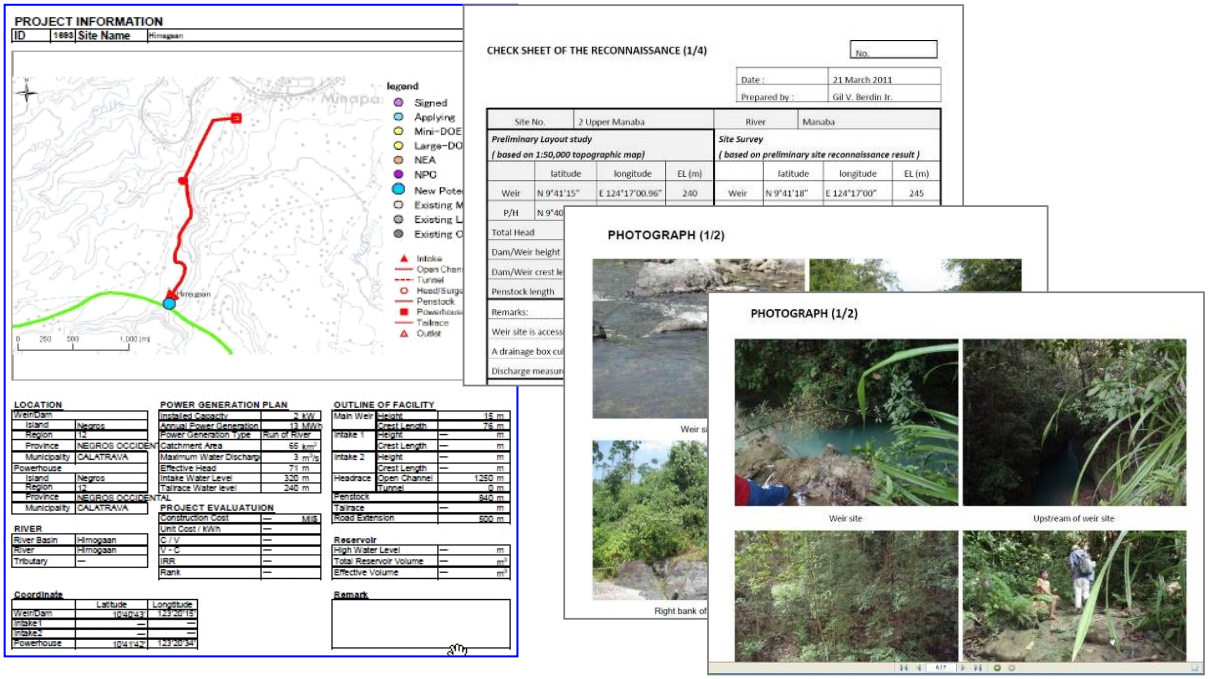


Fig. 5-3 Information on HEP Potential Sites provided by Face-to-Face Services

5.3 Utilization of a Result of New HEP Potential Sites

Contents related to the 47 promising HEP potential sites selected in this study are provided in "Resource Development of Work Program for Hydropower Project." In the NREP 2011-2030 established by the DOE in July 2011. According to the program, bidding, awarding contracts, construction, development, commissioning and operation are to be conducted continuously.

6. RECOMMENDATIONS

Described below are recommendations for sustainable O&M (Operation and Maintenance) of the HEP resources database, effective utilization of the database for the promotion of HEP development, promotion of promising HEP potential sites identified in this study, sharing and updating data / information in collaboration with related agencies and improvement of the investment environment surrounding HEP development.

(1) Sustainable O&M of the Hydropower Resources Database

The database should properly and efficiently provide data / information regarding promising HEP potential sites to the RE developers and be utilized to promote the development of HEP projects.

Furthermore, the following considerations were shown in database development so as to utilize the database sustainably.

- That the database could be used for the DOE's routine jobs.
- That templates for relevant documents and presentations would be easily provided.
- That the database operation and maintenance cost would be minimized by collaboration amongst the related divisions in the DOE.
- That a backup system and security system would be provided.

The DOE has to update the database and manage it so that it always contains the latest data and infomration.

(2) Effective Utilization of the Database for Promoting Hydropower Development

In this study, the following methods of utilizing the database for developers / investors are proposed to promote HEP development .

- Information provision through the website
- Establishment of an information desk for HEP development
- Provision of data / information on relevant potential sites by face-to-face services
- Seminars to provide information on HEP development

The DOE and the consultant agreed that the DOE has to decide an O&M organization, staff assignments, budgets and coordination with other divisions in order to assuredly and diligently carry out the above activities, and maintain the sustainable operation of the database.

It is effective for promoting new HEP development to hold workshops for RE developers / investors in various locations in cooperation with financial institutions, for the purpose of presenting relevant data / information on HEP potentials from the database and finance information.

(3) Effective Utilization of Promising Hydropower Potential Sites Selected by this Study

According to the program mentioned in the Resource Development of Work Program for HEP Project of the National Renewable Energy Program, 2011 – 2030 (NREP) formulated in July 2011 by the DOE, bidding, awarding of contracts, construction, development, commissioning and operation are to be continually planned for the selected 47 potential sites in this study. This study is in the preliminary study stage, so the bidding for rights to implement F/Ss (Feasibility Studies) is planned by means of "Open and Competitive Selection." The next stage is to judge feasibility of projects based on the results of investigations, designs and financial analyses from F/Ss. Then, projects can move forward to the D/D (Detail Design) and construction stages.

(4) Recommendations for Sharing and Updating Data / Information of the Database in Collaboration with Related Agencies

The database utilizes data / information of government agencies such as the DPWH (Department of Public Works and Highways), PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration), NAMRIA (National Mapping and Resource Information Authority), NIA (National Irrigation Administration), DENR (Department of Environment and Natural Resources), and NGCP (National Grid Corporation of the Philippines). Evaluation of potential sites depends on basic data such as water resources, environment, infrastructure, etc. and the reliability of data / information. It would be useful towards providing developers / investors with updated and reliable data / information related to the potential sites by sharing and updating this data / information in cooperation with those institutions.

The DOE shall reduce developer / investor risk by sharing information with those government agencies related to water resource development such as the DPWH, PAGASA, NAMRIA, NIA and DENR. They also aim at economic development via the effective use of irrigation facilities.

(5) Need for Capacity-Building Capability for Evaluating F/S

In a short time, the DOE shall evaluate F/S results and issue development and construction permits to developers / investors. The DOE has experience with F/S for mini-HEP projects but not poundage or reservoir types or large-scale HEP projects. Therefore, it technical training in those HEP projects is required.

The DOE currently uses a cash flow model of revenues and expenses to calculate profits and losses, along with the projected electricity generation assumed by the project proponent. Tariffs are the only precondition used for simulation (as of 2011). The DOE examines the validity of the IRR (Internal Rate of Return) solely based on this. Furthermore, the cost is derived from the data written in the F/S. The DOE should be able to replicate and simulate the F/S outputs, using financial programs.

(6) Further Cooperation with the DBP in Providing Information from the Database

In the interview with the DBP, applications for the EDP were thought to be increasing after deciding the official FIT (Feed-in-Tariff) price. Since F/S costs will be funded, cooperative activities for EDP promotion (especially the F/S component) are encouraged in utilizing EDP loans. For this purpose, participation by the DBP's local branches will be necessary.

(7) Encouraging Partnership between ECs and LGUs

Joint ventures between LGUs and ECs can be beneficial to both parties, as it makes it easier for ECs to obtain project approval and LGUs can corporate with in-kind contributions like access roads.

(8) Possible Cooperative Activities with the CDA

Some ECs with good performance are considering joining the CDA (Cooperative Development Authority) in order to get exemptions from VAT (Value Added Tax), franchise tax, etc. The CDA should also consider cooperating in EDP promotion activities that target ECs. At present, 12 ECs have joined the CDA. The CDA has 16 local branches.

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Abbreviations

ABEP	Area Based Energy Program
ADB	Asian Development Bank
ANTECO	Antique Electric Cooperative, Inc.
APEC	Asia-Pacific Economic Cooperation
ARMM	Autonomus Region in Muslim Mindanao
ASPA	Ancillary Services Procurement Agreement
BANELCO	Bantayan Island Electric Cooperative, Inc.
BAP	Bankers Association of the Philippines
BCQ	Bilateral Contract Quantity
BDO	Banco de Oro Unibank
BIR	Bureau of Internal Revenue
BOI	Board of Investments
BOO	Build-Own-Operate
BOT	Build-Operate-Transfer
BPI	Bank of the Philippine Islands
BPS	Bureau of Product Standards
BRS	Bureau of Research and Standards, DPWH
B/S	Balance sheet
CADT	Certification of Ancestral Domain Title
CALT	Certification of Ancestral Land Titles
CAR	Cordillera Administrative Region
CBRED	Capacity Building to remove barriers for Renewable Energy Development project
CCPL	Climate Change Program Loan
CDA	Cooperative Development Authority
CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CF	Cash Flow
C/F	Cash Flow Statement
CFSF	Carbon Finance Support Facility
CM	Combined Margin
CMP	Conference of Parties serving as the meeting of the Parties to the Kyoto Protocol
CNC	Certificate, of Non-Coverage
COGS	Cost of Goods Sold
COP	Conference of the Parties
CPA	CDM Programme Activity
CSR	Corporate Social Responsibility
DAO	DENR Administrative Order
DBP	Development Bank of the Philippines
D/D	Detail Design
DEM	Digital Elevation Model
DENR	Department of Environment and Natural Resources
DNA	Designated National Authority
DOE	Department of Energy
DOE	Designated Operational Entity

DOST	Department of Science and Technology
DOTC	Department of Transportation and Communications
DPWH	Department of Public Works and Highway
DTI	Department of Trade and Industry
DU	Distribution Utility
EA	Electrification Administration
EB	Executive Board
EC	European Commission
ECAs	Environmentally Critical Areas
ECC	Environment Compliance Certificate
ECPs	Environmental Critical Projects
EC(s)	Electric Cooperatives
EDP	Environmental Development Project
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EIS	Environmental Impact Statement
EMB	Environmental Management Bureau, DENR
EMPAS	Environmental Management and Protected Area Sector, DENR
EO	Executive Order
EPIMB	Electric Power Industry Management Bureau
EPIRA	Electric Power Industry Reform Act
ER	Expanded Rural Electrification Program
ERA	Environmental Risk Assessments
ERC	Energy Regulatory Commission
ERPA	Emission Reduction Purchase Agreement
ETS	Emission Trading Scheme
EU	European Union
EUMB	Energy Utilization Management Bureau
EVAT	Expanded Value Added Tax
FCSEC	Flood Control Sabo Engineering Center, DPWH
FIRR	Financial Internal Rate of Return
FIT	Feed-in-Tariff
FPIC	Free and Prior Informed Consent
FREED	Fund of Rural Electrification Economic Development
F/S	Feasibility Study
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GOCC	Government Owned Controlled Corporation
GRAM	The Generation Rate Adjustment Mechanism
GREI	Ger Phil Renewable Energy Inc.
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HEP	Hydro Electric Power
HOEMD	Hydropower and Ocean Energy Management Division, DOE

