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Japan International Cooperation Agency
Department of Energy, Republic of the Philippines
Provincial Government of Palawan, Republic of the Philippines

The Master Plan Study of Power Development In Palawan Province Republic of the Philippines

Final Report (Main Report)

September 2004

Chubu Electric Power Co., Inc.

Nomura Research Institute, Ltd.

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Preface

In response to the request from the Government of Republic of the Philippines, the Government of Japan decided to conduct the Master Plan Study of Power Development in Palawan Province, and the study was implemented by the Japan International Cooperation Agency (JICA).

JICA sent to the Philippines the study team headed by Mr. Yoshitaka SAITO of Chubu Electric Power Co., Inc. and organized by Chubu Electric Power Co., Inc. and Nomura Research Institute, Ltd. five times from February 2003 to September 2004.

The team held discussions with the officials concerned of the Government of Republic of the Philippines and the Provincial Government of Palawan, and conducted related field surveys. After returning to Japan, the study team conducted further studies and compiled the final results in this report.

I hope this report will contribute to the promotion of the plan and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Republic of the Philippines and the Provincial Government of Palawan for their close cooperation throughout the study.

September 2004

Tadashi IZAWA
Vice President
Japan International Cooperation Agency

September 2004

Tadashi IZAWA
Vice President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

We are pleased to submit to you the report of the Master Plan Study of Power Development in Palawan Province. This study was implemented by Chubu Electric Power Co., Inc. and Nomura Research Institute, Ltd from February 2003 to September 2004 based on the contract with your Agency.

This report presents the comprehensive proposal, such as the Optimal Power Development Plan considering environmental aspects in the Province, Transmission Development Plan and System Operation Plan considering appropriate placement of power plants, Rural Electrification Plan focusing on its sustainability and measures from technical, organizational and institutional aspects in order to realize the above plans.

We trust that the realization of our proposal will much contribute to the enhancement of sustainability in rural electrification activities, the stable progress of electric power sector and will contribute the improvement of the public welfare as well in Palawan.

In view of urgency to increase efficiency of the power sector and promote rural electrification, we recommend that the Government of Republic of the Philippines and the Provincial Government of Palawan implement our proposal by applying results of technology transfer in the study as a top priority.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Economy, Trade and Industry. We also wish to express our deep gratitude to the Department of Energy, the Provincial Government of Palawan, other authorities concerned of the Government of Republic of the Philippines for the close cooperation and assistance extended to us during our investigations and study.

Very truly yours,

Yoshitaka SAITO
Team Leader
The Master Plan Study of Power Development in Palawan Province

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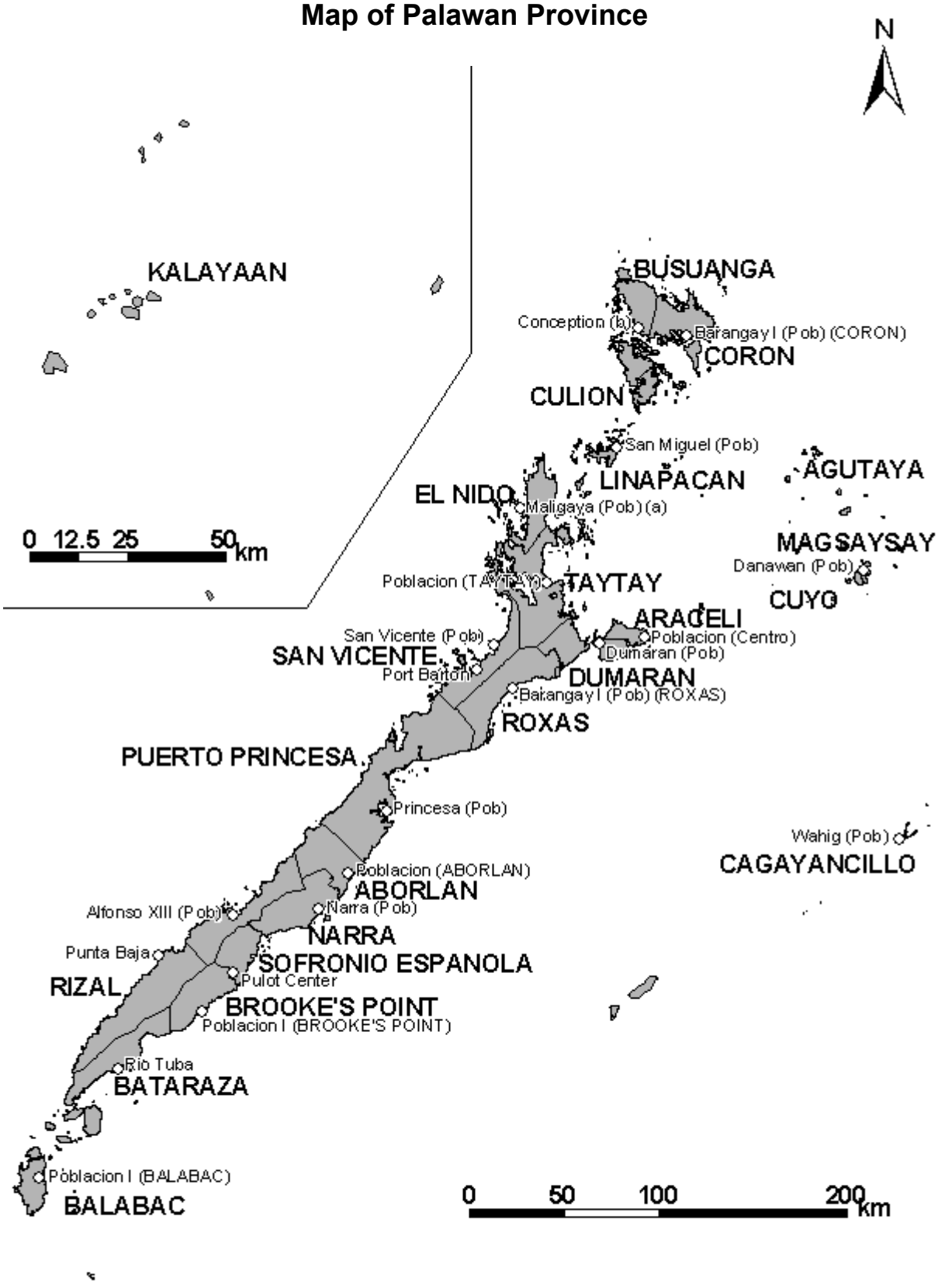
Abbreviation

ALD	Automatic Load Dropping
APL	Adaptable Program Loan
BAPA	Barangay Power Association
BCS	Battery Charging System or Battery Charging Station
BEP	Barangay Electrification Program
BISELCO	Busuanga Island Electric Cooperative
BOT	Build - Operate - Transfer
CDM	Clean Development Mechanism
DENR	Department of Environment and Natural Resources
DILG	Department Interior and Local Government
DNA	Designated National Authority
DOE	Department of Energy
DPP	Diesel Power Plant
ECs	Electric Cooperatives
ECAN	Environmentally Critical Areas Network
EPIRA	Electric Power Industry Reform Act
ER	Expanded Rural Electrification
ERC	Energy Regulatory Commission
GDP	Gross Domestic Products
GEF	Global Environment Facility
GHG	Green House Gas
GPDP	Gross Provincial Domestic Products
IPP	Independent Power Producer
IRR	Implementing Rules and Regulations
JICA	Japan International Cooperation Agency
KEPCO	Korea Electric Power Corporation
LGU	Local Government Unit
LOLP	Loss-of-Load Probability
MEDP	Missionary Electrification Development Program
NEA	National Electrification Administration
NGO	Non-Governmental Organization
NPC	National Power Corporation
NPC-SPUG	National Power Corporation - Small Power Utilities Group
O&M	Operation & Maintenance
ODA	Official Development Assistance
PALECO	Palawan Electric Cooperative
PCSD	Palawan Council for Sustainable Development
PDP	Power Development Program
PEP	Philippine Energy Plan

PGP	Provincial Government of Palawan
PNRELSP	Palawan New and Renewable Energy and Livelihood Support Project
POPS	Private Owned Power Sources or Privately Owed Power System
PPDO	Provincial Planning and Development Office
QTPs	Qualified Third Parties
RE	Rural Electrification
REFP	Rural Electrification Fund Pool
RESCO	Renewable Energy Service Company
SCADA	Supervisory Control And Data Acquisition System
SEP	Strategic Environmental Plan for Palawan
SHS	Solar Home System
UNDP	United Nations Development Programme
WB	World Bank
WASP-IV	Wien Automatic System Planning

Exchange Rate : 55 Pesos/US dollars (As of the end of December 2003)

Map of Palawan Province



Executive Summary

The most important issue facing the power sector in the Philippines is the improvement of barangay electrification of the whole country and the creation of a vibrant power sector through the Electric Power Industry Reform Act (EPIRA), which was enacted in June of 2001. This act aims at the unbundling of the power market and the creation of conditions that are more conductive to competition.

Under the Philippine Energy Plan 2002-2011, the Department of Energy (DOE) plans to achieve the electrification of the whole barangays by 2006. In order to achieve this goal, many electrification projects have been conducted using funds from DOE, NEA, ECs, provincial governments, IPP and various donors so far, which raised the barangay electrification ratio to 89.99 %[1]. The number of un-electrified barangay decreased to 4,197 as of 2003 year-end.

However, these efforts to improve the barangay electrification ironically widened the gap between urban and rural areas in terms of the electricity level since most of projects were implemented in the urban areas where the electrification projects are economically feasible.

Palawan is categorized as the Missionary Electrification Area defined by EPIRA and compared to the national average it had a considerably lower barangay electrification ratio of 62.9 % and a household electrification ratio of 34.0% as of 2003 year-end.

NPC-SPUG owns several power facilities and transmission facilities in Palawan province (hereinafter referred to as the "EC-grid system") and provides about 95% of the electricity for all of Palawan. ECs in Palawan, PALECO and BISELCO purchase electricity from NPC-SPUG and distribute it to consumers.

The capacity of the EC-grid system has enough reserve margins for the electricity demand at the year of 2003. However, the annual increase in power demand, which was mainly led by the residential sector, was about 10%[2], which will lead to a significantly higher demand in the future. Therefore, expanding and upgrading the EC-grid system will be needed.

The Master Plan includes the following two sub-plans reflecting the situation of the power sector in Palawan Province described above.

1) Barangay Electrification Plan with electrification target up to 2015
2) Power Development Plan of the EC-grid system based on the results of demand forecast and Barangay Electrification Plan

[1] Source : DOE Homepage
[2] Actual averaged incremental ratio from 1995 to 2001

Barangay Electrification Plan

The barangay electrification plan in the Master Plan should be consistent with the National Energy Plan and also consider the diffusion of electricity at the household level. Therefore, the barangay electrification plan consists of two phased plans, 1) a plan to electrify all barangays by 2006 and 2) a household electrification improvement plan after 2007.

In the Study, three electrification methods were considered: 1) extension of the existing EC-grid, 2) mini-grid system and 3) stand-alone system. The appropriate electrification method with the least cost was selected from the three options for each barangay through economic evaluations based on the demand forecast and socio-economic conditions of the target barangay.

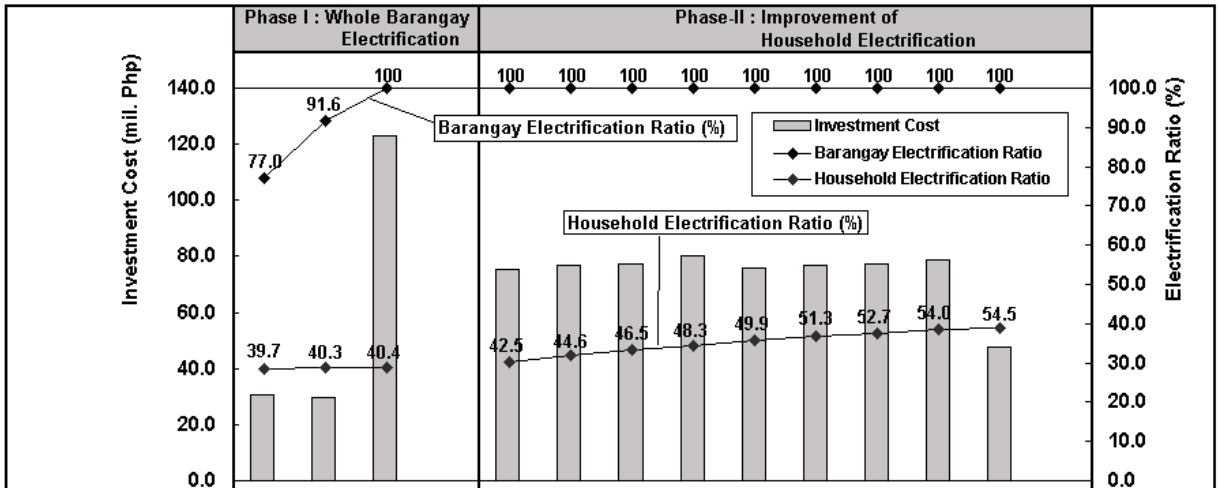
Moreover, the Study team looked into the possibility for various generation systems, including renewable energy systems such as mini-micro hydropower, photovoltaic systems and wind power systems, as well as the standard diesel configuration. The appropriate generation system was selected based on the evaluation of the renewable energy potential and the economic efficiency of the project.

The barangay electrification plan consists of following two phases.

Phase-I : Whole Barangay Electrification
Phase-II : Improvement of Household Electrification

Phase-I (2004-2006) will aim for electrification of all barangays, which will require the electrification of 160 barangays. After completion of phase-I, the barangay electrification ratio in Palawan Province will be 100%. Investment for phase-I will come to 183.3 million pesos.

Phase-II (2007-2015) aims at the improvement of household electrification. The number of households connected to the power system will increase, and stand-alone systems will also be installed to improve household electrification. After completion of phase-II, the household electrification ratio will increase from 40.4% in 2006 to 54.5% in 2015. Investment for phase-II will total 665.2 million pesos.



Year	2004	2005	2006	S-Total	2007	2008	2009	2010	2011	2012	2013	2014	2015	S-Total	Total
Invest. Cost (mil. Php)	30.5	29.7	123.1	183.3	75.2	76.6	77.3	80.0	75.7	76.7	77.3	78.9	47.5	665.2	848.5
Barangay Electrification Ratio (%)	77.0	91.6	100.0		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
Household Electrification Ratio (%)	39.7	40.3	40.4		42.5	44.6	46.5	48.3	49.9	51.3	52.7	54.0	54.5		

Source : JICA Study team

EC-Grid Power Development Plan

The EC-grid power development plan consists of the plan for the backbone grid and the plan for isolated grids. Considering the current situation and the unique constraints of the power sector in Palawan, the Study team formulated the power development plan using the method involving the least cost. Moreover, environmental standards and regulations applicable to the region were taken into consideration for designing the power facilities.