HRD	Hydropower Resource Database
ICC	Indigenous Cultural Communities
ICERA	Incremental Currency Exchange Recovery Adjustment
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IGES	Institute for Global Environmental Strategies
IP	Indigenous Peoples
IPP	Independent Power Producer
IPP	Investment Priorities Plan
IPRA	Indigenous Peoples Rights Act
IRR	Internal Rate of Return
IRR	Implementing Rules and Regulations
I/S	Income Statement
ITD	Information Technology Division, ITMS
ITH	Income Tax Holiday
ITMS	Information Technology and Management Service, DOE
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JV	Joint Venture
KEPCO	Korea Electric Power Corporation
LGU-GC	Local Government Unit Guarantee Corporation
LGU-OUs	Local Government Unit-Owned Utilities
LGUs	Local Government Units
LOA	Letter of Approval requirement of Executive Board
MERALCO	Manila Electric Company
MFIs	Micro-Finance Institutes
MGB	Mines and Geosciences Bureau, DENR
MHP	Micro-Hydro electric Power
MHPDOC	Mini-Hydro electric power development operating contract
MISD	Management Information Systems Division, DENR
MOA	Memorandum of Agreement
MLEs	Medium to Large Private Developers
NAMRIA	National Mapping and Resource Information Authority, DENR
NCIP	National Commission on Indigenous People
NCR	National Capital Region
NEA	National Electrification Administration
NECAs	Non-Environmentally Critical Areas
NEDA	National Economic and Development Agency
NGCP	National Grid Corporation of the Philippines
NIA	National Irrigation Administration
NIPAS	National Integrated Protected Area System
NOL	Net Operating Loss
NOLCO	Net Operating Loss Carry Over
NPC	National Power Corporation
NPC-SPUG	National Power Corporation Small Power Utility Group

NPP	New Private Power Provider
NREB	National Renewable Energy Board
NREP	National Renewable Energy Program
NSO	National Statistics Office
NWRB	National Water Resources Board, DENR
NWRC	National Water Resources Council
O&M	Operation and Maintenance
ORMECO	Oriental Mindoro Electric Cooperative, Inc.
PAGASA	Philippine Atmosphere, Geophysical and Astronomical Services Administration, DOST
PAGCOR	Philippine Amusement and Gaming Corporation
PAWB	Protected Area and Wild Life Bureau, DENR
PBR	Performance - Based Regulation
PD	President Decree
PDD	Project Design Document
PDP	Power Development Plan
PEIS	Programmatic Environmental Impact Statement
PEMC	Philippines Electric Market Corporation
PEP	Philippine Energy Plan
PHIVOLCS	Philippine Institute of Volcanology and Seismology, DOST
PhP	Philippines Peso
PIOU	Private Investor-Owned Utilities
P/L	Profit and Loss Statement
PMHD	Philippines Mini Hydro Division, GTZ
PMO	Project Management Office, DOE
PNOC	Philippine Oil Company
PNOC-EDC	Philippine National Oil Company - Energy Development Corporation
PNOC-RC	Philippine Oil Company - Renewable Corporation
PoA	Programme of Activities
PPA	Power Purchase Agreement
PSALM	Power Sector Assets and Liabilities Management Corporation
PV	Photovoltaic power generation
QTP	Qualified Third Parties
RA	Republic Act
RE	Renewable Energy
RE	Retained Earnings
RE-LGF	Renewable Energy Loan Guarantee Fund
REMB	Renewable Energy Management Bureau, DOE
ROE	Return On Equity
RPR	Review Process Report
RPS	Renewable Portfolio Standard
RSEC-WR	Rules for Setting the Electric Cooperatives' Wheeling Rates
SEC	Securities Exchange Commission
SEIPI	Semiconductor and Electronics Industries in the Philippines, Inc
SPUG	Small Power Utility Group
SRTM	Shuttle Radar Topography Mission

SSC	Small Scale CDM
TRANSCO	National Transmission Corporation
TSMD	Technical Service and Management Division, DOE
UC	Universal Charge
UNDP	United Nations Development Programme
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USAID	Unites States Agency for International Development
VAT	Value Added Tax
WACC	Weighted Average Cost of Capital
WB	World Bank
WESM	Wholesale Electricity Spot Market
WRR	Water Resource Region

CHAPTER 1

PREFACE (BACKGROUND AND OBJECTIVE OF THE STUDY)

CHAPTER 1 PREFACE (BACKGROUND AND OBJECTIVE OF THE STUDY)

1.1 BACKGROUND OF THE STUDY

A database of hydropower resources was prepared from an inventory study by the NEA (National Electrification Administration) in 1981, and it has been used almost without any update. Since the IRR (Implementing Rules and Regulations) of Renewable Energy Act was made public, developers who are interested in hydropower development are proposing low-risk projects whose F/S (Feasibility Study) or assessment was conducted. However, in the coming year, these developers need to conduct F/S, which requires tremendous amounts of money and time in and unto itself to put the project together. It is an important point for the developers whether reliable information of low risk is provided or not.

Considering the above situation, the DOE (Department of Energy) asked the Government of Japan for technical cooperation in building and promoting a database of HEP (Hydro Electric Power) resources that would meet developer needs, for the purpose of enhancing their ability to provide information that would enable them to promote development of HEP resources. On the other hand, JICA (Japan International Cooperation Agency) is providing a two-step loan for EDP (Environmental Development Project) to the DBP (Development Bank of the Philippines), and decided to implement this plan as a supplementary yen loan project with a view to promoting and realizing the yen loan project by extracting and planning subproject candidates in the process of building a database in this study. JICA agreed to an Implementation Plan with the Philippine side in December 2009.

The basic framework of the study is mentioned in this Implementation Plan. However, this only covers the preliminary framework of the study, period of study, implementation agency and reports to be submitted, while the detailed scope based on the needs of the Philippine side have not yet been determined.

Therefore, the 1st Site Investigation Inception Report draft, which includes detailed scopes of works, procedures and methodologies of the study proposed by the Consultant, was explained to and discussed with the DOE, which is the implementing agency, and their needs were heard. Then, the Consultant prepared an Inception Report of the 1st work in Japan based on the results of the discussion with the DOE.
The Consultant study team conducted a 2nd Site Investigation from May 25, 2010 to July 2, 2010 and explained the Inception Report to the DOE and discussed matters with them. Resultantly, the Report was approved.

1.2 OBJECTIVE OF THE STUDY

The objective of this study is to organize and review the current inventory database and establish a new database by identifying new HEP potential sites by map study, conducting site verifications of prospective new HEP potential sites among selected sites, and setting priorities for potential projects to facilitate yen loans, other official financing and also private investment. At the same time, this database will be helpful towards planning projects that could be eligible for financing as an EDP with a Japanese yen loan and will increase the effectiveness of the EDP.

Technology will be transferred in this study in the form of investigative methods for planning HEP projects, hydropower generation technology, and O&M (Operation and Maintenance) of the database of HEP resources.

1.3 OUTLINE OF THE STUDY

Under the Philippine Renewable Energy Act of 2008 (Republic Act 9513) enacted in December 2008, the DOE has approved the use of service contracts to implement F/S for RE projects in the Philippines. As of March 2010, a total of 221 service contracts for RE (Renewable Energy) projects have been approved and signed with developers. Among them are 124 HEP projects. By law, a developer who meets the financial and technical requirements specified by the DOE is entitled to conduct a F/S over a 2-year period.

The developer will conduct a F/S of a promising HEP potential site and judge whether the project is to be implemented or not. So, it is very important for the DOE to provide as much information on promising HEP potential sites as possible to developers in order to promote the development of RE projects.

In lieu of the promotional effect of this approach, the DOE will give priority to providing more information on promising new HEP potential sites to developers than providing information pertinent to maintaining and improving existing HEP potential sites.

Based on discussions with the DOE, components of the study were revised to the following six (6). The revised framework of the overall study is shown in Fig. 1.3-1.

I. Confirmation of Detailed Project Scope
II. Map Study, Priority Ranking and Site Verifications of New Hydropower Potential Sites
III. Collection and Review of Database of Existing Hydropower Resources
IV. Development of the Database, Preparation of an O&M Manual and Facilitation for Promoting Utilization for Hydropower Resources
V. Facilitation of Financial Planning for Attractive Hydropower Projects
VI. Holding Workshops (for Training) and Seminars

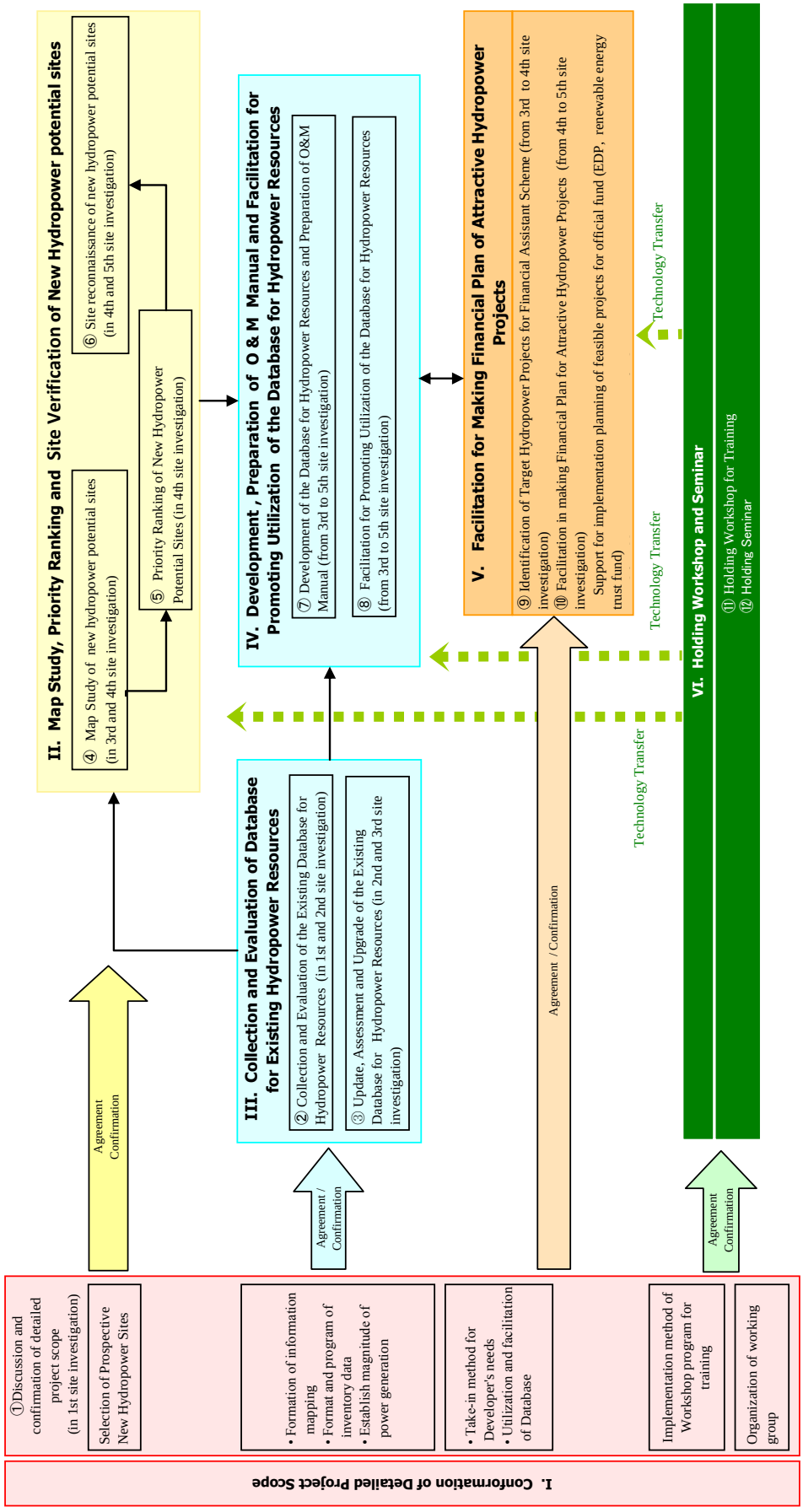


Fig. 1.3-1 Framework of Overall Study

1.4 CONTENTS OF THE STUDY AND TARGET AREA

The following works, which were revised in line with discussions between the DOE and the Consultant team during the 1st site visit in March 2010, shall be executed. The flow of the study is given in Fig 1.4-1

(1) Discussion and Confirmation of the Scope of Work
(2) Collection and Evaluation of the Existing Database of Hydropower Resources
(3) Update, Assessment and Upgrade of the Existing Database of Hydropower Resources
(4) Map Study of New Hydropower Potential Sites
(5) Priority Ranking of New Hydropower Potential Sites
(6) Site Reconnaissance of New Hydropower Potential Sites
(7) Development of the Database and Preparation of an Operation & Maintenance Manual
(8) Facilitation of Utilization of the Database of Hydropower Resources
(9) Identification of Target Hydropower Projects for Financial Assistant Program
(10) Facilitation of Financial Planning for Attractive Hydropower Projects
(11) Implementation of Training Workshops and Seminars

The target area is the entire Philippines. The selected areas where new hydropower potential sites were identified (new additional scope) are the following 9 islands and 3 regions (Fig. 1.4-2).