The backbone grid system generates and provides over 80% of all electricity for Palawan province. The Study team prepared three sub-plans for the backbone grid power development plan since the system consists of several generation facilities and transmission facilities.

1) **Power generation plan** based on the establishment of the target level for LOLP and the power demand forecast up to 2015
2) **Transmission development plan** including expansion and upgrade plans for the transmission facilities for stable electricity supply
3) **System operation plan**, where the physical investment plan for stable and effective grid operations will be considered

The barangay electrification plan will also include barangays that are electrified by EC-grid extension. The Study team added the electricity demand from barangays electrified by EC-grid extension to the results of the demand forecast for the EC-grid.

On the other hand, the isolated EC-grids generally have a single generator attached to the distribution line. Therefore, the plan is formulated to ensure enough power generation capacity to meet the maximum power demand up to 2015 and also achieve the supply reliability criteria established by NPC-SPUG.

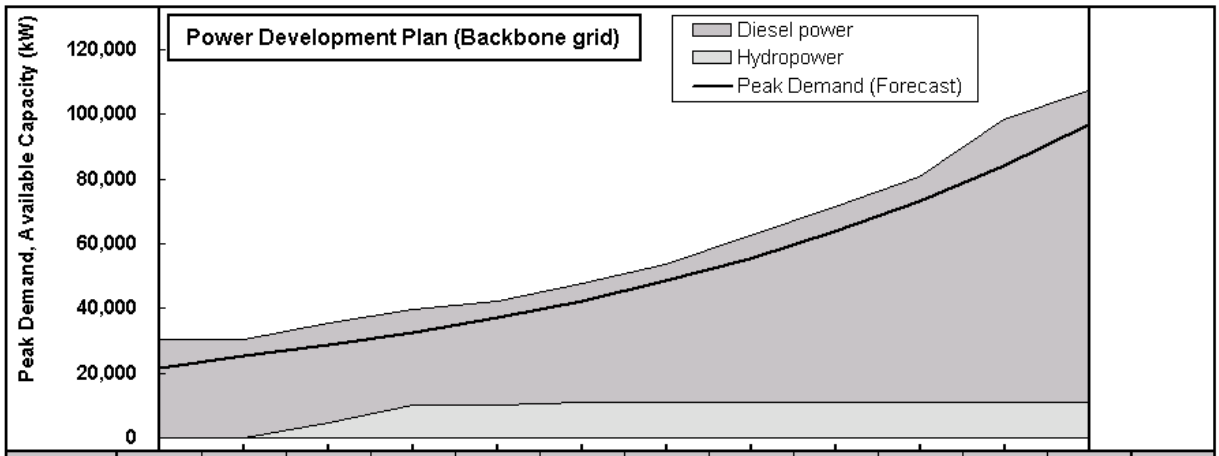
The forecast suggests that the peak power demand for the backbone grid system will increase from 21,517 kW in 2004 to 96,971 kW in 2015, and the power generation demand will increase from 117,723 MWh in 2004 to 530,457 MWh in 2015.

On the other hand, the plan should add a generation capacity of 95,550 kW to the backbone grid by 2015, which will increase the total capacity of the system to 120,550 kW. A hydropower plant will be developed for the first time in Palawan, which should account for 9% of the total capacity of the system in 2015, creating a much more diverse power source mix for Palawan.

The transmission line under construction from Puerto Princesa to Taytay will commence operation at 2005 year-end. Additionally, in 2015, the increase in power demand will make the economic advantage of interconnection much more attractive, which will justify a new transmission line from Taytay to El Nido, in order to connect the El Nido isolated grid to the backbone grid system. Along with the expansion of the transmission lines, 5 new substations will be added to the grid, as well as the addition of new transformers to the 4 existing substations in the backbone grid system by 2015.

The grid operation in 2015 will become considerably more complex, due to the increased number of generators and the total installed capacity. Therefore, it would be advisable to establishment a dispatch center in 2015 in order to achieve O&M cost reduction through the remote control of the hydro generator, and also to increase the reliability of system operations. Additionally, a system stabilizer (ALD) will also be installed to prevent a domino-like failure of the total system. This should be achieved in 2009, when the grid configuration around Puerto Princesa will be improved.

Investment cost for the EC-grid power development plan up to 2015 will come to 8,607.6 million pesos.

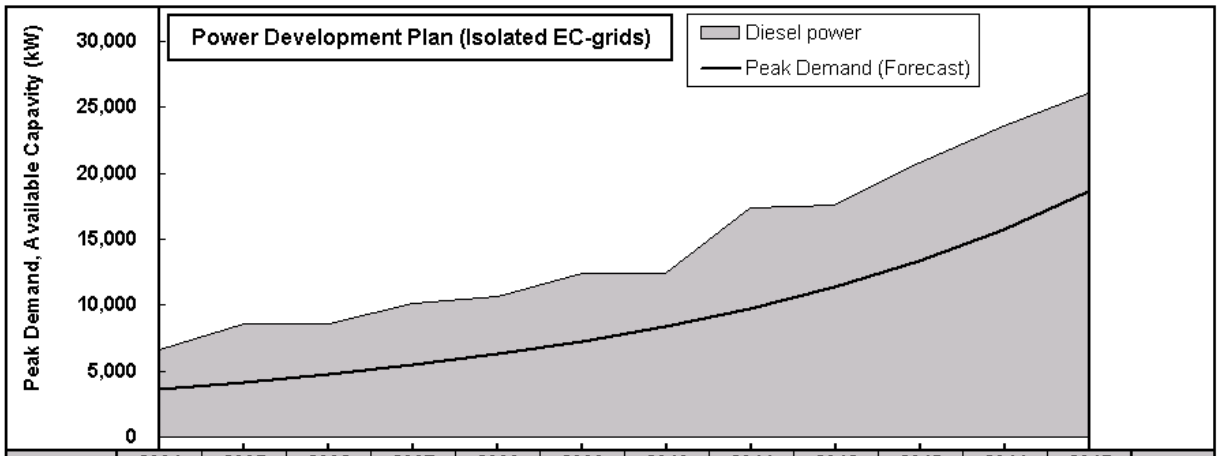


Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Invest. Cost (mil. Php)*	0.0	0.0	1,741.2	1,140.6	226.1	602.3	454.1	669.7	680.2	680.2	1,341.2	1,072.0	8,607.6

Note *: Investment costs including the cost of Generation development plan, Transmission development plan and System operation plan of the backbone grid
Source : JICA Study team

The additional generation capacity for the isolated grids by 2015 will be 23,532 kW, including the 1,269 kW from the 6 diesel power plants that will be transferred from the backbone grid system in 2007.

Investment cost for the power development plan for the isolated EC-grids up to 2015 will come to 1,628.1 million pesos.



Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Invest. Cost (mil. Php)	158.4	102.7	0.0	44.6	39.6	158.4	0.0	419.0	12.1	253.4	238.1	201.8	1,628.1

Source : JICA Study team

Financial Summary

Implementation of the Master Plan will require 11,084.2 million pesos up to 2015.

However, the breakdown of this investment shows that the funds for the EC-grid power development takes up the lion's share of this amount. The barangay electrification itself requires only about 8% of the total. This means that the fund procurement for the EC-grid power development plan is the major issue for the Master Plan.

1. Barangay Electrification Plan	848.5million Php
2. EC-Grid Power Development Plan	10,235.7million Php
a) Generation Development Plan	9,114.5million Php
b) Transmission Development Plan	1,042.0million Php
c) Power System Operation Plan	79.2million Php
Grand Total	11,084.2million Php

Source : JICA Study team

Recommendations

The total funding required for the power development in Palawan up to 2015 is 11,084.2 million pesos. This is a huge amount. Even the procurement of 848.5 million pesos for the barangay electrification alone would be quite a challenge.

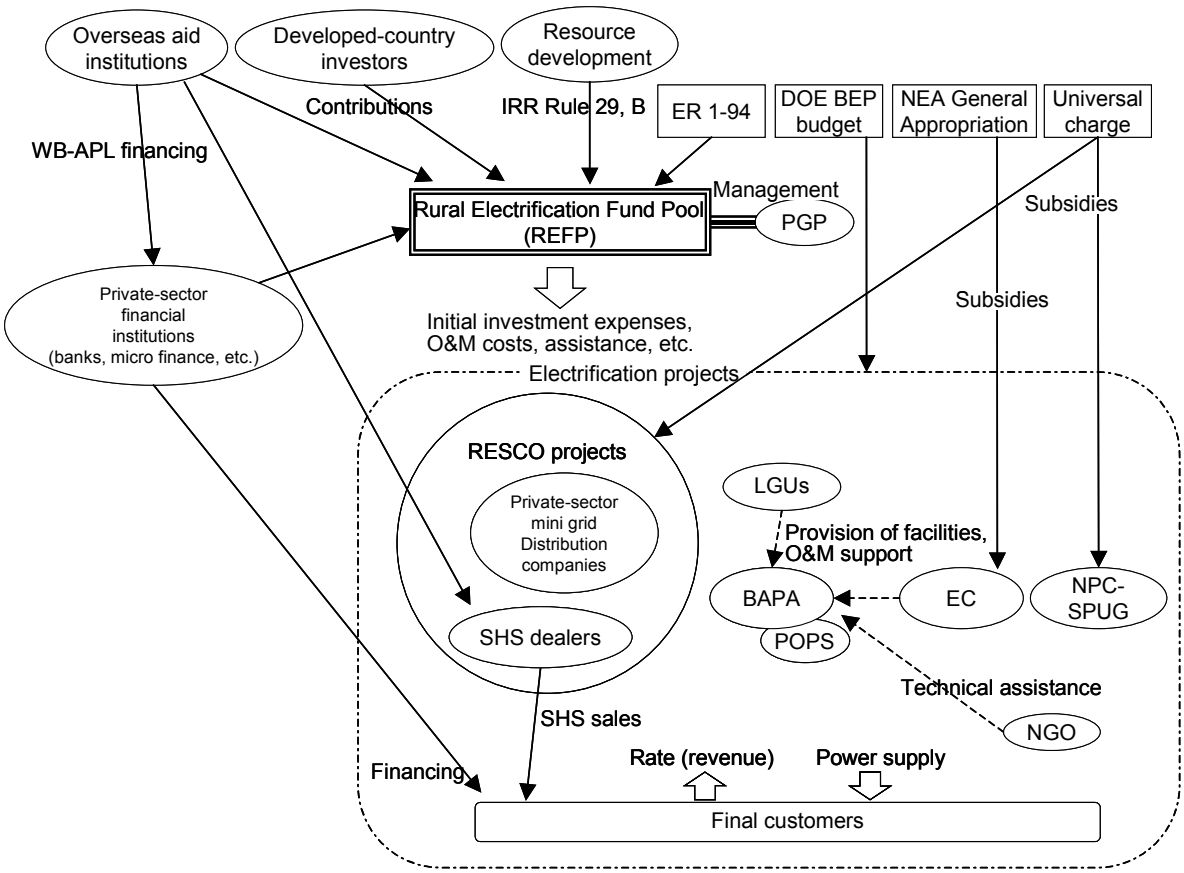
It seems unlikely that the proposed plan can be safely implemented in Palawan under the existing institutional framework. Both the major players, ECs and the NPC-SPUG, have very restricted resources to fund further investment.

Therefore, rather than relying on EC-grid extension alone, the promotion of electrification and other electrification schemes needs to be pursued in order to reduce investment. This could include mini-grid systems and stand-alone systems like Battery Charging stations (BCS) and Solar Home Systems (SHS) to be installed at individual households. New project schemes and fund procurement needs to be pursued for future power development.

Funds from the national government (including subsidies and funds for aid from overseas donors) are extremely important to the power development in Palawan. Therefore, the most important role of the PGP for promotion of power development in Palawan is to petition the national government and assembly for action on various matters, such as policy support for the service plans. The PGP must also take the initiative in making the systemic or institutional arrangements required for promoting power development in Palawan.

The Master Plan proposes the establishment of a rural electrification fund pool for PGP to manage various fund sources for the promotion of rural electrification in Palawan and the diversified scheme for rural electrification (see figure below).

Needless to say, the schemes proposed in the Master Plan do not necessarily ensure the success of power development in Palawan. It is important for PGP to play a strong role in the promotion of power development in Palawan in the scheme, and also it is essential that PGP revises the Master Plan and introduces new schemes for power development.



Source : JICA Study team

Chapter 1 Background and Objectives

1.1 Background

The DOE, in coordination with related agencies, has constantly adopted programs in support of the government's poverty alleviation efforts through wider access to electricity. The Expanded Rural Electrification Program was adopted in April of 2003 with the goals of 1) 100% barangay electrification by 2006, and 2) 90% household electrification by 2017. Accordingly, DOE created the ER team to effectively manage and integrate the country's rural electrification program.

However, most of the un-electrified barangays at present are generally located in areas far from urban areas such as Metro Manila and tend to have poor social-infrastructures and small populations. The electrification of such areas is not economically feasible in most cases.

Therefore, in order to achieve 100% barangay electrification by 2006, a plan for rural electrification with an adequate electrification method is required, which takes into account the barangay size and the economic conditions of the people.

Palawan Province is located at the southwestern part of the Philippines, consisting of a main island and over 1,700 smaller islands. The majority of the population on the main island lives in the city of Puerto Princesa, the capital of Palawan province, while others live at the rural areas extensively.

Palawan Province is composed of 24 municipalities, including the central district of Puerto Princesa City, and it is composed of 431 barangays.

The entire population of Palawan was about 755 thousands as of 2000, and the average annual population growth was 3.60%, higher than the national average of 2.36%.

Although GPDP of Palawan increased from about 11,802 million pesos in 1997 to about 14,877 million pesos in 2000, GPDP per capita in 2000 was 19,694 pesos, less than a half of the national average of 43,687 pesos. These figures show that the economic gap between Palawan province and urban regions such as Metro Manila is significant, since Palawan province is located far from the capital city, the center of commerce and industry.

On the other hand, Palawan province is expected to be an important region for tourism, with its attractive natural resources. Republic Act No. 7611 was approved in June of 1992 adopting the SEP[3], a comprehensive framework for the sustainable development of Palawan compatible with protecting the natural resources and endangered environment of the province. A special zoning system named ECAN was provided to offer protection and development control over the whole province. SEP classified the whole province into several zones according to the elevation criteria, topographic features, vegetation and land use. No development or construction is allowed in zones classified as environmentally important conservation areas.

The barangay electrification ratio of Palawan was 62.9 % as of 2003 year-end, extremely

[3] Strategic Environmental Plan

lower than the national average of 90 %. Moreover, the household electrification ratio was less than 35 %. The lower electrification level in Palawan is caused by the low population density, and also by the lower level of income. To achieve the DOE goal of electrification for all barangays by 2006, 160 barangays must be electrified between 2004 and 2006.