1) Selected Islands
   Mindoro, Masbate, Marinduque, Romblon, Panay, Bohol, Negros, Palawan and Samar

2) Selected Regions
   CAR, Region I, Region II

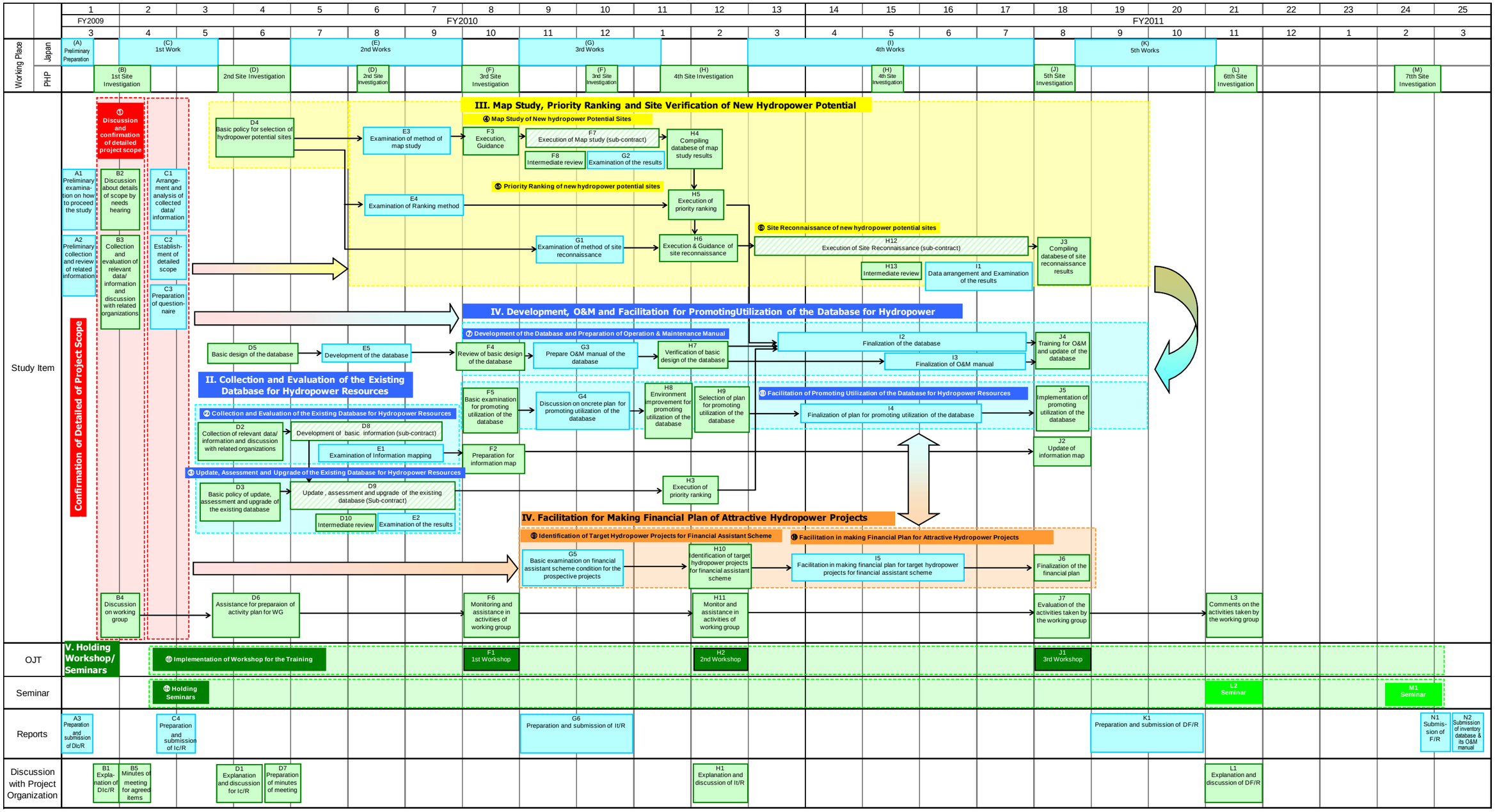


Fig. 1.4-1 Flow of the Study

	No.	Island	Region
3 Region	0	Luzon	Region-1
			Region-2
			CAR
9 Island	1	Mindoro	Region-4B
	2	Marinduque	
	3	Ronblon	
	4	Palawan	
	5	Masbate	Region-5
	6	Panay	Region-6
	7	Negros	Region-6, 7
	8	Bohol	Region-7
	9	Samar	Region-8

Fig.1.4-2 Selected Areas Where New Hydropower Sites were identified

1.5 CONSULTANT TEAM MEMBER

Team members of the study are as below.

Responsibility	Name
Team Leader / Electric Power Development	Yuichi SANO
Deputy Team Leader / Electric Power Policy	Masakazu ITAKURA
Hydropower Civil Engineering	Hideo TAKASE
Hydropower Generating Technology	Yoshikazu ISHII
Renewable Energy (Small Scale Hydropower) / Hydrology & Geology	Takao SARUHASHI
Economic & Financial Analysis / Private Investment Promotion	Hiroaki NAGAYAMA
Socio-Environment Engineering	Satoshi YAMAOKA
Database Development	Taketoshi MATSUNAGA Ryuichi NISHI
Database Operation & Maintenance (Application & Upgrade)	Yukihiro MIKUMO
Transmission Line and Power System Planning	Yukao TANAKA
Coordinator 1	Naonori Okawa
Coordinator 2 / Database Training	Sho SHIBATA

1.6 SCHEDULE OF THE SITE INVESTIGATION

The number of seven (7) times in total of the site investigation have been implemented in this study from March 2010 to March 2012. The schedule is shown as follows.

The 1st Phase of the Site Investigation (March 15 ~ April 13, 2010)

Responsible Task	Name	Stay in the Philippines		
		In	Out	Days
Team Leader / Electric Power Development	Yuichi SANO	Mar-15	Apr- 2	19
Sub-team Leader / Power Policy	Masakazu ITAKURA	Mar-15	Apr-13	30
Hydropower Civil Engineering	Hideo TAKASE	Mar-15	Apr-13	30
Economic & Financial Analysis/ Private Investment Promotion	Hiroaki NAGAYAMA	Mar-21	Mar-27	7
Database Operation & Maintenance	Yukihiro MIKUMO	Mar-21	Mar-27	7

The 2nd Phase of the Site Investigation (May 25 ~ July 2, 2010)

Responsible Task	Name	Stay in the Philippines		
		In	Out	Days
Team Leader / Electric Power Development	Yuichi SANO	May-31	Jun-12	13
Sub-team Leader / Power Policy	Masakazu ITAKURA	Jun-14	Jun-26	13
Hydropower Technology	Yoshikazu ISHII	May-31	June-12	13
Renewable Energy (small scale hydropower) / Hydrology &Geology	Takao SARUHASHI	Jun-7	Jul-2	26
Environmental and Social Engineering	Satoshi YAMAOKA	Jun-14	Jun-26	13
Database Development	Taketoshi MATSUNAGA	May-25	Jul-2	39
Database Operation & Maintenance	Yukihiro MIKUMO	May-30	Jul-2	34
Project Coordinator 1	Naonori OKAWA	May-30	Jun-20	22

The 2.5th Phase of the Site Investigation (August 9 ~ September 7, 2010)

Responsible Task	Name	Stay in the Philippines		
		In	Out	Days
Database Development	Taketoshi MATSUNAGA	Aug-9	Aug-18	10
Economic & Financial Analysis / Private Investment Promotion	Hiroaki NAGAYAMA	Aug-26	Sep-7	13

The 3rd Phase of the Site Investigation (October 3 ~ October 30, 2010)

Responsible Task	Name	Stay in the Philippines		
		In	Out	Days
Team Leader / Electric Power Development	Yuichi SANO	Oct-11	Oct-30	20
Sub-team Leader / Power Policy	Masakazu ITAKURA	Oct-11	Oct-16	6
Hydropower Civil Engineering	Hideo TAKASE	Oct- 3	Oct-30	28
Renewable Energy (small scale hydropower) / Hydrology &Geology	Takao SARUHASHI	Oct-13	Oct-30	18
Database Development	Taketoshi MATSUNAGA	Oct- 3	Oct-16	14
Database Operation & Maintenance	Yukihiro MIKUMO	Oct- 3	Oct-30	28
Project Coordinator 2	Sho SHIBATA	Oct- 3	Oct-30	28

The 3.5th Phase of the Site Investigation (December 5 ~ December 16, 2010)

Responsible Task	Name	Stay in the Philippines		
		In	Out	Days
Database Development	Ryuichi NISHI	Dec-5	Dec-16	12
Database Operation & Maintenance	Yukihiro MIKUMO	Dec-5	Dec-16	12

The 4th Phase of the Site Investigation (February 6 ~ February 25, 2011)

Responsible Task	Name	Stay in the Philippines		
		In	Out	Days
Team Leader / Electric Power Development	Yuichi SANO	Feb- 6	Feb-20	15
Hydropower Technology	Yoshikazu ISHII	Feb- 13	Feb-25	13
Hydropower Civil Engineering	Hideo TAKASE	Feb- 6	Feb-25	20
Renewable Energy (small scale hydropower) / Hydrology &Geology	Takao SARUHASHI	Feb- 6	Feb-25	20
Environmental and Social Engineering	Satoshi YAMAOKA	Feb-21	Feb-25	5
Economic & Financial Analysis / Private Investment Promotion	Hiroaki NAGAYAMA	Feb- 13	Feb-25	13
Planning of Power Transmission / Power System	Yukao TANAKA	Feb-21	Feb-25	5
Database Development	Ryuichi NISHI	Feb- 6	Feb-25	20
Database Operation & Maintenance	Yukihiro MIKUMO	Feb- 6	Feb-25	20
Project Coordinator 2	Sho SHIBATA	Feb- 6	Feb-25	20

The 4.5th Phase of the Site Investigation (April 3 ~ April 20, 2011)

Responsible Task	Name	Stay in the Philippines		
		In	Out	Days
Sub-team Leader / Power Policy	Masakazu ITAKURA	Apr-09	Apr-14	6
Hydropower Civil Engineering	Hideo TAKASE	Apr-07	Apr-20	14
Renewable Energy (small scale hydropower) / Hydrology &Geology	Takao SARUHASHI	Apr-07	Apr-20	14
Environmental and Social Engineering	Satoshi YAMAOKA	Apr-07	Apr-16	10
Database Development	Ryuichi NISHI	Apr-03	Apr-16	14
Database Operation & Maintenance	Yukihiro MIKUMO	Apr-03	Apr-16	14
Project Coordinator 2	Sho SHIBATA	Apr-03	Apr-20	18

The 4.5th Phase of the Site Investigation – Part II (June 12 ~ June 18, 2011)

Responsible Task	Name	Stay in the Philippines		
		In	Out	Days
Database Operation & Maintenance	Yukihiro MIKUMO	Jun-12	Jun-18	7