Achievement of the electrification for all barangays in the country and promotion of household electrification improvement requires not only the national program for barangay electrification and power development, but also a long-term provincial level plan.

Such development plans will require the examination of the availability of funds and the institutional recommendations to compensate any shortage of resources. Moreover, the development plan must be formulated to incorporate all applicable environmental laws and regulations.

The Master Plan proposed in the Study is expected to serve as a model for the other provinces in the Philippines, as well as demonstrating the best methods for rural electrification in Palawan province itself.

1.2 Objectives

The objectives of the Study are as follows:

(1) To formulate the Master Plan for Power Development in Palawan Province up to 2015, with proper environmental consideration

- Socio-economic survey of barangays
- Power demand forecast
- Barangay electrification plan
- Optimal power development plan reflecting barangay electrification plan
- Project implementation plan
- Policy recommendation on institutional and organization
- Database

(2) To transfer the technology and know-how to the counterparts for revising the Master Plan

1.3 Terminology

The following terminology is used in the Study and the Master Plan.

(1) Terms related to Electrification

Electrified Barangay

DOE defines a barangay as being electrified when it meets the following criteria;

1) 10 or more households are electrified
2) EC's distribution lines run through the barangay

In Palawan there are some barangays where over 10 households are electrified by a private owned small generator. This system has economic advantages over individual power systems such as SHS and BCS provided that the system provides electricity to a certain target number of households.

In this context the Study team set the criteria of electrification for 20 households in order for the Barangay to be counted as "electrified" in the Study and the Master Plan.

(2) Terms related to the Electrification Method

EC-grid

EC-grid means the system in which the ECs distribute electricity to consumers.

The EC-grid can be categorized into two systems in accordance with the features of the system.

1) Backbone grid system : A system composed of several generators and transmission facilities owned by NPC-SPUG and distributing lines owned by ECs
2) Isolated grid system : A system composed of a single generator owned by NPC-SPUG and a distributing line owned by ECs

Mini-grid

Mini-grid refers to the system in which entities other than ECs distribute electricity through their distribution lines that meet the NEA ENGINEERING BULLETIN.

In Palawan, BAPA and LGU's engagement is categorized as being in this system.

Stand-alone system

Stand-alone system means a system that supplies electricity other than those above.

In Palawan, SHS, BCS and POPS are categorized as being in this system.

Chapter 2 Current Status of the Power Sector in Palawan Province

2.1 Structure of the Power Sector in Palawan Province

(1) NPC-SPUG and ECs

NPC-SPUG is responsible for the development planning, operation and maintenance of power generation[4] and transmission facilities in Palawan.

As of February 2003, the total installed capacity in Palawan was 48.9 MW and the dependable capacity was 36.8 MW including one IPP power plant. Through the 69kV transmission facilities (known as the backbone grid), the southern part of the backbone grid from Puerto Princesa City to Brooke's Point has already been energized and operated (see Figure 2.2), and the northern part from Puerto Princesa to Taytay is now under construction[5].

Almost all power generated by NPC-SPUG and IPP is supplied to the two ECs, PALECO and BISELCO. Both ECs are responsible for distribution. PALECO's main service area is the Palawan main island and presently PALECO covers about 90% of the total number of consumers in Palawan. On the other hand, BISELCO's service area covers four island municipalities in the northern part of Palawan, which are Busuanga, Coron, Culion, and Linapacan.

(2) Other Entities

In addition to NPC-SPUG and ECs, there are some other entities that supply electricity to consumers. One is the Barangay Power Association (BAPA). BAPA has a generator and distribution lines for its own use and is responsible for their operation and maintenance[6]. In this relationship, PALECO provides technical assistance to BAPA[7]. Additionally, some people have access to electricity using small diesel generators (POPS), SHS, or BCS.

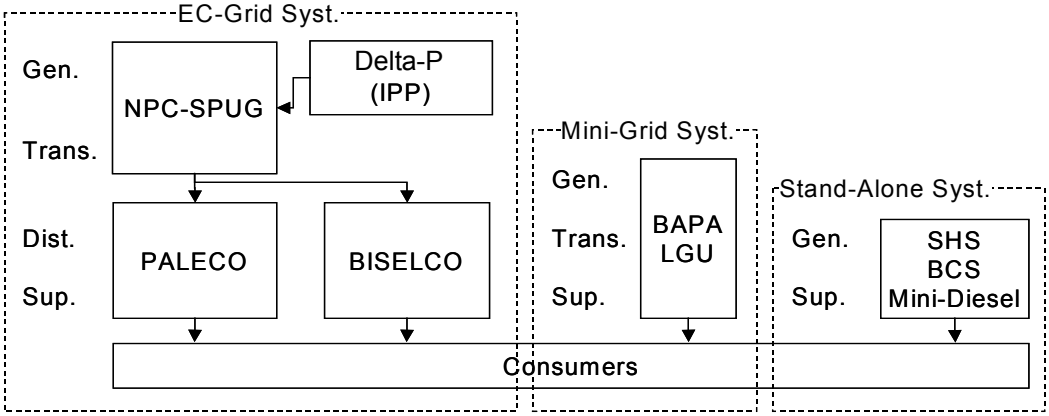
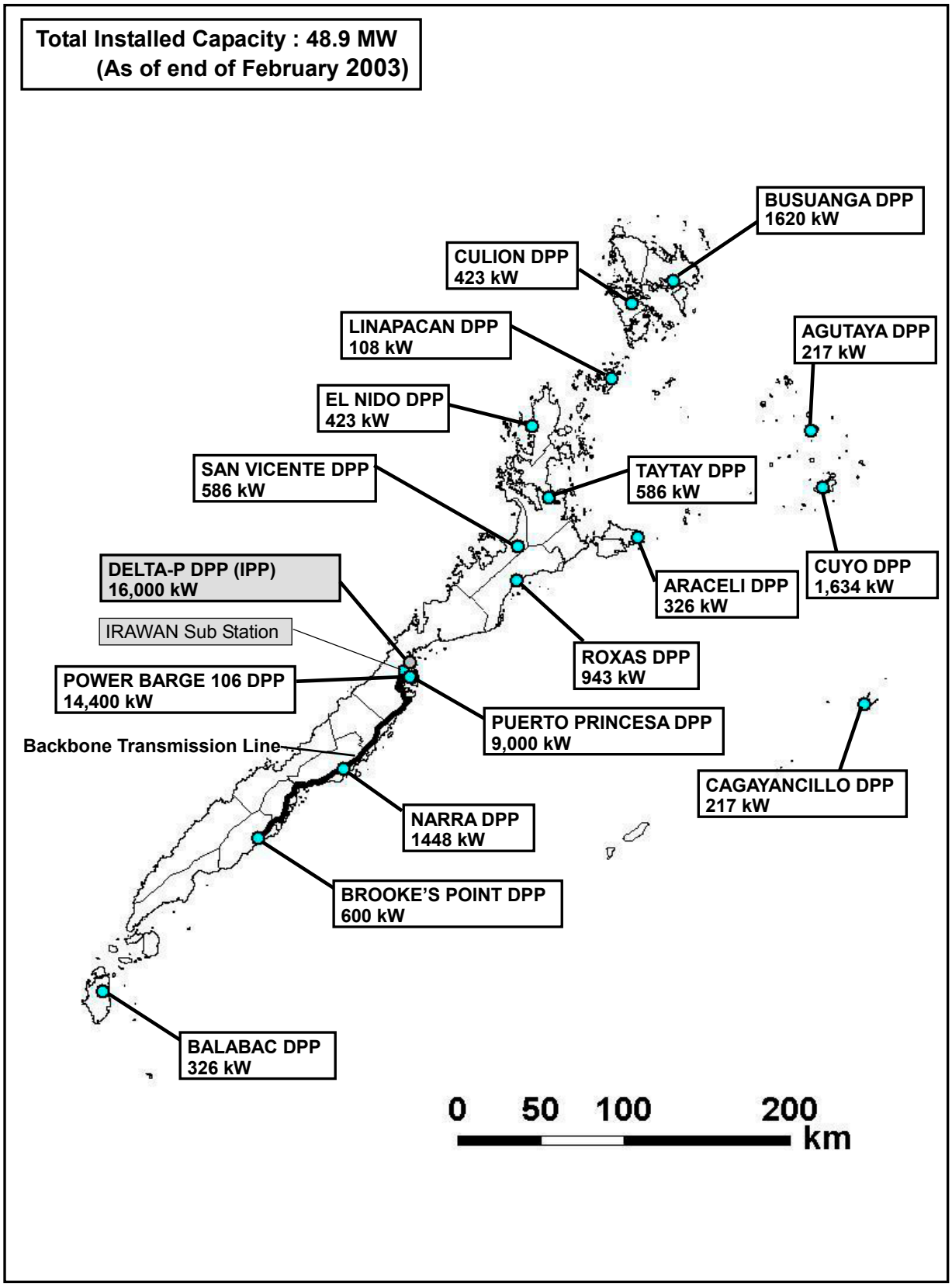


Figure 2.1 Structure of Power Sector in Palawan Province

[4] In addition to the generation facilities owned by NPC-SPUG, there is one IPP power plant in the backbone grid. This IPP, Delta-P, was constructed on a BOT basis in 1997 and has sold its generated electricity to NPC-SPUG through a ten-year contract.
[5] It will be in operation at the end of 2005.
[6] The BAPA organized in Puerto Princesa City purchases electricity from PALECO and resells it to consumers.
[7] There is no BAPA in BISELCO service areas at present.



Source : NPC

Figure 2.2 Map of Existing Power Stations in Palawan EC-Grid

2.2 Status of Electrification in Palawan Province

As of the end of December 2003, the number of barangays with access to electricity was 271 (62.9%) in the total 431 barangays in Palawan and the number of electrified households was 56,924 (34.0%) out of a total of 167,391 households in Palawan (see Table 2.1 and Table 2.2).

Table 2.1 Status of Barangay Electrification (as of the end of December 2003)

Electrification Method	Number of Barangays	Share (%)
Electrified Barangay	**271**	**62.9**
EC-grid System	212	49.2
Mini-Grid System	6	1.4
Stand-Alone System	53	12.3
Un-electrified Barangay	**160**	**37.1**
Total	**431**	**100.0**

Source: NEA, PGP

Table 2.2 Status of Household Electrification (as of the end of December 2003)

Electrification Method	Number of households	Share (%)
Electrified Barangay	**56,924**	**34.0**
EC-grid System	54,416	32.5
Mini-Grid System	870	0.5
Stand-Alone System	1,638	1.0
Un-electrified Barangay	**110,467**	**66.0**
Total	**167,391**	**100.0**

Source: NEA, PGP

Chapter 3 Process for Formulating the Master Plan

3.1 Basic Policy

3.1.1 Structure of the Master Plan

The Master Plan consists of the following two plans.

1) Barangay Electrification Plan:
   A power development plan at the barangay level for the achievement of electrification for all barangays by 2006 and the improvement of the household electrification until 2015

2) Power Development Plan for the EC-grid System:
   A power development plan based on the forecasted power demand for each EC-grid

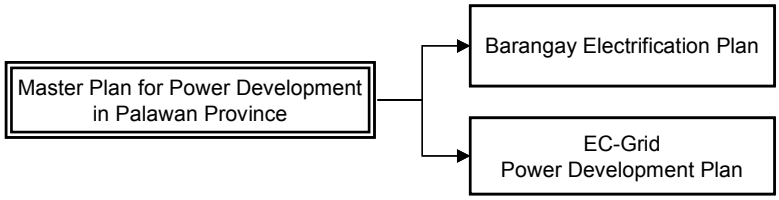


Figure 3.1 Structure of the Master Plan

3.1.2 Basic Policy for the Master Plan

The Study is based on the following basic policies for the Master Plan.

Basic Policy 1: Master Plan for Rural Development

The objective of the Master Plan should not be limited to only the development of power facilities to meet the future power demand and achieve the electrification for all barangays by 2006[8] in Palawan, but also to support poverty alleviation and economic growth through rural electrification in Palawan Province.

For the above reason, the Master Plan is formulated in consideration of socio-economic situations of each barangay in 2015.

[8] DOE plans that all barangays will be electrified by 2006 under the Philippine Energy Plan 2002-2011.

Basic Policy 2: Model Master Plan Applicable for other Provinces

The Master Plan should be in consistency with national energy policy and also reflect the socio-economic and energy situations in Palawan.

Therefore, the Master Plan is formulated to be in harmony with national level plans such as PDP[9] and MEDP[10] of DOE, and takes into consideration the renewable energy potential, environmental restrictions in Palawan Province and other key issues.

In addition, the Master Plan makes its formulation process clear and gives useful information on formulating a master plan as a model for other municipalities.

Basic Policy 3: Master Plan with Sustainability and Feasibility

The Master Plan should have feasibility and sustainability concerning technical, institutional and financial aspects. Especially, financial feasibility is important in Palawan Province because of the severe financial restrictions on the promotion of electrification and power development. Therefore, the Master Plan includes the examination of promising fund sources and the amounts, as well as recommendations on the appropriation of new funds.

Basic Policy 4: Technical Transfer to PGP and DOE

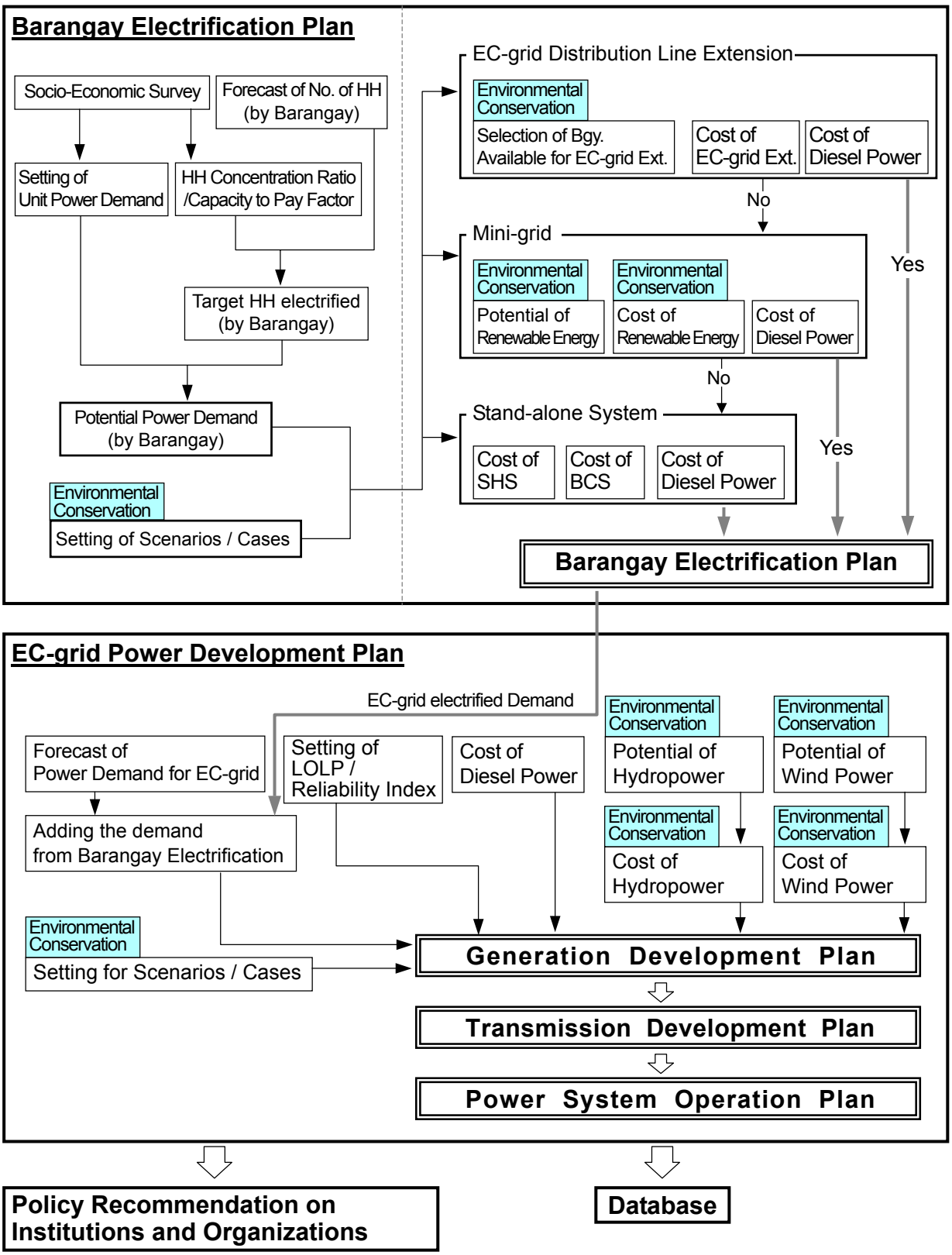
Proper technical skills can enhance the accuracy and feasibility of technical, institutional and financial aspects of the Master Plan that PGP will carry out continuously, the renewal of data and information necessary for the formulation of the Master Plan and the revision of projects in the Master Plan, and thus consequently increase the autonomy of the energy supply.

For this reason the technical transfer to DOE and mainly PGP was implemented.

[9] Power Development Program
[10] Missionary Electrification Development Program

3.1.3 Procedure for Formulating the Master Plan

Figure 3.2 shows the flow chart for the Master Plan formulation.



Source: JICA Study team

Figure 3.2 Flow chart for Formulating the Master Plan

3.2 Formulation of Barangay Electrification Plan

3.2.1 Electrification Phase

Regarding the barangay electrification, the Master Plan has two objectives. One is to achieve electrification for all barangays by 2006 and the second is to improve household electrification by 2015. Consequently, the barangay electrification plan of the Master Plan has the following two phases;

Phase-I : Electrification of All Barangays from 2004 to 2006
Phase-II : Household Electrification Improvement from 2007 to 2015

The image of the electrification phases is shown in Figure 3.3.

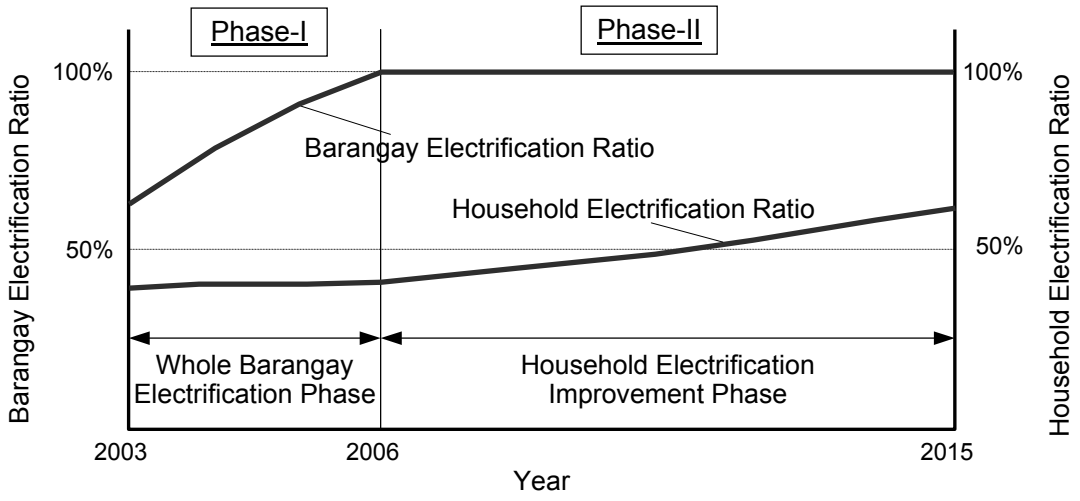


Figure 3.3 Image of Electrification Phases

3.2.2 Selection of Barangay Electrification Method

(1) Barangay electrification method

The following are employed as electrification methods in the Master Plan.

1) EC-Grid Extension
2) Mini-Grid System
3) Stand-Alone System

(2) Selection of a barangay electrification method

A barangay electrification plan should be formulated in consideration of the socio-economic situations of each barangay. Therefore, an appropriate electrification method for a barangay is selected from the above three methods based on the barangay's potential power demand in 2015 and the economic evaluation of the electrification costs for each method.

According to the results of the selection, each barangay is to be electrified by EC-grid extension or a mini-grid system installed with the necessary power facilities by 2006 to meet its potential power demand in 2015 (Phase-I). For some barangays, even if the EC-grid extension or mini-grid system is feasible, the option may be limited to a stand-alone system due to environmental considerations, especially when the ECAN zoning restrains the extension of the EC-grid distribution lines and the development of mini-grid system. After the achievement of electrification for all barangays, the barangay electrification plan will install stand-alone systems until 2015 in order to increase the household electrification ratio (Phase-II).

3.2.3 Potential Power Demand Forecast

The potential power demand of each barangay in 2015 was forecasted using the following process (see Figure 3.4).

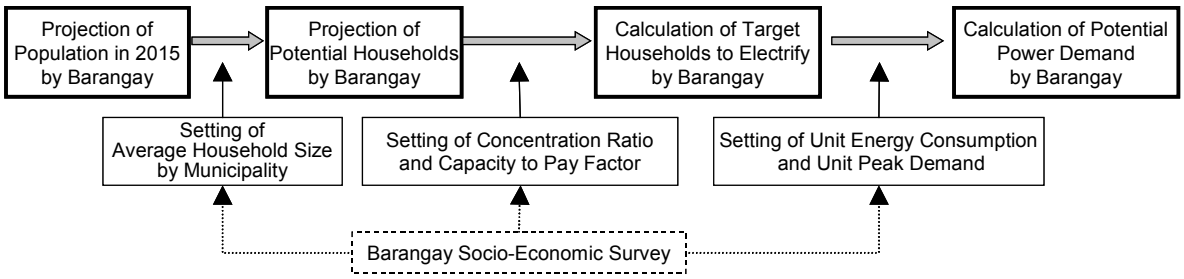


Figure 3.4 Work Flow of Potential Power Demand Forecast

(1) Barangay socio-economic survey

The barangay socio-economic survey was carried out to grasp and appropriately reflect the diversification of socio-economic situations in the power demand forecast for each barangay in the barangay electrification plan. The survey consists of the following two sub-surveys.

(i) Whole barangay survey

The whole barangay survey targeted all of the barangays in Palawan. It collected and analyzed data and information on socio-economic conditions from existing surveys held by various organizations and institutions such as the Provincial Planning and Development Office, Department Interior and the local government in Palawan and DOE. The data and information covers demographic, social, economic, organizational, infrastructure, and electrification / energy creation concerns. Based on these data and information, barangays for the sample barangay survey are selected in consideration of barangay size, electrification status, and electrification method.

(ii) Sample barangay survey

The sample barangay survey targeted several sampled barangays. The survey collected and analyzed qualitative and quantitative data and information about these barangays. The collected information included settlement patterns, economic conditions, electrification and energy creation concerns in order to obtain a concentration ratio of households at a barangay center, the factor of capacity to pay, and unit power demand in a household as a necessary parameter for a potential demand forecast.

(2) Potential power demand

The potential power demand forecast of the barangay electrification plan, that is a power demand forecast for un-electrified areas and electrified areas except for ECs service areas, employs the micro-method, which means the components of power demand are estimated individually and future power demand is obtained by adding up the components. This is because there are few time-series data on the areas except for ECs service areas.

The components include the number of potential households of each barangay, a concentration ratio of households at a barangay center, the factor of capacity to pay, and unit power demand, which are the parameters obtained from the barangay socio-economic survey. Potential power demand of each barangay is estimated by the following formula.

Potential Power Demand =
(Number of Potential Household) x (Concentration Ratio)
x (Capacity to Pay Factor) x (Unit Power Demand)

The follow explains why such parameters as a concentration ratio of households at a barangay center and the factor of capacity to pay are employed.

1) Concentration Ratio:
Not all households are settled at one spot. Generally, a certain number of households concentrate at a barangay center, which is the center of economic activity, and the rest settle in scattered sitios[11] within the barangay.

2) Capacity to Pay Factor:
Not all households around a barangay center have enough money to pay for electricity due to the diversification of economic situations for each household.

Regarding electrification with EC-grid extension or mini-grid system, it is better from the viewpoint of economic efficiency to electrify a high demand area, or in other words is a high population density area.

[11] A small hamlet

The image of target households to be electrified by EC-grid extension or a mini-grid system is shown in Figure 3.5.

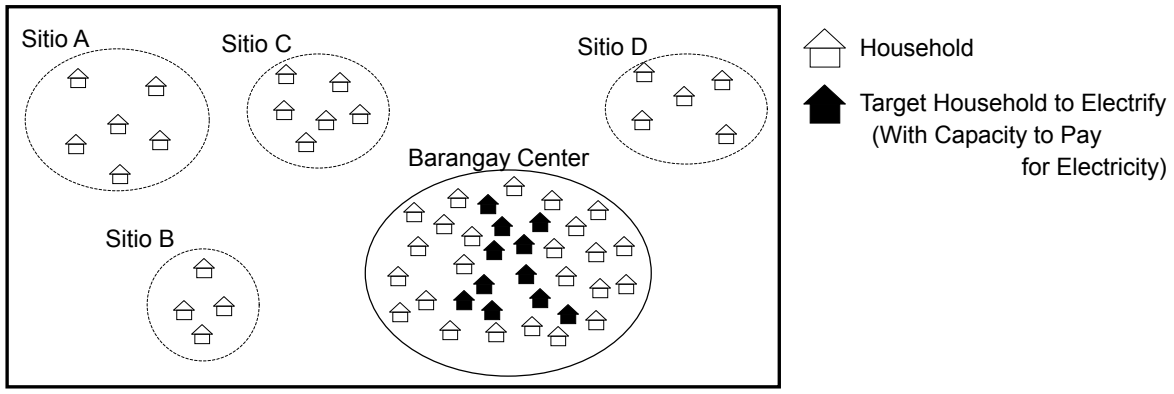


Figure 3.5 Image of Target Households to Electrify by EC-Grid Extension or Mini-Grid System

3.2.4 Barangay Electrification Scenarios

A master plan is usually heavily influenced by various policy decisions. Therefore, it is important to set several scenarios concerning policies that have large effects. In this sense, the Master Plan prepared the following three scenarios.

1) Base Scenario (Least Cost Electrification)
2) Reliability-Oriented Scenario (Utilization of Grid Extension)
3) Environment-Friendly Scenario (Utilization of Hydropower Resources)

Electrification in un-electrified areas is significant because electrification provides a basic infrastructure for economic development, which serves not only to alleviate poverty but also to bridge the economic gap. In order to electrify as many areas as possible using a limited amount of funds, stand-alone systems are often used in addition to EC-grid extension. On the other hand, an EC-grid serves as a better infrastructure for development due to its stable and long-term electricity supply. Utilization of hydropower resources as renewable and domestic energy sources[12] is also important, due to environmental considerations. The scenarios reflect these concerns.

3.2.5 Household Electrification Improvement Scenarios

The Master Plan plans to improve household electrification[13] in Phase-II after the achievement of electrification for all barangays by 2006. For this purpose, the Master Plan considers the following two cases for the target electrification ratio in 2015 (Table 3.1) and conducts a sensitivity analysis.

[12] MEDP 2003 has a strategy to promote hydropower resources as renewable and domestic energy sources.
[13] MEDP has an objective to reach the average 90% household electrification in the Philippines by 2017.

The image of household electrification improvement is shown in Figure 3.6.

Table 3.1 Case of Household Electrification

Year		Electrification Method in Phase-I		
		EC-Grid Extension	Mini-Grid System	Stand-Alone System
- 2006		Whole Barangay Electrification	Whole Barangay Electrification	Whole Barangay Electrification
2007 ↓ 2015		EC-Grid Extension / Stand-Alone System → **Household Electrification Improvement**	Mini-Grid System / Stand-Alone System → **Household Electrification Improvement**	Stand-Alone System → **Household Electrification Improvement**
Target Ratio (%)	Case 1	50	35	35
	Case 2	80	35	35

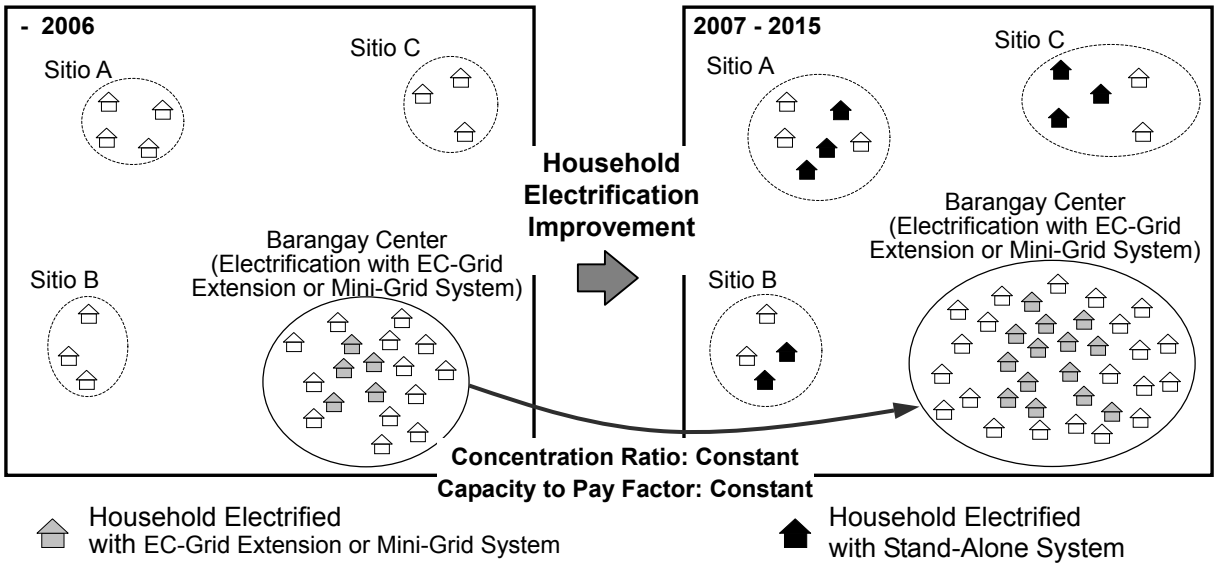


Figure 3.6 Image of Household Electrification Improvement (EC-grid extension and Mini-grid system)

3.2.6 Scenario and Case for the Master Plan

The Master Plan employs the most viable scenarios and cases in order to achieve the first priority goal, which is the electrification for all barangays by 2006, in consideration of the availability of funds.