The 5th Phase of the Site Investigation (August 30 ~ September 16, 2011)

Responsible Task	Name	Stay in the Philippines		
		In	Out	Days
Team Leader / Electric Power Development	Yuichi SANO	Aug-30	Sep-16	18
Renewable Energy (small scale hydropower) / Hydrology & Geology	Takao SARUHASHI	Sep-1	Sep-10	18
Economic & Financial Analysis / Private Investment Promotion	Hiroaki NAGAYAMA	Aug-30	Sep-14	16
Database Development	Ryuichi NISHI	Aug-30	Sep-16	18
Database Operation & Maintenance	Yukihiro MIKUMO	Aug-30	Sep-16	18
Project Coordinator 2	Sho SHIBATA	Aug-30	Sep-16	18

The 6th Phase of the Site Investigation (November 20 ~ December 3, 2011)

Responsible Task	Name	Stay in the Philippines		
		In	Out	Days
Team Leader / Electric Power Development	Yuichi SANO	Nov-20	Dec-3	14
Hydropower Civil Engineering	Hideo TAKASE	Nov-21	Dec-2	12
Renewable Energy (small scale hydropower) / Hydrology & Geology	Takao SARUHASHI	Nov-21	Dec-2	12
Economic & Financial Analysis / Private Investment Promotion	Hiroaki NAGAYAMA	Nov-22	Nov-30	9
Database Operation & Maintenance	Yukihiro MIKUMO	Nov-27	Dec-3	7
Project Coordinator 2	Sho SHIBATA	Nov-20	Dec-3	14

The 7th Phase of the Site Investigation (February 13 ~ March 7, 2012)

Responsible Task	Name	Stay in the Philippines		
		In	Out	Days
Team Leader / Electric Power Development	Yuichi SANO	Feb-13	Mar-7	24
Renewable Energy (small scale hydropower) / Hydrology & Geology	Takao SARUHASHI	Feb-13	Mar-7	24
Economic & Financial Analysis/ Private Investment Promotion	Hiroaki NAGAYAMA	Feb-13	Mar-7	24
Database Development	Ryuichi NISHI	Mar-2	Mar-7	6
Database Training	Sho SHIBATA	Feb-13	Mar-7	24

1.7 IMPLEMENTATION OF WORKSHOPS, DATABASE TRAINING, AND SEMINARS

Information of HEP potential sites of the DOE has been rearranged to establish a GIS (Geographic Information Systems) database of HEP resources, and the search and integrated management functions of the database have been improved for this study. It can be expected that this database will be useful towards increasing work efficiency and providing information to stakeholders for the promotion of HEP development.

Technical assistance has been implemented in this study for sustained and continuous use of

the database of HEP resources by the HOEMD (Hydropower and Ocean Energy Management Division, DOE), of the REMB (Renewable Energy Management Bureau, DOE), who is in charge of HEP of RE. Also, technical training has been conducted for the DOE in preparation for examination of F/Ss of HEP projects, which will be implemented in the future by development proponents.

Technical assistance in this study is described as follows.

(1) Technical training for a hydropower project

- Training in the method of project formation, HEP development planning, technical standards of a HEP plant, dam design, and construction planning
- Training in economic and financial analyses, conceptual design of electro-mechanical equipment, design of transmission lines and power system planning, and social and environmental considerations for a HEP project
- Training in site reconnaissance of new HEP potential sites (2 sites for run-of-river type and 1 site for reservoir type)

(2) Training in operation, maintenance and facilitating the utilization of the database of hydropower resources

- Collection of information materials and implementation of data analysis for the development of the database in cooperation with the study team
- Training in basic knowledge, operation, maintenance and updating of the database
- Practical training in operation, maintenance and updating of the database
- Facilitation of the preparation of information materials on HEP resources by utilization of the database
- Facilitation for information disclosure of HEP resources through the DOE website.

(3) Facilitation of information provision through seminars on the promotion of hydropower development

- Holding of seminars for stakeholders jointly by the DOE and JICA

1) First Workshop

Target	DOE staff (HOEMD, PD, NREB, Luzon Field Office, Visayas Field Office, Mindanao Field Office), about 20 people
Period	October 12 ~ 15, 2010
Resources	Japanese consultants (4 people) Team Leader / Electric power development Deputy Team Leader / Electric power policy Hydropower civil engineering Renewable energy (Small-scale hydropower) / Hydrology and geology
Content	• Preliminary studies for HEP development (Map studies, power generation planning, estimation of construction costs • Feasibility studies for HEP development • Technical standards for HEP (Dams, waterway structures) * • Hydrological analyses (Runoff analysis, flood analysis, sediment analysis) • Power generation planning (Reservoir type, run-of-river type) • Design and construction of dams • Design of waterway structures
Results	Training materials, Certificate of training

2) Second Workshop

Target	DOE staff (HOEMD, PD, NREB, Luzon Field Office, Visayas Field Office, Mindanao Field Office), 19 people
Period	February 22 ~ 24, 2011
Resources	Japanese consultants (5 people) Hydropower generating Technology Renewable energy (Small-scale hydropower) / Hydrology and geology Socio-environment engineering Economic and financial analysis / Private investment promotion Transmission line and power system planning
Content	• Environmental impact assessments • Hydrological analysis (Runoff analysis, flood analysis) • Design of hydroelectric generators • Power system analysis • Design and planning of transmission line facilities • Economic and financial analyses
Results	Training materials, Certificate of training

3) Third Workshop

Target	DOE staff (HOEMD, ITMS, NREB), 19 people
Period	September 2, 2011
Resources	Japanese consultants (3 people) Team Leader / Electric power development Database development Database Operation and Maintenance
Descriptions	• Basic knowledge of the database • Operation and updating of the database • Preparation of information materials about HEP resources by utilization of the database
Results	Training materials, Certificate of training

4) Fourth Workshop

Target	DOE staff (REMB, PD), 14 people
Period	September 12 ~ 13, 2011
Resources	Japanese Consultants (2 people) Team Leader / Electric power development Economic and financial Analyses / Private investment promotion
Content	• Economic and financial analyses of small-scale hydropower • Practical training by using F/S
Results	Training materials, Certificate of training

5) Site Reconnaissance for New Hydropower Potential Sites

Target	DOE-REMB staff (HOEMD, Visayas Field Office), 3 people Local consultant (7 people)
Period	February 16 ~ 19 / April 10 ~ 13, 2011
Resources	Japanese consultants (6 people) Team Leader / Electric power development Deputy Team Leader / Electric power policy Hydropower generating technology Hydropower civil engineering Renewable energy (Small-scale hydropower) / Hydrology and geology Social and environment engineering
Descriptions	Site reconnaissance (2 sites for run-of-river type and 1 site for reservoir type) was implemented for the purpose of technical transfer to the DOE and training for local consultants. General descriptions of the survey are as follows. a) First survey (Himogaan site and Hinotongan site, run-of-river type) Place: Negros (Province of Negros Occidental and Province of Negros Oriental) Period: February 16 ~ 19, 2011 b) Second survey (Ilog site, reservoir type) Place: Negros (Province of Negros Occidental) Period: April 10 ~ 13, 2011 c) Survey items • Results of the map study were confirmed at the site. (Geography, river condition, altitude, land use such as agricultural land, access roads, etc.) • Information was complemented by confirmation of actual conditions of roads (access roads). • Information was complemented by visits to the local government units (LGUs), electric cooperatives (ECs), etc. (Transmission lines, environment, water use, etc.) • Collection of data such as geological maps, river discharge, etc. (Geology, river discharge) • Natural and social environment (Vegetation, valuable species, land use, activities of agriculture, forestry, fishery and industry, scenic resources, cultural heritages, etc.) • Geography and topography of the reservoir (Distribution of limestone, mineral resources, existence of large-scale collapse, slope stability, etc; Run-of-river type)
Results	Site reconnaissance results and reports

6) Instructions of Initial Operation and Usual Operation of the Database

Target	DOE-REMB staff (HOEMD, ITSM, NREB) 10 people
Period	September 5 ~ 8, 2011
Resources	Japanese consultant Team Leader / Electric power development Database development Database Operation and Maintenance
Content	Training in operation and maintenance of the database for C/P and participants was implemented to confirm their skill level by using the database manual for operation, maintenance and updates.
Results	Database manual

7) Establishment of the System for Information Provision about Hydropower Resources

Target	DOE-REMB staff (HOEMD, ITSM, NREB)
Period	April ~ November, 2011
Resources	Japanese consultant Team Leader / Electric power development Database development Database Operation and Maintenance
Content	The DOE was assisted in establishing a system of information provision on HEP development planning. The method of information provision is described below. a) Online information provision through the DOE website Information on HEP development will be disclosed online from the database in cooperation with the ITSM who manages the website of the DOE. Information can be provided to many stakeholders by spreading information about the online disclosure through the seminar described in 8) below. b) Establishment of the information desk for HEP development An information desk for stakeholders and developers is to be established in the DOE to provide information on hydropower potential sites. c) Distribution of literature with information on HEP development Brochures and so on with information on HEP development are prepared through the database to distribute to stakeholders and developers.
Results	Database Manual

8) Seminar for Stakeholders Held Jointly by the DOE and JICA

Target	Developers and stakeholders of HEP development in the Philippines
Period	November 23, 25, 29, 2011
Resources	Japanese consultant DOE-REMB staff (HOEMD), Financial institutions (DBP, LAND BANK, LGU-GC), etc.
Descriptions	a) Place: Manila, Cebu, Baguio b) Date: November 23 (Manila), 25 (Cebu), 29 (Baguio) c) Participants: Private developers, DOE-ITSM, DOE-NREB, DOE-EPPB, DOE-Visayas Field office, BRS-DPWH, DOE-Luzon Field office, ECs, LGUs, other concerned organizations etc. d) Contents: Information provision to stakeholders to promote HEP • Explanation of this study • Outline of the database • Preliminary study and site reconnaissance for new potential sites • Information provision about loans for HEP projects（DBP、LAND BANK、LGU-GC） • Information provision on HEP resources through the database • Application of the Renewable Energy Act for HEP projects
Results	Information materials for the seminar, hearing of developers and stakeholders of HEP development

9) Seminar for ECs and LGUs Held Jointly by the DOE and JICA

Target	Developers and stakeholders of HEP development in the Philippines
Period	February 16, 20, 22, 24, 28, and March 1 in 2012
Resources	Japanese consultant DOE-REMB staff (HOEMD), Financial institutions（DBP branch office, LAND BANK branch office） ECs etc.
Descriptions	a) Place: Mindro, Bohol, Panay, Negros, Vigan, Tuguegarao b) Date: February 16 (Mindro), 20 (Bohol), 22 (Panay), 24 (Negros), 28 (Tuguegarao) and March 1 (Vigan) c) Participants: ECs, LGUs, other concerned organizations, etc. d) Contents: Information provision to stakeholders to promote HEP • Explanation of this study • Outline of the database • Preliminary study and site reconnaissance for new potential sites • Information provision about loans for HEP projects (DBP, LAND BANK) • Information provision on hydropower resources through the database • Application of the Renewable Energy Act for HEP projects • Experiences of HEP developments
Results	Information materials for the seminar, hearing of developers and stakeholders of HEP development

CHAPTER 2

ELECTRIC POWER SITUATION IN THE PHILIPPINES

CHAPTER 2 ELECTRIC POWER SITUATION IN THE PHILIPPINES

2.1 POWER DEVELOPMENT PLANS

While, during the 1990's, the annual average growth rate of electricity sales had been 6.0% in Luzon, 7.6% in Visayas and 4.4% in Mindanao, respectively, the growth rate for the period from 2000 to 2008 slowed down to 2.6% in Luzon, 6.0% in Visayas and 3.3% in Mindanao, respectively. In Luzon, this can be attributed to factors such as structural changes that transformed the national economy from an industry-led to service-driven growth. On the other hand, the economic growth potential was affected by suppressed demand resulting from tight power supply in Visayas and security issues in Mindanao.