3.3 Formulation of EC-Grid Power Development Plan

3.3.1 Structure of EC-Grid Power Development Plan

The EC-grids in Palawan are classified into two types, the backbone grid with several power plants, transmission facilities and distribution lines, and the isolated grids with one power plant and distribution lines for each grid. Consequently, development plans are considered for each type of grid.

The power development plan for the backbone grid needs not only a generation development plan to meet increasing power demand and to secure appropriate supply reliability, but also a transmission development plan and a system operation plan to transmit electricity stably and efficiently.

On the other hand, the development plan for isolated grids needs just the generation development plan, because there are no transmission facilities.

The structure of the EC-grid power development plan is shown in Figure 3.7.

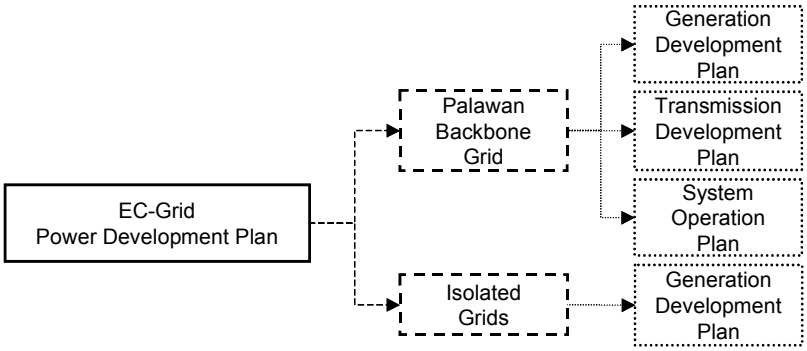


Figure 3.7 Structure of EC-Grid Power Development Plan

3.3.2 Basic Policy for EC-Grid Power Development Plan

The following outlines the basic policies for the power development plan of the backbone grid and other isolated grids.

(1) Basic policy for the power development plan of the backbone grid

(i) Generation Development Plan

The generation development plan of the backbone grid should be a "least cost" plan under such criteria as the LOLP target and environmental constraints.

(ii) Transmission development plan

The transmission development plan should include the upgrading and expansion of the backbone grid based on the standards for transmission capacity according to the generation plan above.

(iii) System operation plan

The system operation plan should examine the necessity and the installation timing of the equipment for the further improvement of system reliability. The examination employed the priority of the equipment and the comparison with the other investments for developing other power facilities.

(2) Basic policy for the power development plan of the isolated grids

(i) Generation development plan

The generation development plan of the isolated grids should be made using the reliability index method by NPC-SPUG. Regarding the selection of a generator to be installed, suitable capacity size for the peak demand should be selected in consideration of the capacity of a power system in the commissioning year of the generator in order to ease any impacts in case of generator trouble.

3.3.3 EC-Grid Power Demand Forecast

The EC-grid power demand forecast employs the macro-method that uses a historical trend of power demand for the following two reasons.

1) There is little correlation between power demand and GPDP[14]. This is because the main industry in Palawan is agriculture for which the value of GPDP fluctuates by weather, while power demand has a close correlation with GDP, especially for the industrial sector in general.
2) Though there usually is a close correlation between the power demand of the residential sector and population, this analysis is difficult in Palawan, since the only reliable data on population is the CENSUS conducted only every five years.

The period of the EC-grid power demand forecast is from 2004 to 2015. The Master Plan forecasts the power demand[15] for each grid. This was necessary for formulating the generation development plan of each isolated grid, and also the transmission development plan of the backbone grid. Also in the barangay electrification plan, the electrified household power demand was added to the power demand forecast where the EC grid extension was chosen as the electrification method.

[14] Gross Provincial Domestic Products
[15] The power demand of barangays whose electrification method is decided to be EC-grid extension is included.

3.3.4 Formulation of Power Development Plan for the Backbone Grid

(1) Formulation of a generation development plan for the backbone grid

A diesel generator is still the most applicable generator type in Palawan. And the mini and micro hydropower potential survey identified that there are seven candidate sites for the backbone grid. There are other generator types popular in the Philippine main grid such as a gas turbines or a coal fired power plants. However, these types may still not be suitable even in the year of 2015, because the demand of the backbone grid will be still small and the infrastructure of fuel transportation may be still restricted. Therefore, only diesel and hydro power plants should be treated as candidates to be developed. The list of candidate plants for the generation development plan of the backbone grid is shown in Appendix I.

The Study team set an optimal LOLP and estimated the development costs of candidate generation facilities through the sensitivity analysis of them since these parameters were applied to the generation development plan. The least-cost generation development plan was examined by WASP-IV simulation.

In addition to the scenarios mentioned in Section 3.2.4, the Master Plan includes the environment deregulation scenario. The scenarios for a generation development plan for the backbone grid are shown below.

1) Base Scenario
   Includes barangays electrified with EC-grid extension in the base scenario of the barangay electrification plan

2) Reliability-Oriented Scenario
   Includes barangays electrified with EC-grid extension in the reliability oriented scenario of the barangay electrification plan

3) Environment-Friendly Scenario
   Includes barangays electrified with EC-grid extension in the environment-friendly scenario of the barangay electrification plan and applies a soft loan to hydropower development

4) Environment Deregulation Scenario;
   Applies bunker C fuel to newly developed diesel power generation

The Philippines has ratified the Kyoto Protocol in November 2003, and is active in pursuing the reduction of global warming emissions. It also has decided to pursue the introduction of renewable energy that can be obtained domestically. Hydropower has a smaller environmental impact in terms of various emissions. Therefore, it is desirable to pursue hydropower where it is appropriate. Scenario 3) thus provides additional incentives for hydropower development.

Also, since the available funds for electrification is limited for EC grid extension, as well as barangay electrification, the project must have low cost. Therefore, the least cost scenario that minimizes the total cost up to 2015 is chosen as the optimal base scenario for the Master Plan.

The environment deregulation scenario is eliminated for selecting a scenario for the Master Plan because the scenario is just a scenario for a sensitivity analysis of fuel use and also is not based on the present environmental regulations in the Philippines.

(2) Formulation of a transmission development plan for the backbone grid

According to the basic policy for the power development plan of the backbone grid, a transmission development plan was formulated based on the following ideas.

1) Existing backbone grid improvement

Examination of the necessity for upgrading existing systems and systems under construction and the installing of new substation and upgrading existing substations

2) New grid expansion

Planning of the new transmission lines for newly installed power plants and examination of interconnections between the isolated grids and the backbone grid

3) Improvement of system configuration

Examination of the necessity and the timing of the system configuration improvement around Puerto Princesa in accordance with economic efficiency

(3) Formulation of a power system operation plan for the backbone grid

Due to low demand and the simple configuration of the existing system, there has been no dispatch center for the grid operation. However, it is assumed that the power demand of the backbone grid in 2015 will reach nearly 100 MW, which justifies a dispatching center. In addition, there are many blackouts in the backbone grid some of them, however, can be avoided if the backbone grid has an ALD[16].

For these reasons above, a power system operation plan for the backbone grid will include the necessary facilities concerning power system operations up to 2015.

3.3.5 Formulation of Power Development Plan for the Isolated Grids

A generation development plan for the isolated grids formulated with the reliability index method includes not only the development of new generators, but also the examination of the option to transfer the existing generators in the backbone grid to the isolated grids.

[16] Automatic Load Dropping

3.4 Institutional and Organizational Concerns

The Master Plan includes not only the examination from the technical and economic points of view but also policy recommendations on institutions and organizations for the achievement of the Master Plan.

Though the central government has established various frameworks for the promotion of rural electrification such as EPIRA as a legal foundation for the complete restructuring of the power sector, O-Ilaw Program, ER programs and others, there are still many issues considering the outlook for assurance of funding sources or the current electrification scheme.

For example, it is obvious that the amount of funds that can be procured under the government's control will not meet the necessary amount for the achievement of the electrification for all barangays by 2006 and the 90% household electrification by 2017.

Such issues regarding finance and electrification schemes become more serious in Palawan Province.

Therefore, policy recommendations on the role of PGP for the assurance of fund sources and a new framework for the promotion of rural electrification in consistency with the central government's policy are given in the Master Plan.

Chapter 4 Master Plan for Power Development in Palawan Province

4.1 Structure of the Master Plan for Power Development in Palawan Province

The Master Plan for power development in Palawan Province consists of the barangay electrification plan for un-electrified areas[17] and the EC-grid power development plan for electrified EC service areas.

The barangay electrification plan has two phases.

Phase-I : Electrification of all Barangays
Phase-II : Household Electrification Improvement

Phase-I is covers 2004 to 2006 with an objective of achieving electrification for all barangays by 2006, which is mentioned in the Philippine Energy Plan (2002 - 2011).

Phase-II covers 2007 to 2015 with an objective of improving the household electrification ratio after achieving electrification for all barangays in Palawan.

The EC-grid power development plan, on the other hand, consists of the power development plans for the backbone grid[18] and for other isolated grids. The EC-grid power development plan has a generation development plan, a transmission development plan and a system operation plan, and the plan for the isolated grids consists of only a generation plan.

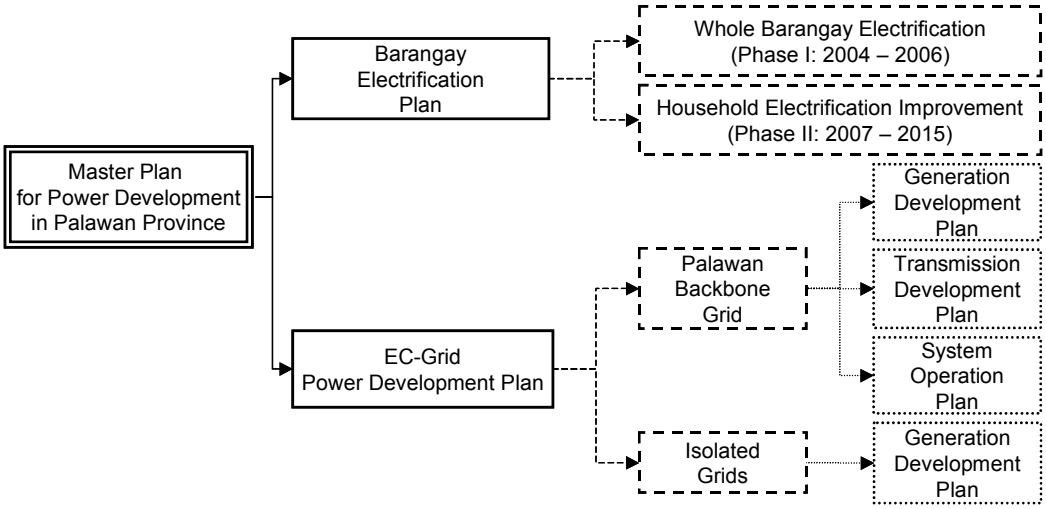


Figure 4.1 Whole Structure of the Master Plan

[17] Un-electrified areas include existing electrified barangays with a mini-grid or stand-alone system. The number of un-electrified barangays and electrified barangays with mini-grid or stand-alone systems are 160 and 59 respectively as of December, 2003.
[18] The backbone grid runs from Brooke's Point to Puerto Princesa City at present. The transmission line to Taytay through Roxas is under construction and will be complete at the end of 2005.

4.2 Barangay Electrification Plan

4.2.1 Potential Power Demand Forecast

The potential power demand of un-electrified barangays is forecasted with the estimated unit peak demand (106W/HH) mentioned in Section 3.2.3 and the potential number of households in 2015.

As shown in Table 4.1, the potential power demand of the un-electrified barangays is generally small, because the population density of un-electrified areas is low, and in addition, the unit peak demand is also small.

Table 4.1 Potential Power Demand Forecast

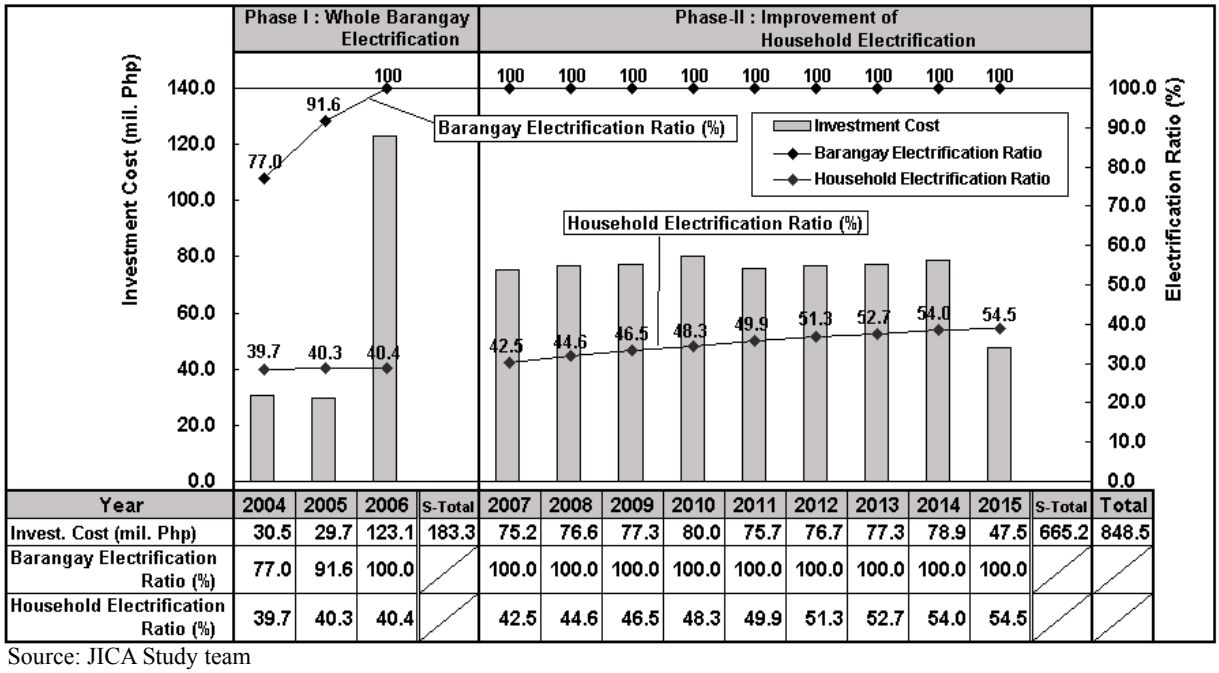
Peak Demand (kW)	Number of Barangay
x < 30	136
30≤ x ≤100	22
100< x	2
Total	160

Source: JICA Study team

4.2.2 Barangay Electrification Program

The investment costs of Phase-I for the electrification for all barangays amounts to 183.3 million pesos. With Phase-II, the household electrification ratio increases to 54.5% in 2015 from 40.4% in 2006. The investment cost of Phase-II amounts to 665.2 million pesos.