The expected annual average growth rate of electricity sales and peak demands up to 2030 are shown in table below. In all 3 regions, a high growth rate between 4.5 ~ 5.0% is forecasted and the required power sources over the coming 20 years will increase about 3 times from the present power sources.

	Annual average growth rate between 2009 and 2030	
Region	Energy sales	Peak demand
Luzon	4.53% (41,275GWh → 109,477 GWh)	4.41% (6,822 MW → 17,636 MW)
Visayas	4.98% (6,565 GWh → 19,121 GWh)	4.97% (1,176 MW → 3,404 MW)
Mindanao	4.62% (7,578 GWh → 20,470 GWh)	4.86% (1,228 MW → 3,493 MW)

* : the beginning value is actual record in 2008

At present, as given in the following table, power development projects of about 1,300 MW are to be developed.

Table 2.1-1 Power Development Plans (Planned Projects)

Grid	Project Name	Capacity (MW)	Target Completion	Location	Proponent
Luzon	2x300MW Coal-Fired Power Plant	600	4th Qtr. Of 2012	Mariveles, Bataan	GN Power
	Sub-total Luzon	**600**			
Visayas	3x80MW CFB Power Plant Expansion Project	240	Unit I-March2010 Unit II-June 2010 Unit III-Jan 2011	Brgy. Daanlungsod, Toledo City, Cebu	Cebu Energy Development Corporation (Global Business Power Corp.)
	2x100MW Cebu Coal-Fired Power Plant	200	Unit 1-Feb 2011 Unit 2-May 2011	Naga, Cebu	KEPCO SPC Power Corporation (KSPC)
	17.5MW Panay Biomass Power project	17.5	2011	Brgy. Cabalabaguan, Mina, Iloilo	Green Power Panay Phils., Inc.
	Nasulo Geothermal Plant	20	2011	Nasuji, Valencia, Negros oriental	Energy development Corporation
	2x80MW CFB Power Plant	160	Unit I-Sep 2010 Unit II-Dec 2010	Brgy. Ingore, La Paz, Iloilo	Panay Energy Development Corporation (Global Business Power Corp.)
	Sub-total Visayas	**638**			
Mindanao	Sibulan Hydroelectric Power (Unit I-16.5MW) (Unit II-26MW)	43	Unit I-Feb2010 Unit II-Apr 2010	Sta. Cruz, Davao del Sur	Hedcor Sibulan, Inc.
	Cabulig Mini-Hydro Power Plant	8	June 2011	Plaridel, Jasaan, Misamis oriental	Mindanao Energy Systems,Inc. (MINRGY)
	Mindanao 3 Geothermal	50	July 2014	Kidapawan, North Cotabato	Energy Development Corporation
	Sub-total Mindanao	**101**			
Total Philippines		**1,338**			

Note: Mindanao 3 Geothermal Plant was moved to 2014 from its original target year of 2010

Source : Power Development Plan, 2009 – 2030,DOE (Department of Energy) Portal

In order to promote development of emerging HEP (Hydro Electric Power) resources across the country, various RE (Renewable Energy) policy mechanisms such as the FIT (Feed-in-Tariff) system, RPS (Renewable Portfolio Standards) and incentives for HEP projects such as preferential treatment on taxes and funds for project financing are being developed as government policy under the Renewable Energy Law.

As of December 31, 2011, the status of committed power projects initiated by the private sector was as Table 2.1-2.

Table 2.1-2 Status of Committed Private Sector Initiated Power Projects (As of Dec. 2011)

No.	Name of Project Location	Rated Capacity (MW)	Project Status	Target Commissioning
Luzon				
1	2 × 300 MW Coal-Fired Power Plant, Mariveles, Bataan	600	Under construction	Unit 1 : Aug. 2012 Unit 2 : Oct. 2012
2	CIP 2 Banker Fired Power Plant (Diesel), Bacnotan, La Union	21	Completed ECC. Outgoing GIS. EPC contractor awarded. Internal funds	Feb. 2012 Started in Feb. 2011
3	Maibarara Geothermal Power Project, Sto. Tomas, Batangas	20	Obtained RE service contract. ECC obtained in Aug. 2010. EPC contract financing with RCBC & BPI capital. GIS from NGCP completed in Mar. 2011	Oct. 2013
4	Pililla Wind Power Project Pililla, Rizal	67.5	To finance project implementation with 100% equity.	December 2012 (Subject to FIT)
5	Green Future Biomass Project, Isabela	13	4.3 billion loan from Banco de Oro already approved. Has obtained permits and met other requirements.	April 2012 Started in Oct. 2010
Visayas				
1	Nasulo Geothermal Power Project, Nasuji, Valencia, Negros Oriental	20	Obtaining necessary permits and requirements. Turnkey contracts up for bidding.	December 2013
2	Villasiga Hydro electric Power Project, Sibalom, Antique	8	Completed LGU endorsement, Water Permit, Reconnaissance Permit, ECC certificate, DOE RE service contract and BOI Registration, with financing from Land Bank.	December 2012
3	Asian Energy System Biomass Project, Cebu	4	Obtained necessary permits. Obtained ECC on Feb. 2010. Loan approval from DBP granted on May 2011.	2015
Mindanao				
1	2 × 100 MW Southern Mindanao Coal Fired Power Project, Maasim, Sarangani	200	Obtained various permits. BDO, DBP, RCBC and UCPB have obtained their respective pre-clearances to enter into the transaction. Power Sales Agreement for 70 MW between Sarangani Energy Corporation and South Cotabato II Electric Cooperative, Inc (SOCOTECO II) was executed on June 2011.	2014 Issuance of Notice to Proceed to the EPC Contractor is scheduled on Mar. 2012. Commissioning will commence 29 months and commercial operation will commence 35 months after Notice to Proceed.
2	2 × 13.75 MW Bunker Fired Power Plant, Tablon, Cagayan de Oro	27.5	Waiting for ERC approval on the Power Supply Agreement with CEPALCO.	January 2012 Accomplishments as of Dec. 2011 are 99%.
3	Mindanao 3 Geothermal, Kidapawan, North Cotabato	50	Ongoing resource assessment. DENR ECC obtained. Land use permits obtained.	September 2014
4	2 × 4 MW Cabulig Mini-Hydro Power Plant, Plaridel, Jasaan, Misamis Oriental	8	Obtained RE service contract.	April 2012 Civil works started in Nov. 2009. Actual accomplishments as of Dec. 2011 is 70%.

Source : Power Planning Division, DOE

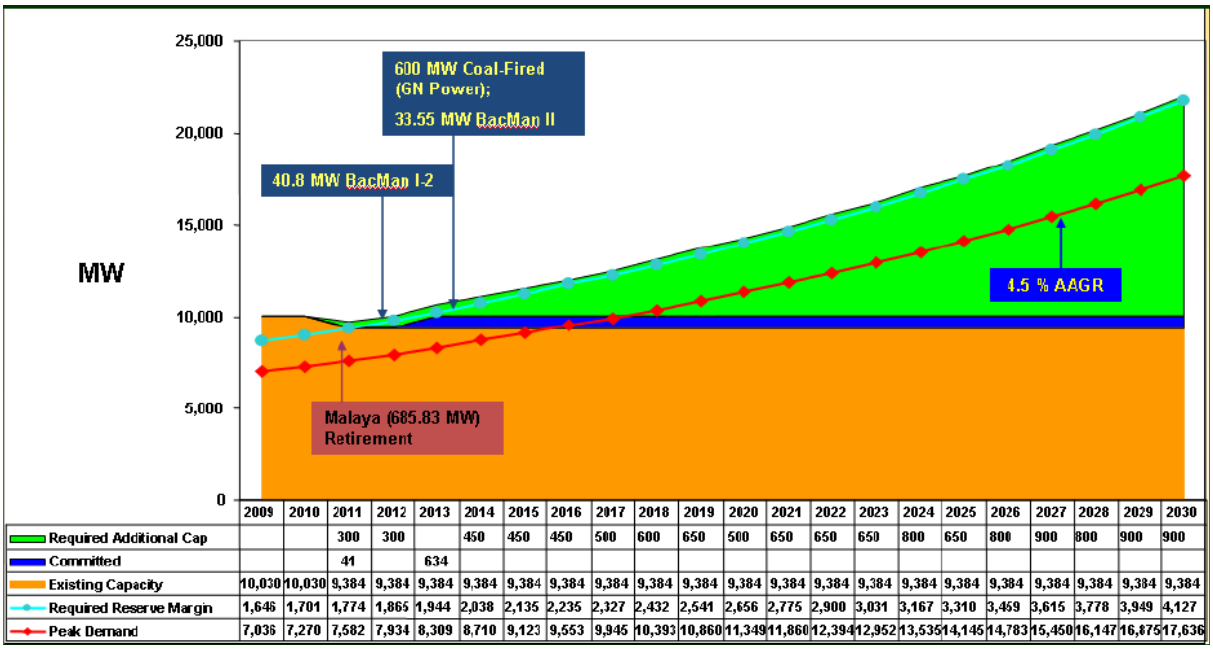
The following table shows Power Development Plans up to 2030 for the 3 regions. The required power sources are 11,900 MW in Luzon, 2,150 MW in Visayas and 2,500 MW in Mindanao. However, at present, the total capacities of planned projects are only around 1,300 MW as mentioned above.

Table 2.1-3 List of Required Power Sources from 2009 to 2030

Year	Luzon Grid				Visayas Grid				Mindanao Grid			
	Plant Type			Total	Plant Type			Total	Plant Type			Total
	Base load	Mid range	Peaking		Base load	Mid range	Peaking		Base load	Mid range	Peaking	
2009							150	150				
2010											50	50
2011			300	300							50	50
2012		300		300					200			200
2013									100			100
2014		300	150	450					100			100
2015			450	450					100			100
2016		300	150	450					100			100
2017	500			500								
2018		300	300	600			100	100	100			100
2019	500		150	650	100		50	150	100			100
2020	500			500	100			100	100			100
2021	500		150	650	100		50	150			100	100
2022	500		150	650	100			100	100			100
2023	500		150	650	100		50	150	100		50	150
2024	500		300	800	100		50	150	100		50	150
2025	500		150	650	100		50	150	100		50	150
2026	500	300		800	100		100	200	100		50	150
2027		600	300	900	100		50	150	100		50	150
2028	500	300		800	100		100	200	200			200
2029		600	300	900	200			200	100		50	150
2030		900		900	200			200	200			200
Total	**5,000**	**3,900**	**3,000**	**11,900**	**1,400**		**750**	**2,150**	**2,000**		**500**	**2,500**

Source: Power Development Plan, 2009 - 2030, DOE Portal

In the Luzon grid, 600 MW Bataan Coal Fired Plant is planned to be completed in 2012, 40 MW BacMan 1-2 Geothermal Plant (2012) and 34 MW BacMan II Geothermal Plant (2014).

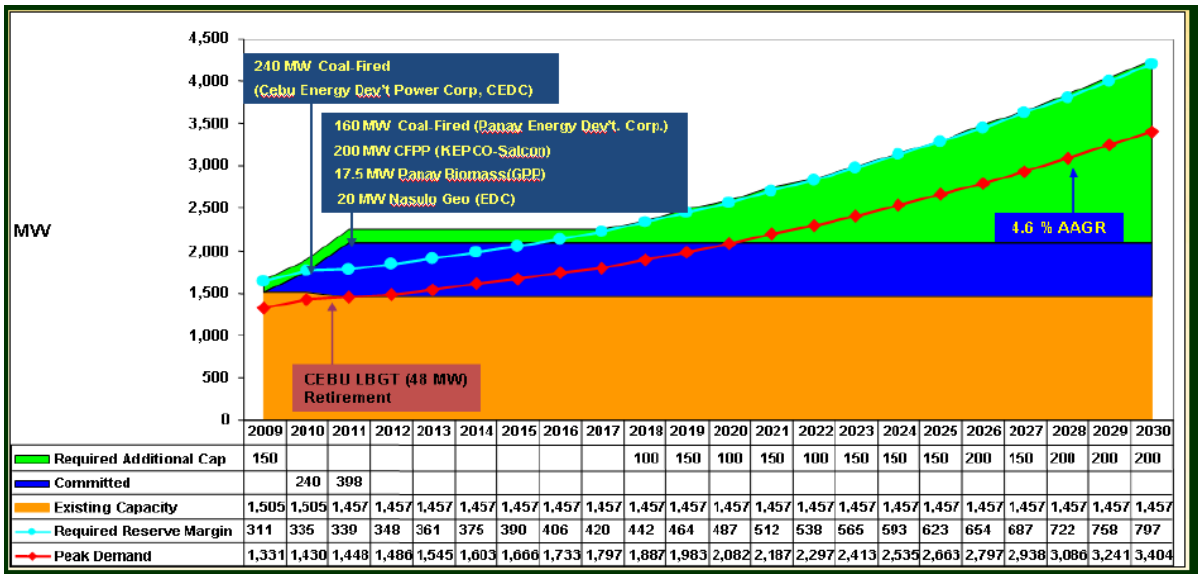


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Required Additional Cap			300	300		450	450	450	500	600	650	500	650	650	650	800	650	800	900	800	900	900
Committed			41		634																	
Existing Capacity	10,030	10,030	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384	9,384
Required Reserve Margin	1,646	1,701	1,774	1,865	1,944	2,038	2,135	2,235	2,327	2,432	2,541	2,656	2,775	2,900	3,031	3,167	3,310	3,459	3,615	3,778	3,949	4,127
Peak Demand	7,036	7,270	7,582	7,934	8,309	8,710	9,123	9,553	9,945	10,393	10,860	11,349	11,860	12,394	12,952	13,535	14,145	14,783	15,450	16,147	16,875	17,636

Fig. 2.1-1 Forecast of Power Supply vs. Demand in the Luzon Grid

Source: Power Development Plan, 2009 – 2030, DOE Portal

In the Visayas grid, a 240 MW Cebu Coal Fired Plant (2010), 160 MW Coal Fired Plant (2011), 200 MW Combined Cycle Coal Fired Plant, 18 MW Panay Biomass Plant and 20 MW Nasulu Geothermal Plant are planned as shown in Fig. 2.1-2.

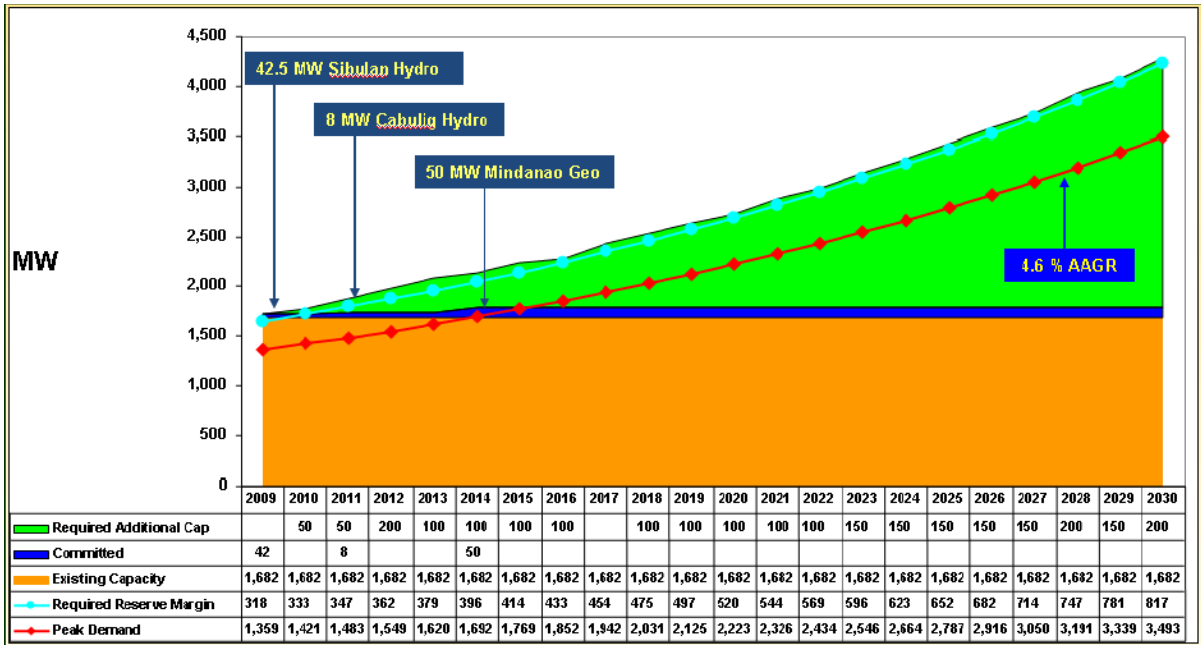


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Required Additional Cap	150									100	150	100	150	100	150	150	150	200	150	200	200	200
Committed		240	398																			
Existing Capacity	1,505	1,505	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457	1,457
Required Reserve Margin	311	335	339	348	361	375	390	406	420	442	464	487	512	538	565	593	623	654	687	722	758	797
Peak Demand	1,331	1,430	1,448	1,486	1,545	1,603	1,666	1,733	1,797	1,887	1,983	2,082	2,187	2,297	2,413	2,535	2,663	2,797	2,938	3,086	3,241	3,404

Fig. 2.1-2 Forecast of Power Supply vs. Demand in the Visayas Grid

Source: Power Development Plan, 2009 - 2030, DOE Portal

In the Mindanao grid, the Cabulig HEP will be completed in 2012 and Mindanao Geothermal Plant (2014) are planned.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Required Additional Cap		50	50	200	100	100	100	100		100	100	100	100	100	150	150	150	150	150	200	150	200
Committed	42		8			50																
Existing Capacity	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682
Required Reserve Margin	318	333	347	362	379	396	414	433	454	475	497	520	544	569	596	623	652	682	714	747	781	817
Peak Demand	1,359	1,421	1,483	1,549	1,620	1,692	1,769	1,852	1,942	2,031	2,125	2,223	2,326	2,434	2,546	2,664	2,787	2,916	3,050	3,191	3,339	3,493

Fig. 2.1-3 Forecast of Power Supply vs. Demand in the Mindanao Grid

Source : Power Development Plan, 2009 - 2030, DOE Portal

2.2 TRANSMISSION DEVELOPMENT PLANS

2.2.1 Current Status of Transmission Lines

Voltages of transmission lines in the Philippines are 500 kV, 350 kV, 230 kV, 138 kV, 115 kV and 69 kV. Transmission line facilities owned by the NPC (National Power Corporation) were transferred to the TRANSCO (National Transmission Corporation) following the enactment of the EPIRA (Electric Power Industrial Reform Act) in June 2001, and then in January 2009, the NGCP (National Grid Corporation of the Philippines) took over the commercial operation of the nationwide transmission line grids. The total length of transmission lines owned by TRANSCO is as given in the following table.

Table 2.2-1 Length of Transmission Lines (as of Dec. 2004)

(unit : km)

Voltage Level	Luzon	Visayas	Mindanao	Philippines
500kV	1,234			1,234
350kV	390	564		954
230kV	5,011	375		5,386
138kV		1,784	3,211	4,996
115kV	3,859			3,859
69kV		2,349	2,541	4,890
Total	10,494	5,072	5,753	21,319

Source : "Power Demands and Power Development Plans for the Philippines," Aug. 2009

The nationwide transmission line grids are shown in Fig. 2.2-1.

In the Luzon grid, the transmission backbones are 500 kV and 230 kV and load grids are 115 kV, 69 kV and 34.5 kV. In the Visayas and Mindanao grids, the transmission backbone is 138 kV and load grids are 69 kV and 34.5 kV.
In Luzon, where Metro Manila has large demand, power sources are concentrated in the northern and southern portions of Manila. In order to meet such demand, 230 kV and 500 kV transmission line networks are formed around the metropolitan area.

Since the 350 kV DC submarine cable was connected between Luzon and Leyte islands in 1997, a regional grid became available between Luzon and Visayas. Grid connections between 6 islands in Visayas have been established. 138 kV overhead lines are linked between Leyte and Samar, a 138 kV AC submarine cable between Leyte and Bohol, a 230 kV AC submarine cable between Leyte and Cebu, a 138 kV AC submarine cable between Cebu and Negros and a submarine cable between Negros and Panay. Also, since the power demand in Cebu has been increasing steadily, the line between Cebu and Leyte has been upgraded from 200 MW to 400 MW (refer to Fig. 2.2-2).

In Visayas, as large-scale geothermal plants exist on Leyte, the power is supplied from Leyte to Cebu, then to Negros and Panay, and from Leyte to Bohol. Moreover, the power flows from Leyte to Luzon by submarine cable.

The Mindanao grid is independent. The demand is high in the southeastern part of Davao. On the other hand, major power sources are the Agus HEP Complex and Pulangi HEP Plant located in the middle and mid-western parts. A 138 kV backbone line expands east-west and to the south from the center of the Agus HEP Complex (refer to Fig. 2.2-3).