The transitions of the electrification ratio and electrification cost of the barangay electrification plan are shown in Figure 4.2.



Year	2004	2005	2006	S-Total	2007	2008	2009	2010	2011	2012	2013	2014	2015	S-Total	Total
Invest. Cost (mil. Php)	30.5	29.7	123.1	183.3	75.2	76.6	77.3	80.0	75.7	76.7	77.3	78.9	47.5	665.2	848.5
Barangay Electrification Ratio (%)	77.0	91.6	100.0		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
Household Electrification Ratio (%)	39.7	40.3	40.4		42.5	44.6	46.5	48.3	49.9	51.3	52.7	54.0	54.5		

Source: JICA Study team

Figure 4.2 Transitions of Electrification Ratio and Electrification Costs

(1) Whole barangay electrification program (Phase-I)

Table 4.2 summarizes the optimal electrification method and investment costs, which were determined based on the comparison of the electrification cost of each electrification method in each un-electrified barangay.

Table 4.2 Barangay Electrification Method (Base Scenario)

Electrification Method	Number of Barangays				Investment Cost (million Php)			
	Total	Electrification Year			Total	Electrification Year		
		2004	2005	2006		2004	2005	2006
EC-grid Extension	**6**	3	2	1	***__22.1__	***9.5	***8.7	***3.9
Mini-grid System	**23**	0	0	23	**115.0**	0.0	0.0	115.0
Stand-alone System*	**132**	60	60	12	**46.2**	21.0	21.0	4.2
Total	**__161__	63	62	36	**183.3**	30.5	29.7	123.1

* The electrification of only 20 households per un-electrified barangay is implemented for the electrification for all barangays from 2004 to 2006 in Phase-I. Electrification with a stand-alone system for the improvement of household electrification is carried out after 2007 in Phase-II. The target electrification ratio of a barangay with stand-alone systems is set at 35%.

** The reason the total is beyond 160, which is the number of un-electrified barangays, is the upgrade in electrification method (Stand-alone system➡ EC-grid extension).

*** Investment costs with EC-grid extension includes counter measure costs for a voltage drop.

Source: JICA Study team

The selection of the optimal electrification method identified that only six un-electrified barangays satisfy conditions for electrification with EC-grid extension. The reason is that it is impossible for some barangays to expand distribution lines due to the prohibition or restrictions imposed by the ECAN zoning and that the electrification costs of the EC-grid extension is higher in almost all the un-electrified barangays due to the long distances between a tapping point of the EC-grid and a center of potential power demand.

Regarding mini-grid systems, only twenty-three un-electrified barangays satisfy conditions for electrification with a mini-grid system (i.e., more than 30 kW of peak demand.)

Therefore, more than 80% of un-electrified barangays result in electrification using stand-alone systems. The status of barangay electrification in 2015 is shown in Figure 4.3. The program list of the electrification for all barangays from 2004 to 2006 is in Appendix II.

The total investment costs of Phase-I are estimated to be 183.3 million pesos (average about 1.14 million pesos per barangay electrification). The average investment costs per barangay of a stand-alone system is about 0.35 million pesos, which is the minimum costs among the three electrification methods. Average investment cost for an EC-grid extension and a mini-grid system is about 3.68 million and 5.00 million pesos respectively. It should be noted, however, that the electrification using stand-alone systems only provides power to 20 households, and the natural increase in the number of electrified households cannot be covered.

(2) Household electrification improvement program (Phase-II)

Only stand-alone systems are installed for the improvement of a household electrification ratio from 2007 to 2015.

The ratio of household electrification will increase 14.1% in Phase-II, which will bring the total to 54.5% in 2015. The investment costs of Phase-II are estimated to be 665.2 million pesos. Therefore, the average investment cost for a 1% rise in a household electrification ratio is about 47.2 million pesos. It has been noted that the improvement of the household electrification ratio requires a greater investment than the electrification for all barangays.

Table 4.3 shows the program list for household electrification improvement. The program list for household electrification improvement by municipality from 2007 to 2015 is shown in Appendix III.

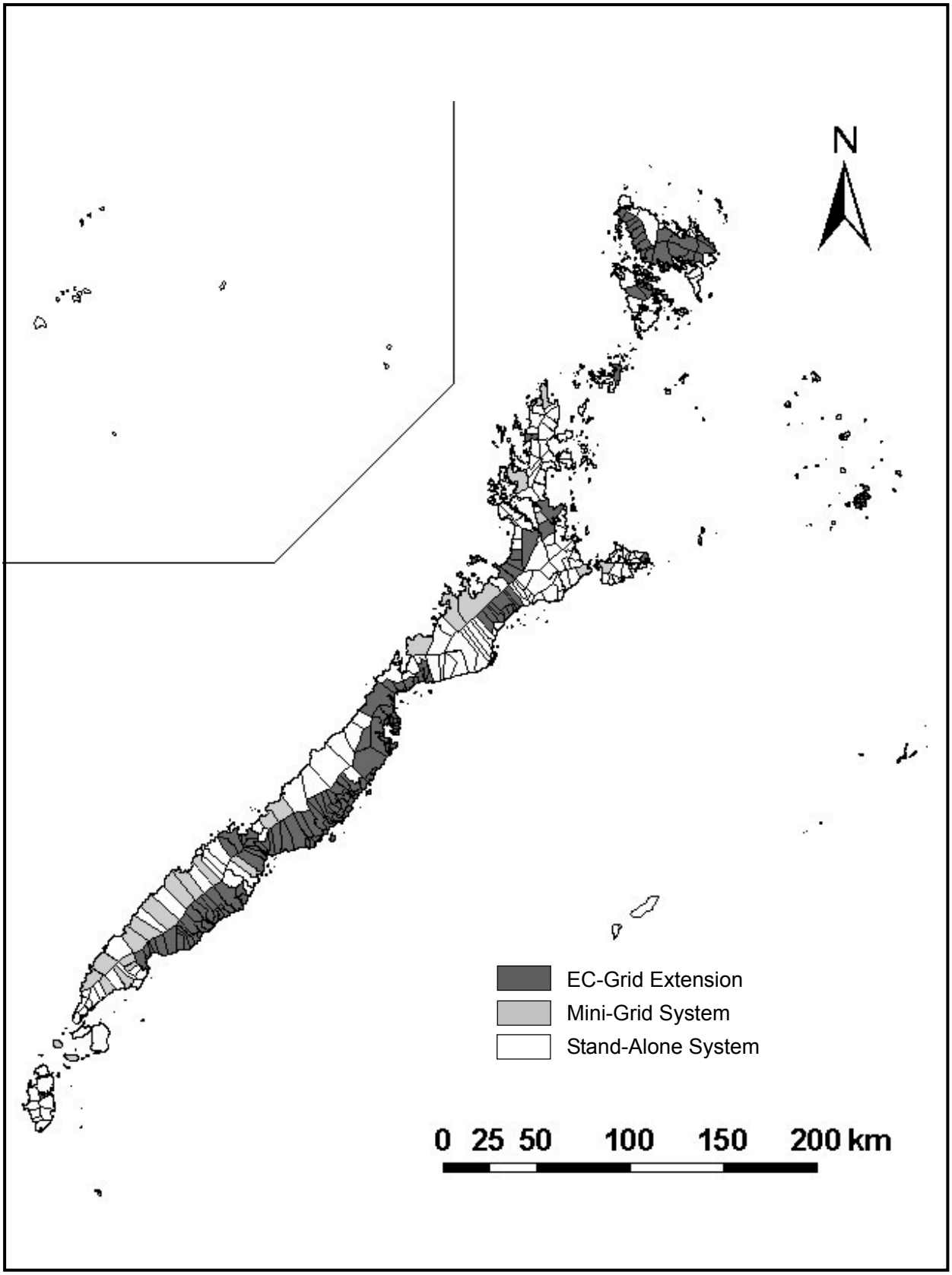
Table 4.3 Household Electrification Improvement Program from 2007 to 2015 (Phase-II)

<Whole Palawan Province>

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target No.of HH to Electrify	4,300	4,377	4,419	4,572	4,328	4,387	4,418	4,508	2,718	38,027
Investment Cost	75.2	76.6	77.3	80.0	75.7	76.7	77.3	78.9	47.5	665.2

Electrification Cost: Php17,493/HH

Source: JICA Study team



Source: JICA Study team

Figure 4.3 Status of Barangay Electrification in 2015

4.3 EC-Grid Power Development Plan

4.3.1 Power Demand Forecast for EC-Grid System

Power demand forecast identified that the energy sales of the EC grid system increase to 517, 730MWh in 2015 from 117,014 MWh in 2004 (annual average increment of 14.5%) and the peak demand of the system increases to 115,683 kW from 26,299 in 2004 (annual average increment of 14.4%).

It is thought that there is a high possibility for realizing the above forecast, considering the fact that the population of Puerto Princesa City, which has 90% of power demand for all of Palawan, has increased at an annual average of 10%[19] and power demand in the commercial sector of Puerto Princesa City has increased at an annual average of 20%[20] for the past five years.

Table 4.4 shows the power demand forecast[21] for the EC-grid system in the whole Palawan from 2004 to 2015. The power demand forecasts for each EC-grid is are Appendix III.

Table 4.4 Power Demand Forecast for EC-grid System in All of Palawan

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	117,014	132,676	150,708	171,510	195,551	223,386	255,679	293,217	336,945	387,989	447,706	517,730
Gross Gen. (MWh)	132,766	150,643	171,117	194,738	222,035	253,643	290,312	332,938	382,598	440,566	508,388	587,924
Peak Demand (kW)	26,299	29,427	33,442	38,075	43,435	49,639	56,846	65,236	75,020	86,461	99,876	115,638

Source: JICA Study team

4.3.2 Power Development Plan for the Backbone Grid

(1) Generation development plan for the backbone grid[22]

The peak demand of the backbone grid is forecasted to be 96,971 kW in 2015. On the other hand, the total dependable capacity of the backbone grid will be 107,500 kW in 2015, almost 3.6 times the capacity in 2004. The newly developed generation capacity between 2004 and 2015 will be 87,100 kW, 80% of which will be from diesel generation.

[19] It is thought that the growth rate of 10% is caused by an influx to Puerto Princesa City, considering the growth rate of Palawan Province is about 5%.
[20] PALECO records from 1990 to 2001. The growth rate of the residential sector is about 15%.
[21] This power demand forecast includes the power demand of the 6 un-electrified barangays whose electrification method is EC-grid extension.
[22] Although the results of the environment-friendly scenario show that it is not the least cost plan, the Study team included it as an optional scenario in the Master Plan since the difference from the least cost plan is small in the economic evaluation.

As for hydropower, 6 sites are developed in the base scenario and 7 sites in the option scenario up to 2015. In the both scenarios, 4 hydropower plants are developed in 2006. The results indicate that installing these hydropower plants contributes to reducing O&M cost of the system.

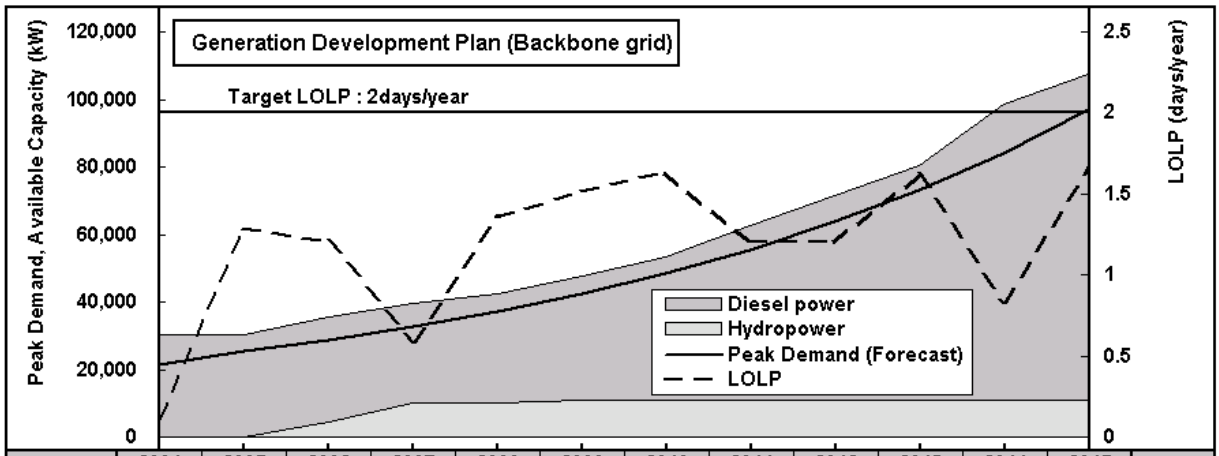
Table 4.5 shows the generation development plan obtained from the simulation for optimal power development.

Table 4.5 Generation Development Plan for the Backbone Grid (Base Scenario and Option Scenario)

Year		Project	Generator Type	Rated Capacity (kW)	Dependable Capacity (kW)	Note
2004		(Transfer of Power Barge 106)	Diesel (Bunker C)	(14,400)	(8,400)	On-going
		Temporally Leased Genset (8,400)	Diesel	8,400	8,400	On-going
2005		-------(No Project)-------				
2006		(Removal of Temporally Genset)	Diesel	(8,400)	(8,400)	
		New Diesel (2x5,000)	Diesel	10,000	9,000	
		Malatgao Hydro (2,200)	Hydro	2,200	2,200	
		Barong Barong Hydro (620)	Hydro	620	620	
		Talakaigan Hydro (990)	Hydro	990	990	
		Cabinbin Hydro (800)	Hydro	800	800	
2007		(Removal of Roxas & Taytay Genset)	Diesel	(1,529)	(1.420)	
		Babuyan Hydro (5,600)	Hydro	5,600	5,600	
2008		New Diesel (2x1,500)	Diesel	3,000	2,700	
2009		Baraki Hydro (840)	Hydro	840	840	
		New Diesel (5,000)	Diesel	5,000	4,500	
2010		New Diesel (1,500, 5,000)	Diesel	6,500	5,850	
2011		New Diesel (2x 5,000)	Diesel	10,000	9,000	
2012		New Diesel (2x 5,000)	Diesel	10,000	9,000	
2013		New Diesel (2x 5,000)	Diesel	10,000	9,000	
2014	A	New Diesel (2x 10,000)	Diesel	20,000	18,000	Base Scenario
	B	New Diesel (3x 5,000)	Diesel	15,000	13,000	Option Scenario
2015	A	New Diesel (2x 5,000)	Diesel	10,000	9,000	Base Scenario
	B	Batang Batang Hydro (6,700)	Hydro	6,700	6,700	Option Scenario
		New Diesel (2x 5,000)	Diesel	10,000	9,000	

Source: JICA Study team

The peak demand forecast, generation capacity and LOLP of the generation development plan (Base Scenario) for the backbone grid are shown in Figure 4.4.



Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Invest. Cost (mil. Php)	0.0	0.0	1,226.9	1,121.4	215.6	492.7	454.1	669.7	669.7	669.7	1,296.9	669.7	7,486.4

Source: JICA Study team

Figure 4.4 Peak Demand Forecast, Generation Capacity and LOLP in the Backbone Grid

(2) Transmission development plan for the backbone grid

The transmission development plan for the backbone grid consists of the following three items:

(i) Upgrading the existing backbone grid
(ii) New expansion of the backbone grid
(iii) Improvement of the power system configuration around Puerto Princesa City

Table 4.6, Figure 4.5, and Figure 4.6 show the transmission development plan, the power system map and the power system diagram of the backbone grid in 2015.

(i) Upgrading the existing backbone grid

The existing transmission lines of the backbone grid are designed with a sufficient capacity[23]. There is no need to increase their capacity before 2015. Regarding substations, however, it will be necessary to install new substations in Puerto Princesa City and in Sofronio Espanola (Bgy. Abo-Abo) and add transformers in the Narra and Brooke's Point substations.

(ii) New expansion of the backbone grid

Access lines for new hydropower plants will be constructed and will be sequentially brought into commission. In addition, a new transmission line from Taytay to El Nido is included in the transmission development plan.

[23] The transmission lines are designed at 138kV for Narra - Puerto Princesa City - Roxas and at 69kV for Narra - Brooke's Point and Roxas - Taytay.

According to the evaluation of the backbone grid extension to El Nido, the larger the size of the El Nido system becomes, the better the economic benefits for interconnections. The economic benefits, however, will still be small in 2010. For this reason, the construction of the El Nido transmission line and substation is included for 2015, the final year of the Master Plan, and then the El Nido system will be interconnected with the backbone grid system.

(iii) Improvement of the power system configuration around Puerto Princesa City

The reliability of the system around Puerto Princesa City will be vastly improved, by installing a temporary diesel generator beside the Irawan substation along with the transfer of the Power Barge 106 in 2004, and by installing a new substation in the Puerto Princesa City DPP in 2009[24]. The system configuration around Puerto Princesa City in 2009 is shown in Figure 4.7.

Table 4.6 Transmission Development Plan for the Backbone Grid (Base Scenario and Option Scenario)

<Transmission Line Development Plan>					
Year	Project		Category	Distance (km)	Note
2006	69kV Puerto Princesa-Roxas T/L		New T/L	111.1	On-going
	69kV Roxas-Taytay T/L		New T/L	65.1	On-going
	69kV Malatgao Hydro T/L		New T/L	9.1	
	69kV Barong Barong Hydro T/L		New T/L	7.0	
	69kV Talakaigan Hydro T/L		New T/L	9.3	
	13.8kV Cabinbin Hydro S-T/L		New S-T/L	5.0	
2007	69kV Babuyan Hydro T/L		New T/L	25.0	
2008	13.8kV Tie Line (Doubled Circuit)		Rehabilitation	11.0	
2009	69kV Baraki Hydro T/L		New T/L	8.8	
	69kV Tie Line (Voltage step-up)		Rehabilitation	11.0	
2015	A	69kV Taytay-El Nido T/L	New T/L	75.0	Base Scenario
	B	69kV Taytay-El Nido T/L	New T/L	75.0	Option Scenario
		Batang Batang Hydro T/L	New T/L	13.0	
<Substation Development Plan>					
Year	Project		Category	Capacity (kVA)	Note
2006	69/13.8kV Roxas S/S		New S/S	5,000	
	69/13.8kV Taytay S/S		New S/S	5,000	
	69/13.8kV Abo-Abo S/S		New S/S	5,000	
2008	69/13.8kV Transformer (Narra S/S)		Additional Tr.	5,000	
2009	69/13.8kV Puerto Princesa S/S		New S/S	40,000	
2012	69/13.8kV Transformer (Brooke's S/S)		Additional Tr.	5,000	
2013	69/13.8kV Transformer (Narra S/S)		Additional Tr.	5,000	
2014	69/13.8kV Transformer (Puerto S/S)		Additional Tr.	40,000	
2015	69/13.8kV El Nido S/S		New S/S	5,000	

Source: JICA Study team

[24] It is necessary to improve the inappropriate system configuration in which the generator circuit and the distribution circuit connect to the same circuit. This is achieved by separating both circuits in along with the installation of the Puerto Princesa City substation.

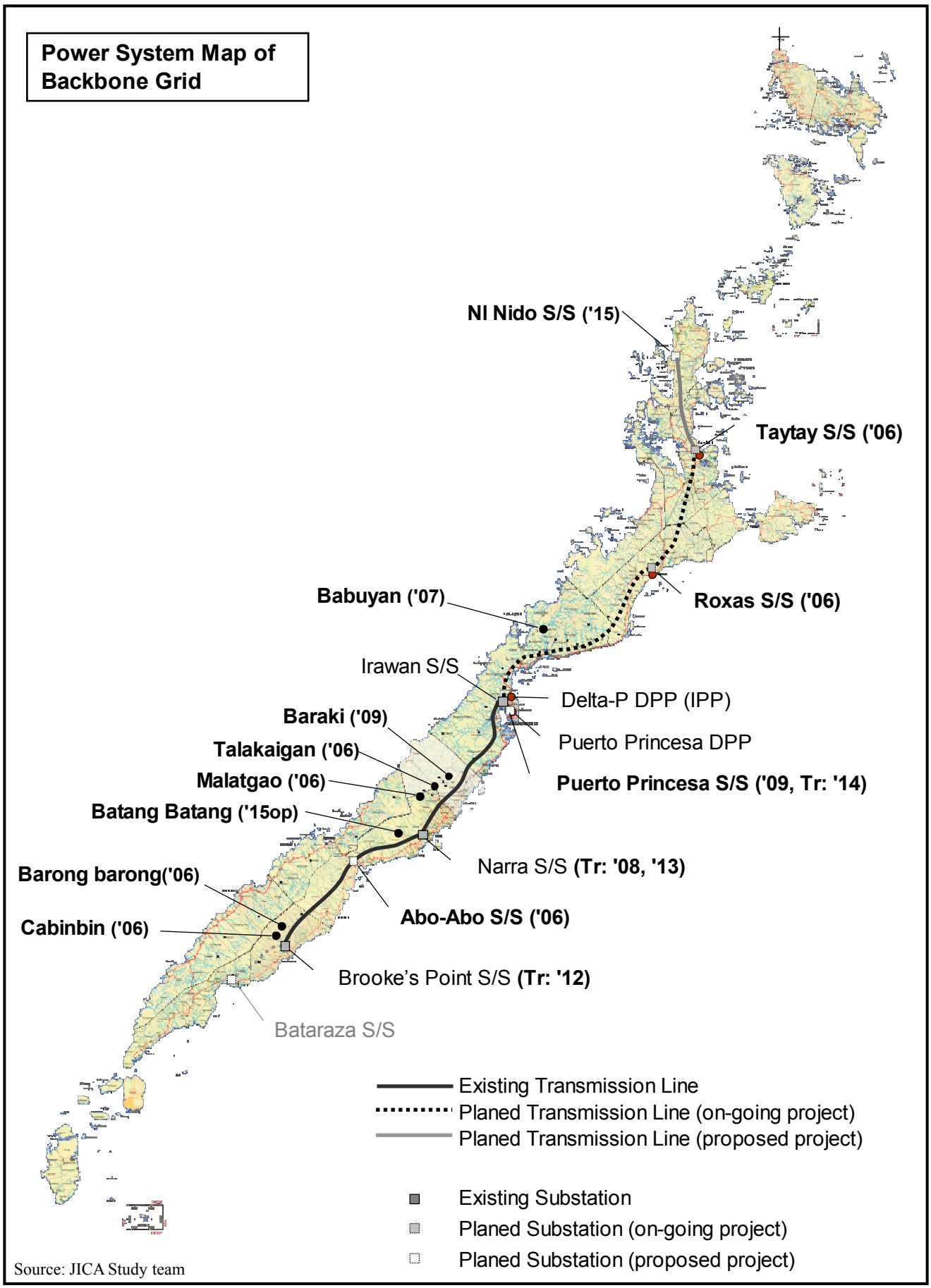


Figure 4.5 Power System Map of the Backbone Grid in 2015

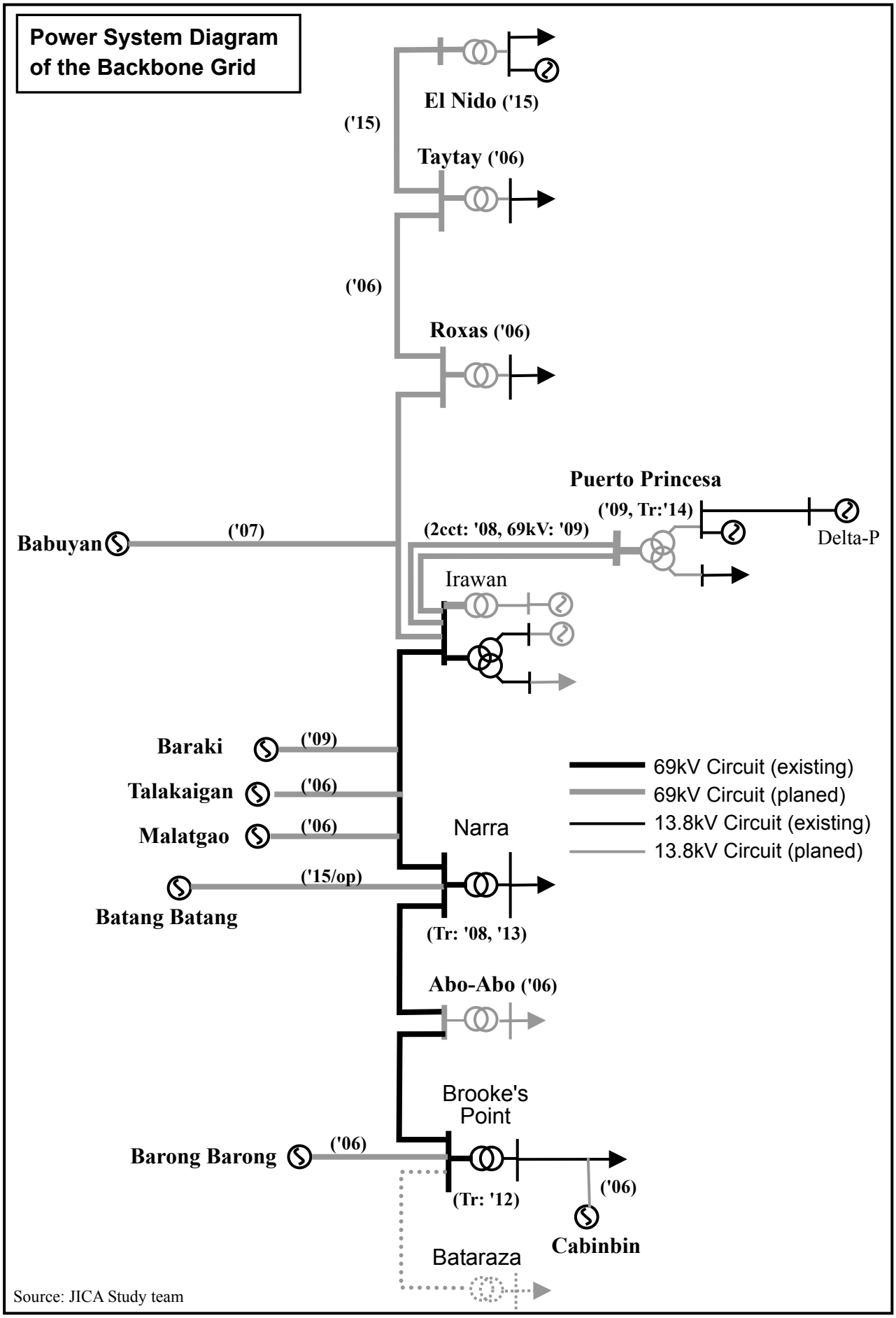
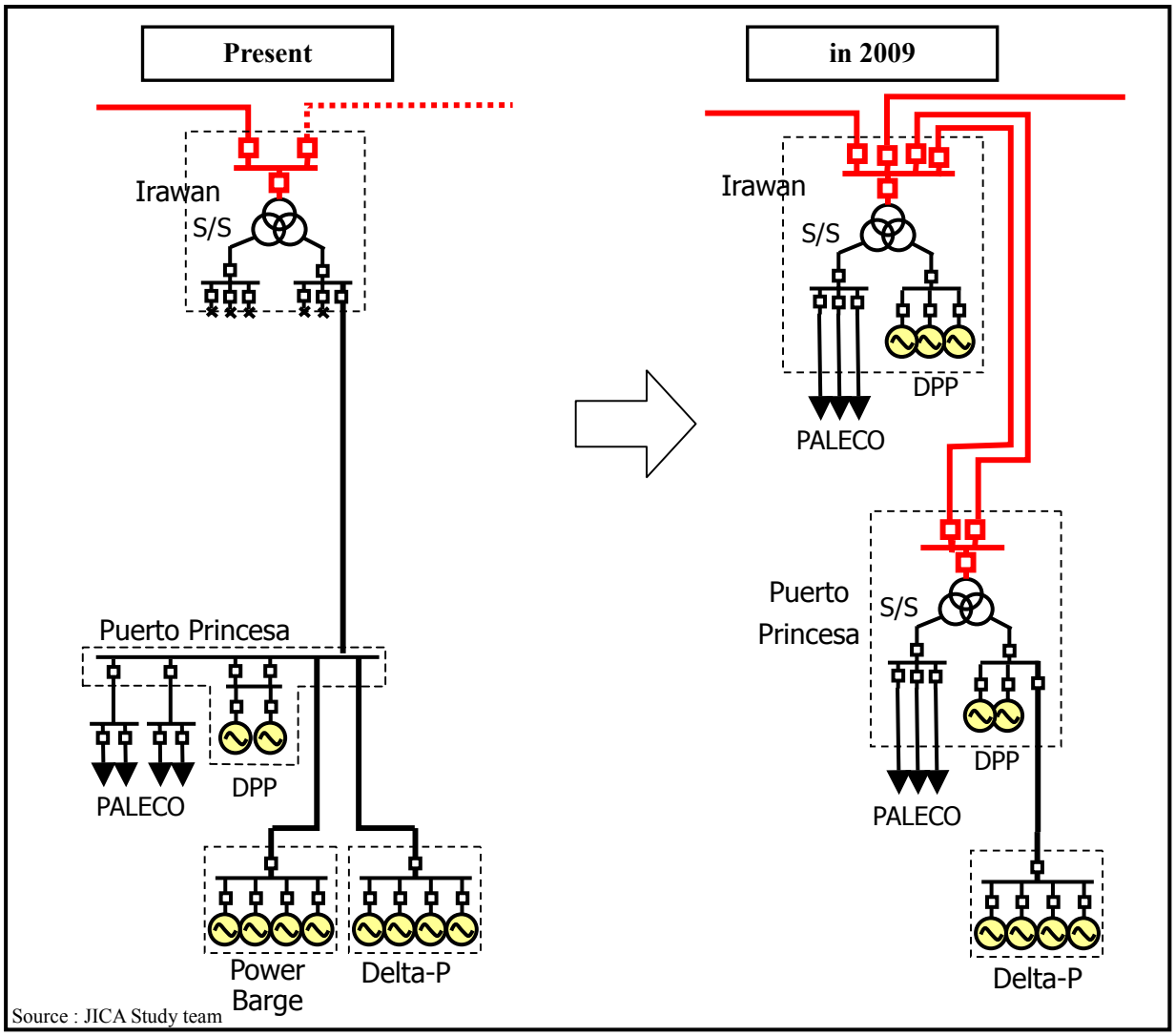