Fig. 2.2-1 Nationwide Transmission Line Grids

Source : TRANSCO

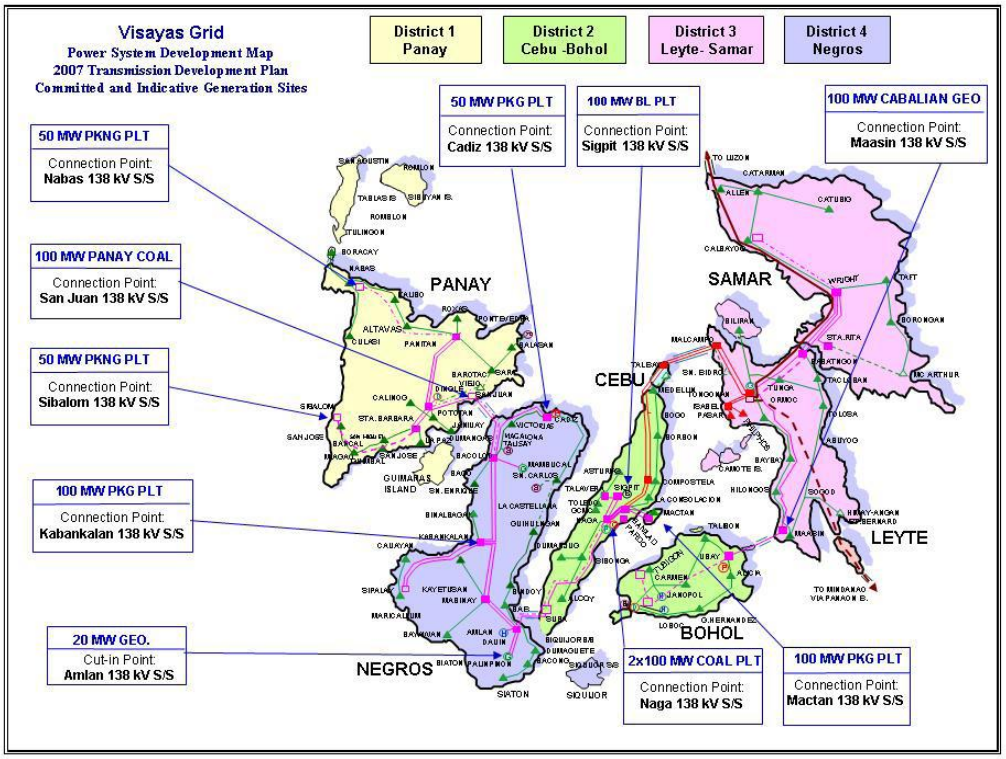


Fig. 2.2-2 Transmission Line Network of the Visayas System

Source : Transmission Development Plan 2007, TRANSCO

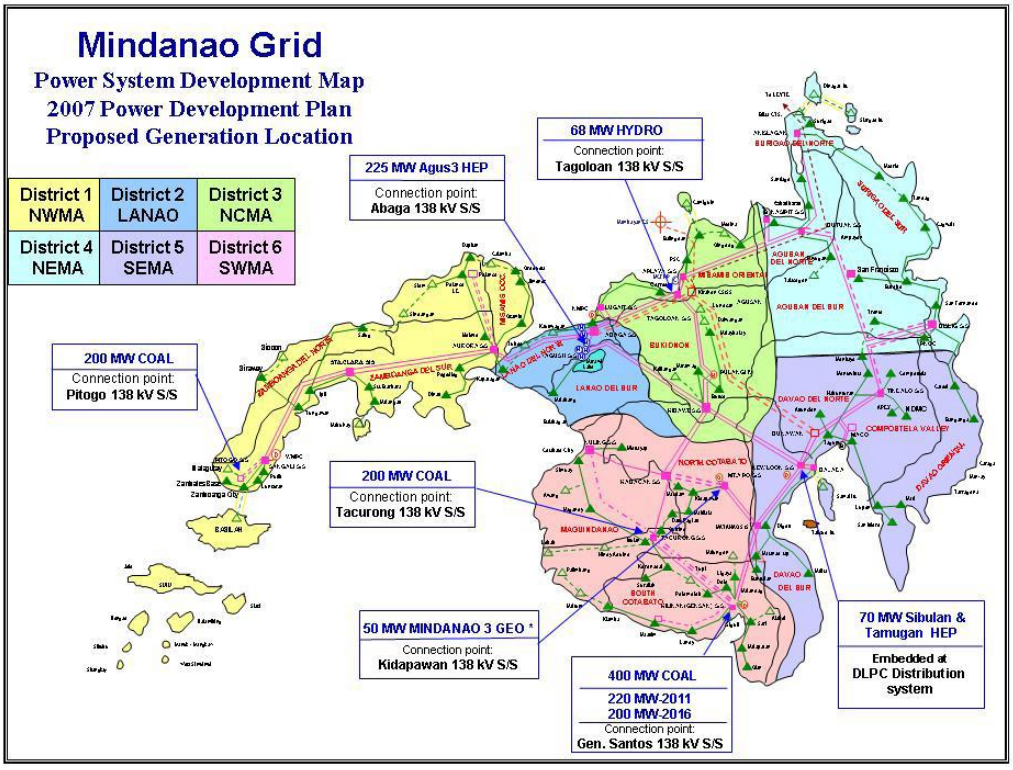


Fig. 2.2-3 Transmission Line Network of the Mindanao System

Source : Transmission Development Plan 2007, TRANSCO

2.2.2 Transmission Line Development Plans

At present, there are grid connections between the Visayas islands, and projects to enhance the existing grids between Cebu and Negros (from 100 MW to 200 MW, 2007), and between Negros and Panay (from 100 MW to 200 MW, 2008) were implemented. A submarine cable between Leyte (Visayas) and Mindanao (500 MW) is planned.

Among the 9 targeted islands in the study, the grids of the 5 islands of Mindoro, Masbate, Marinduque, Romblon and Palawan are independent grids.

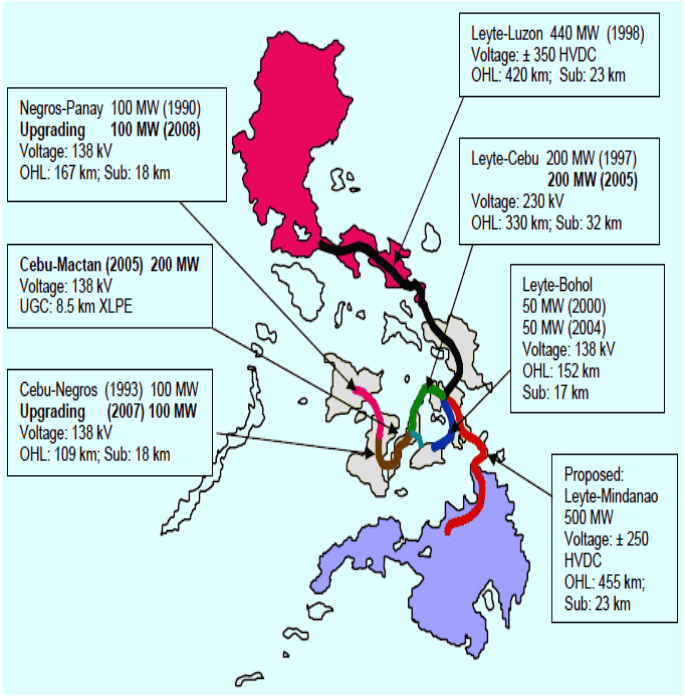


Fig. 2.2-4 Grid Connections of Transmission Lines between Islands

Source : Transmission Development Plan 2007, TRANSCO

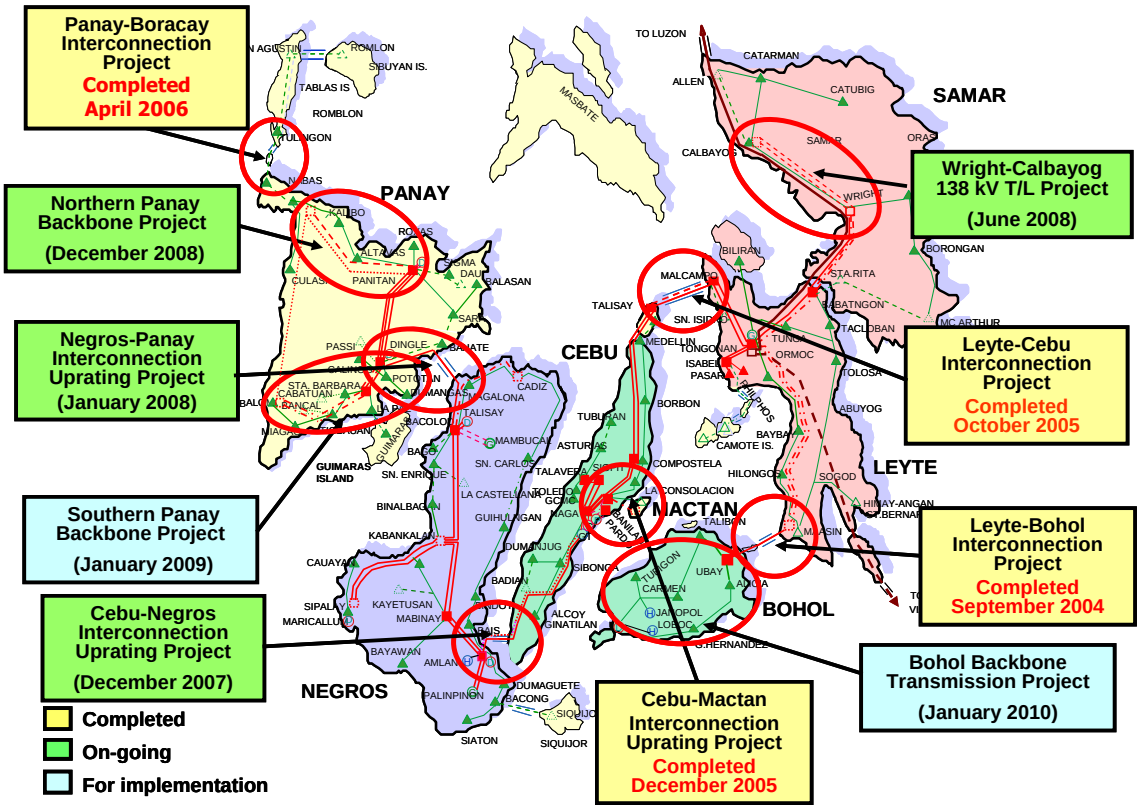


Fig. 2.2-5 Grid Connections of Transmission Lines between Islands in the Visayas System

Source : Transmission Development Plan 2007, TRANSCO

2.3 DISTRIBUTION LINES

In the Philippines the voltage of the distribution line steps down from 69 kV to 13.2 kV or 7,620 V at substations for distribution. Operation and management of the distribution line network are done by ECs (Electric Cooperatives), PUs (Private Utilities), etc.

The distribution power companies in the Philippines consist of 16 PIOUs (Private Investor-Owned Utilities) or DU (Distribution Utility), 119 ECs and 8 LGUOUs (Local Government Unit-Owned Utilities). The supply area of distribution power companies is shown in Fig. 2.3-1.

As of the end of 2007, the number of customers signed up with ECs numbered 7,764,000 (58% of total) and the electricity sales by the ECs accounted for 100,285 GWh (24%)

Table 2.3-1 Outline of Power Distribution Companies (December 2007)

Electric Distribution Utilities	Towns/Cities			Barangays			Connections		
	Coverage	Energized	%	Coverage	Energized	%	Coverage	Served	%
Electric Cooperatives	1,471	1,471	100	36,030	34,682	96.0	11,499,900	7,764,307	68.0
MERALCO	111	111	100	4,322	4,261	98.6	4,416,000	4,404,305	99.0
PIOUs/LGUs/Others	48	48	100	1,628	1,599	98.0	1,486,000	1,194,111	80.0
TOTAL PHILIPPINES	1,630	1,630	100	41,980	40,542	97.0	17,401,900	13,362,723	77.0

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

In order to ensure the competitive performance and responsiveness of ECs in a challenge-driven power industry, the NEA (National Electrification Administration) issued the Enhanced Criteria for Categorization of ECs in June, 2008 through Memorandum No. 2008-019.

The EC categorization is an indication to assess the performance of each and every EC based on a set of criteria, which consists of (1) amortization payment to the NEA, (2) system loss, (3) collection efficiency, (4) payment to power supplier/s and the NGCP, including EC's unpaid power accounts with the NPC / PSALM (Power Sector Assets and Liabilities Management Corporation), EVAT (Expanded Value Added Tax) and WESM (Wholesale Electricity Spot Market), (5) Non-power cost, (6) level of energization, which now centers on sitios, and (7) results of financial operation.

Table 2.3-2 Enhanced Criteria for Categorization of ECs

	Criteria	Description	Point Score
(1)	Amortization payment to NEA	This pertains to the ability of the ECs to fulfill their loan obligations with the NEA in terms of payment of their respective amortization contracts.	Regular: 15 ~ -8 Restructured: 12 ~ -10 Incentive: Max. 2
(2)	System loss	This parameter measures the ECs ability to reduce the power losses in their electric system and effectively reduce their distribution cost.	25 ~ 0 25: Below 10% 0 : 15.51% and above Incentive: Max. 2
(3)	Collection efficiency	This item refers to the capability of ECs to collect accounts receivables. While the EC may be performing well in other aspects of operations, its inability to collect receivables on time will affect its financial position.	7 ~ 0 7: 95% and above 0: 80% and below
(4)	Payment to power supplier's and TRANSCO	These are the biggest expenses an EC must promptly settle on time so as not to incur additional surcharges and other penalties and ultimately disconnection.	Main Grid: 10 ~ -3 Island EC: 15 ~ -5
(5)	Non-power cost	In order for the ECs to confine their non-power expenditures within the NEA-approved level computed based on the ERC approved rate, appropriate points are added to the overall rating of ECs depending on how these expenditures match with their approved non-power level.	10 ~ 0 Budget compliance within approved level: 10 Above approved level by 5% and above: 0
(6)	Level of energization	This criteria is in line with the NEA's mandate on total electrification and the government's target of 100% barangay energization by 2009. To recognize the EC's efforts to serve additional consumers, the level of connection performance is included as part of this parameter.	7 ~ 0 Level of energization 100%: 7 Below 45%: 0 Incentive: Max. 1 % of accomplishment 3 ~ 0 based on ICPM targets 50% and above: 3 below 30%: 0
(7)	Results of financial operation	This parameter measures the EC's ability to earn margin in order to compete in the deregulated environment and gain credit worthiness among banks and other financing institutions.	5, 0 With margin before reinvestment: 5 Net loss: 0

Source : Memorandum No. 2008-019, 17 June 2007, NEA

http://www.nea.gov.ph/what-is-new/Memorandum-to-ECs/Enhanced-Criteria-for-the-Categorization-of-ECs-NEA-Memorandum-No-2008-019/ecmemo_2008-19.pdf

The overall scoring system is given in Table 2.3-3. Six categories corresponding to the adjectival rating are applied. The evaluation results of the ECs in 2009 are also given in this same table.

Table 2.3-3 Overall Scoring System of ECs and Evaluation Results in 2009

Total Score		Adjectival Rating	Number	% of sub-total
90% and above	A+	Outstanding	64	59
75% - 89%	A	Very Satisfactory	15	14
65% - 74%	B	Satisfactory	12	11
55% - 64%	C	Fair	3	3
30% - 54%	D	Poor	3	3
Below 29%	E	*	8	7
-	-	N/A	3	3
Sub-total			**108**	100
-	-	CDM	11	
Total			**119**	

* : ECs under this category have not shown any improvement in their operation.
N/A: Not available, CDA (Cooperative Development Authorities)

Source : Memorandum No. 2008-019, 17 June 2007, NEA, NEA Annual Report, 2010
http://www.nea.gov.ph/index.php/publications/annual-report

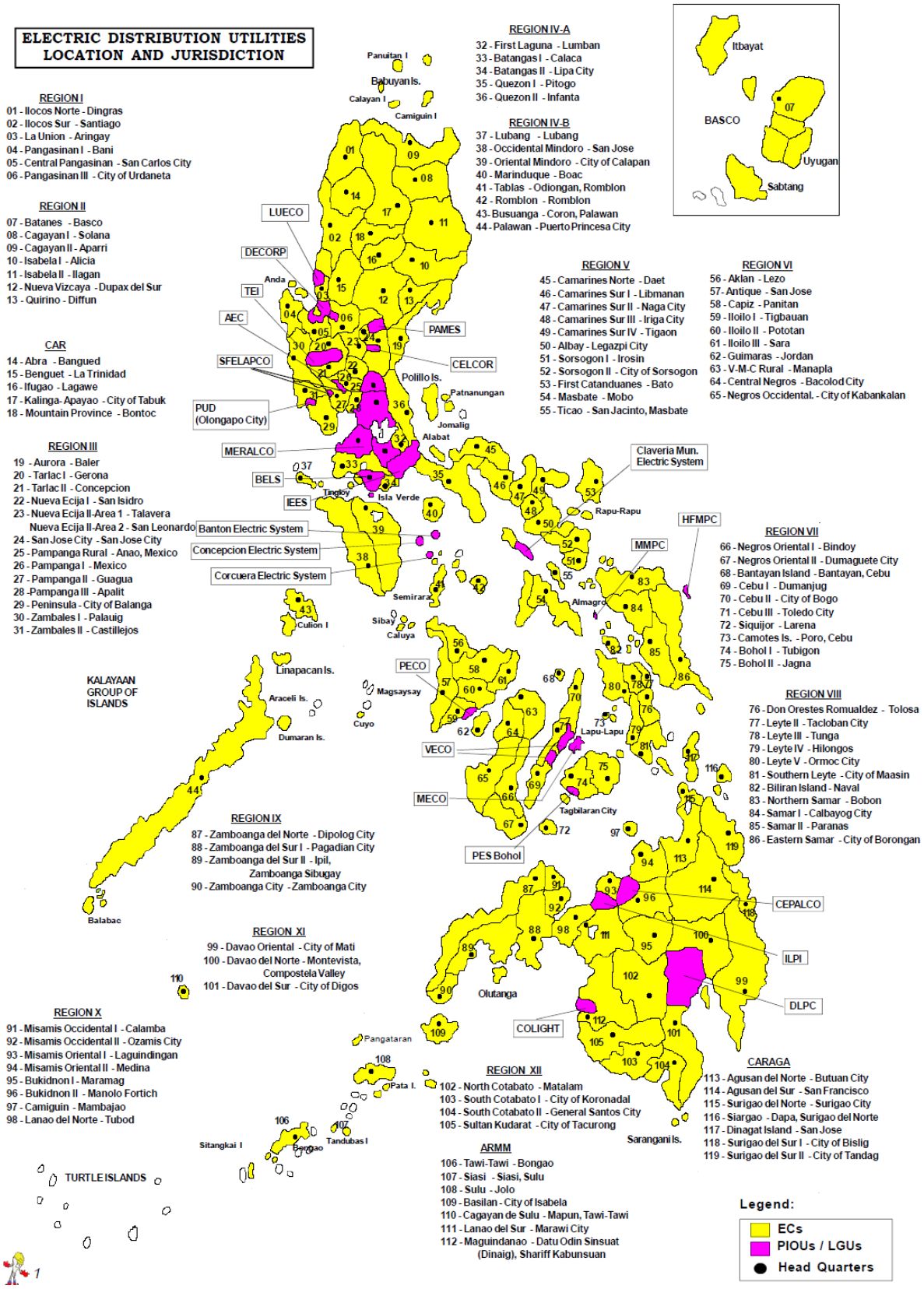


Fig. 2.3-1 Electric Cooperatives and Private Utilities All Over the Philippines

2.4 RURAL ELECTRIFICATION PLANS

Rural electrification in the Philippines has been taken up as an important policy of the government since rural electrification is expected to contribute to poverty reduction in rural area by means of improving the standard of living and creating new income sources. The Philippine Government declared rural electrification a nation policy in 1960 and established the EA (Electrification Authorities). Moreover, in 1969, under the National Electrification Act, the EA was reorganized as the current NEA and ECs were introduced as a community-based approach to rural electrification alongside promotion by this government agency. At that time, the household electrification rate was only 22.9%.

When the former Ministry of Energy was abolished alongside the 1986 collapse of the Marcos regime, the NEA was placed under the jurisdiction of the DENR (Department of Environmental and Natural Recourses). Then, in December 1992, the DOE Law was approved and the DOE was newly established and the NEA was placed under the jurisdiction of the DOE.

Although in 1997, electrification was achieved at the municipality level, the barangay electrification rate was only 72%. As a measure against the low progress of rural electrification, which was approximately 500 barangays per year, the DOE launched the ABEP (Accelerate Barangay Electrification Program) with participation of the NEA, NPC-SPAG (National Power Corporation Small Power Utility Group) and PNOC-EDC (Philippine National Oil Company - Energy Development Corporation) in 1999 in order to accelerate rural electrification. Furthermore, this program was renamed the O'ILAW Program in 2000 and its promotion activities were expanded.

An O'ILAW Program team was established and the policy of rural electrification was crafted so as to include ER-1-94 funded projects and encourage the private sector to participate in rural electrification. Three independent generation companies in PNOC-EDC, Mirant Philippines (IPP (Independent Power Producer)), United States of America), KEPCO Ilijan Corporation (IPP, South Korea) joined the projects.

The FREED (Fund of Rural Electrification Economic Development) was established and attempts were made to introduce mechanisms to utilize private capital. However, this fund is inactive now.

In 2001, the PMO (Project Management Office) was established in the DOE and began conducting activities as the secretariat and network center of the O'ILAW Program. As a result, the barangay electrification rate reached 90.6% in April 2004 and the annual progress of electrification was more than 1,200 barangays per year on average.
In April 2003, the O'ILAW Program was terminated and the ER (Expanded Rural Electrification) Program was newly started. In accordance with the terms of the EPIRA or RA (Republic Act) 9136, this program followed the policy goal of achieving 100% barangay electrification by 2008. Other objectives of the O'ILAW Program were to strengthen public-private cooperation and to achieve a 90 % household electrification rate by 2017.

At the end of 2005, the barangay electrification rate was 94%, but it was reported that the household electrification rate was about 85%, the rural rate was around 75%, and about 2.5 million households did not have access to electricity.

Non-electrified barangays and sitios are mostly scattered in remote areas and it is unlikely that a distribution line will be extended to those areas. While efforts have been made to develop electrification in such remote areas by using RE such as PV (Photovoltaic) facilities

and MHP (Micro-Hydro Electric Power) facilities as independent power sources, sustainability is a serious issue.

The progress of rural electrification from 1997 to 2005 in the Philippines is given in Table 2.4-1. As of 2008, the electrification level of the Philippines was around 97%. Luzon had reached 98.06% level, Visayas, 98.14%, and Mindanao, 93.38% as given in Table 2.4-2,

Consistent with the overall objective of total barangay electrification by 2010 and 90% household electrification by 2017, all remaining unelectrified barangays in the country, which consist of unviable areas in the main island grids and unelectrified barangays in the small islands and isolated grids, will be provided with electricity service.
The next level of implementing rural and missionary electrification, which would include greater support to sitios and household electrification, subsidy from the UC (Universal Charge) will be significant.

Table 2.4-1 Progress of Rural Electrification

Year	Target	Number of Electrified Barangay	Accumulated Number of Electrified Barangay	Electrification Rate (%)
1997	-	854	30,254	72.0
1998	-	1,272	31,526	75.1
1999	900	755	32,281	76.9
2000	1,621	1,366	33,547	80.1
2001	1,353	1,253	34,900	83.1
2002	1,636	1,699	36,590	87.1
2003		1,159	37,749	89.9
2004		1,169	38,918	92.8
2005		463	39,381	**93.9**
2008			40,705	**97.0**

Source : O' ILAW Program Final Report and Philippine Energy Plan

Table 2.4-2 Regional Status of Barangay Electrification (As of 2008)

Area	Number of Potential Barangays	Number of Electrified Barangay	Unelectrified Barangay	Electrification Rate (%)
Luzon	20,489	20,092	397	98.06
Visayas	11,444	11,231	213	98.14
Mindanao	10,047	9,382	665	93.38
Total	**41,980**	**40,705**	**1,275**	**96.96**

Source: Missionary Electrification Development Plan for 2009-2013, Electric Power Industry Management Bureau, DOE, Dec. 2008

In compliance with the EPIRA or RA 9136, the DOE, in coordination with the NPC-SPUG, NEA, NPPs (New Private Power Providers), IPPs, DUs and QTPs (Qualified Third Parties), has prepared the Missionary Electrification Development Plan for 2009-2013 (EPIMB (Electric Power Industry Management Bureau), DOE, December 2008).
The program covers two major activities: a SPUG operation and services improvement

program and private sector participation program in power generation.

A number of programs on RE are being coordinated through the ER Program. Currently, funding for missionary electrification comes from various sources such as the regular budget of the DOE, Electrification Fund from Energy Regulations No.1-94 and corporate social responsibility of IPPs, public private partnerships, grants and loans. Given that, the next level of implementing rural and missionary electrification, which would include greater support to sitios and household electrification, subsidy from the UC will be significant.

The small and medium-scale run-of-river type HEP potential sites identified in the study are to be connected to the grid in principle, so the scheme is not applied to non-electrified barangays and sitios. There are a lot of small-scale run-of-river type HEP potential sites in rural areas and those sites are possible targets to be developed by ECs, LGUs, etc. The FIT, preferential tax treatment for the projects and other incentives are to be applied to run-of-river type HEPs.