Figure 4.6 Power System Diagram of the Backbone Grid in 2015



Source : JICA Study team

Figure 4.7 System Configuration around Puerto Princesa City in 2009

(3) Power system operation plan for the backbone grid

According to the generation and transmission development plan mentioned above, the backbone grid will have more than 30 units of diesel and hydro generators, and the generation capacity of the grid will exceed 100 MW in 2015. As a result, the power system operation of the grid will become complex enough to merit a dispatching center. In addition, since there is a considerable loss of gross generation caused by blackouts, inherent in the present system configuration that offers poor reliability around Puerto Princesa City, the ALD system should be installed in 2009[25] when the system configuration around Puerto Princesa City will be improved.

Table 4.7 shows the power system operation plan for the backbone grid.

Table 4.7 Power System Operation Plan for the Backbone Grid

Year	Project	Contents	Remarks
2009	ALD System	System Stabilizing Equipment	
2015	Palawan Dispatching Center	SCADA/ EMS System	

Source: JICA Study team

[25] Since there are presently few power plants and substations with personal computers in Palawan, this situation requires more labor for the management of operation records, and there is little computerized data on these records that can be analyzed. Therefore, the modernization of general business within power system operations is very necessary in order to carry out stable, efficient and accurate power system operations.

4.3.3 Power Development Plan for Isolated Grids

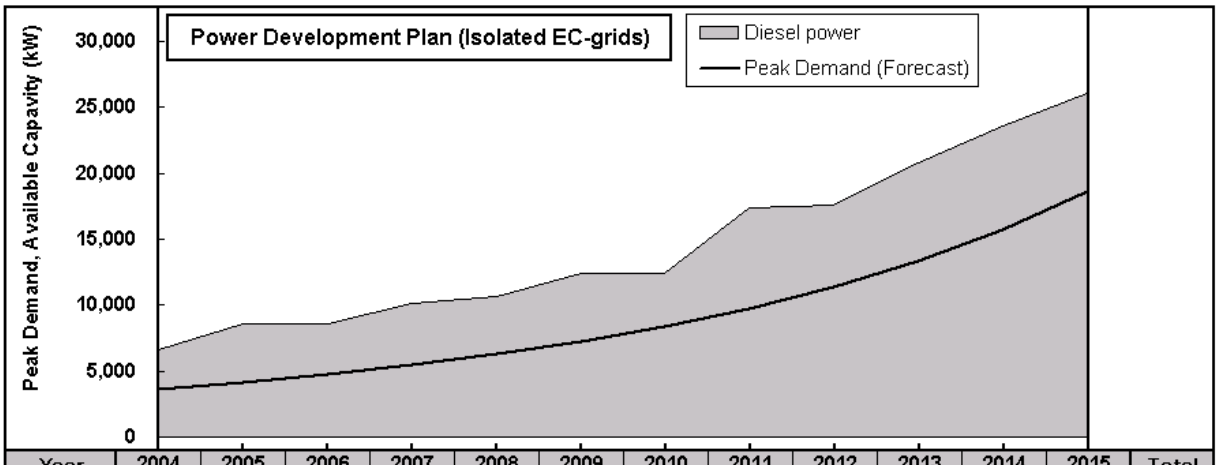
Table 4.8 shows the generation development plan for the isolated grids. The shaded areas for 2007 refer to the generators transferred from the Roxas and Taytay power plants.

Table 4.8 Generation Development Plan for the Isolated Grids

Year	El Nido	San Vicente	Busuanga	Cuyo	Culion	Linapacan	Araceli	Balabac	Cagayancillo	Agutaya	Total
2004	-	-	2x500	2x500	-	-	-	-	-	-	2,000
2005	2x260	260	-	-	2x260	2x163	163	163	54	54	2,060
2006	-	-	-	-	-	-	-	-	-	-	-
2007	-	260	-	500	-	260	260	163	163	163	1,769
2008	500	-	-	-	-	-	-	-	-	-	500
2009	-	-	2x500	500	500	-	-	-	-	-	2,000
2010	-	-	-	-	-	-	-	-	-	-	-
2011	500	500	2x1,000	2x1,000	500	-	-	-	-	-	5,500
2012	-	-	-	-	-	260	-	-	-	-	260
2013	-	500	2x1,000	-	500	-	260	260	-	-	3,520
2014	500	-	-	2x1,000	-	500	-	-	-	163	3,163
2015	-	-	2x1,000	-	500	-	-	260	-	-	2,760
Total	2,020	1,520	8,000	6,000	2,520	1,346	683	846	217	380	23,532

Source: JICA Study team

The peak demand forecast and generation capacity of the generation development plan (Base Scenario) for the isolated grids are shown in Figure 4.8.



Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Invest. Cost (mil. Php)	158.4	102.7	0.0	44.6	39.6	158.4	0.0	419.0	12.1	253.4	238.1	201.8	1,628.1

Source: JICA Study team

Figure 4.8 Peak Demand Forecast and Generation Capacity in the Isolated Grids

4.3.4 Investment Costs for EC-Grid Power Development Plan

Table 4.9 shows the investment costs[26] for the EC-grid power development plan. The cost for a temporally leased generator to be installed at the Irawan substation in 2004 is excluded.

Table 4.9 Investment Costs for the EC-Grid Power Development Plan

(Unit: million Php)

Year	Generation Development Plan			Transmission Development Plan	Power System Operation Plan	Total
	Backbone Grid	Isolated Grids	Total	Backbone Grid	Backbone Grid	
2004	-	158.4	158.4	-	-	158.4
2005	-	102.7	102.7	-	-	102.7
2006	1,226.9	-	1,226.9	514.3	-	1,741.2
2007	1,121.4	44.6	1,166.0	19.2	-	1,185.2
2008	215.6	39.6	255.2	10.5	-	265.7
2009	492.7	158.4	651.1	108.6	1.0	760.7
2010	454.1	-	454.1	-	-	454.1
2011	669.7	419.0	1,088.7	-	-	1,088.7
2012	669.7	12.1	681.8	10.5	-	692.3
2013	669.7	253.4	923.1	10.5	-	933.6
2014	1,296.9	238.1	1,535.0	44.3	-	1,579.3
2015	669.7	201.8	871.5	324.1	78.2	1,273.8
Total	7,486.4	1,628.1	9,114.5	1,042.0	79.2	10,235.7

Source : JICA Study team

4.4 Investment Costs for the Master Plan

Table 4.10 shows the investment costs for the achievement of the Master Plan for power development in Palawan Province.

Total investment costs for the barangay electrification plan from 2004 to 2015 amounts to 848.5 million pesos. 183.3 million pesos is needed for the first three years from 2004 to 2006 (average 61.1 million pesos per year) in order to accomplish the electrification for all barangays in 2006, and an additional investment of 665.2 million pesos from 2007 to 2015 (average 73.9 million pesos per year) in order to promote household electrification using stand-alone systems. As a result, the household electrification ratio is expected to rise to 54.5% in 2015.

On the other hand, total investment costs for the EC-grid power development plan, which accounts for power demand growing at an annual average rate of 14%, amounts to 10,235.7 million pesos. This plan requires an investment of 8,607.6 million pesos in order to develop the backbone grid, which accounts for 90% of the total power demand in all of Palawan, and an investment of 1,628.1 million pesos for the isolated grids.

[26] Investment costs of each project are appropriate at the commissioning year with interest during the construction term.

Therefore, the grand total investment costs for the achievement of the Master Plan for power development in Palawan Province amounts to 11,084.2 million pesos.

Table 4.10 Investment Costs for the Master Plan

(Unit: million Php)

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Barangay Electrification Plan													848.5
Phase-I Whole Barangay Electrification	30.5	29.7	123.1	-	-	-	-	-	-	-	-	-	183.3
Phase-II Household Electrification Improvement	-	-	-	75.2	76.6	77.3	80.0	75.7	76.7	77.3	78.9	47.5	665.2
EC-Grid Power Development Plan													10,235.7
Backbone Grid	0.0	0.0	1,741.2	1,140.6	226.1	602.3	454.1	669.7	680.2	680.2	1,341.2	1072.0	8,607.6
Isolated Grids	158.4	102.7	0.0	44.6	39.6	158.4	-	419.0	12.1	253.4	238.1	201.8	1,628.1
Total	188.9	132.4	1,910.0	1,279.6	342.3	852.6	534.1	1,164.4	769.0	1,010.9	1,658.2	1,321.3	11,084.2

4.5 Issues related to Achievement of the Master Plan

4.5.1 Difficulty of Assuring Funding Sources and Limits of Current Electrification Scheme

The Study suggests that the investment costs for the Barangay Electrification Plan alone from 2004 to 2015 will amount to 848.5 million pesos. Unfortunately, such funds are hard to come by. Even the 183.3 million pesos from 2004 to 2006 for Phase-I will be quite difficult to secure, to say nothing of the 10 billion pesos for the EC-grid power development plan. It would be extremely difficult to achieve barangay electrification solely through the efforts of the existing players in the field of rural electrification (RE), namely ECs and the SPUG, due to their already tight financial conditions.

Obviously, the ECs are expected to play the largest role in RE promotion. With the structural reforms in the power sector, however, the NEA has become unable to provide loans to ECs other than the subsidies from the General Appropriation. As such, for future investment ECs will have to obtain funds through the market based on earnings from their power distribution business. This is to say that they must procure funds on their own as power distributors. From the standpoint of a quasi-commercial enterprise, it will become increasingly difficult to extend distribution lines into areas that do not offer good earning prospects.

The financial capabilities of NPC-SPUG, which is responsible for missionary electrification, are also clearly limited. The enactment of the Electric Power Industry Reform Act (EPIRA) led to the establishment of a universal charge system as a funding source for missionary electrification. At present, however, there is a big gap between the amount applied for by NPC-SPUG and that authorized by ERC[27]. Moreover, most of the income (subsidies) obtained through the universal charge "disappears", in that it is used to compensate for the deficits at existing facilities. Funding available for investment in new projects is extremely limited.

4.5.2 Need for Establishment of Diversified Setup for Promotion of Barangay Electrification

The un-electrified barangays left in Palawan have lower economic feasibility due to their distance from the existing EC-grids and the low density of power demand. Therefore, it is more difficult to recover investment costs for electrification through EC-grid extension.

In other words, the promotion of electrification depending only on NPC-SPUG and ECs is not realistic in respect of sustainability.

This means that electricity supply through mini-grids and the installation of stand-alone systems such as battery charge stations (BCSs) and SHSs, which are easy to manage and need less investment cost, will have a vital role to play for electrification of a fairly large proportion of the remaining un-electrified barangays, instead of EC-grid extension.

The operation of stand-alone power systems requires diverse new project schemes. There are already several schemes that could serve as archetypes, though they still have some issues to overcome;

(1) Barangay power associations (BAPAs)

One such model is the barangay power association (BAPA), which is operated by the barangay residents. However, BAPAs also have many problems. They generally lack the technical foundation needed for operation and maintenance (O&M) required for running the works. They also tend to be on very weak financial ground. At present, the barangays take over facilities constructed by ECs or LGUs, and use them to supply power to the residents. When the facilities break down or otherwise require repair, the BAPAs have no choice but to depend on the ECs or LGUs. The facilities are therefore at risk of being left idle and un-repaired.

In addition, residents may feel some discontent regarding the cost burdens. Compared to the EC retail tariff of 5.8 pesos per kilowatt-hour, the cost burden of the beneficiaries in the BAPA distribution service, which is on the order of 15 pesos per kilowatt-hour, is extremely high.

[27] The universal charge approved for imposition in missionary electrification in 2003 was only 3.37 centavos per kilowatt-hour as opposed to that of 9.52 centavos in the NPC-SPUG application.

(2) SHS dealers

The diffusion of SHSs is another option. There are two major methods of SHS sales: 1) leasing of SHSs to customers and collection of a monthly fee for use, and 2) outright purchase by customers and provision of post-sales services by dealers for a fee. In its current business in Palawan, Shell applies the latter method. Leasing involves a high risk of non-payment of the leasing fees, and past experience made Shell decide against this option.

Shell's business is smoothly expanding, but it is being supported by subsidies from the Dutch government for initial investment (the cost of purchase).[28] In other words, the expanded sales of SHSs rely on these subsidies. The Dutch government has appropriated 5 million dollars for the subsidies, which are to be discontinued once 15,000 systems have been sold.

Since there is a limit to such subsidies, the preparation of a financial scheme enabling individual beneficiaries to procure funds will eventually assume more importance for the widespread diffusion of SHSs.

(3) Distribution service by qualified third parties using mini-grids

Distribution service may also be provided through mini-grids with "qualified third parties", as defined in EPIRA, serving as the operators. Based on concession agreements, this approach may be taken in districts where there are no prospects for grid extension by ECs. This model has already been incorporated into the World Bank APL package, and plans are being made for its implementation in 40 barangays in Palawan. It is also one of the options in the KEPCO "Adopt-a-Barangay" program.

Nevertheless, the economic feasibility varies with the number of customers as one of the preconditions, and therefore must be assessed on a case-by-case basis. In the World Bank APL package, there are plans to prepare funding of 66 million dollars. The way has also been paved for subsidies from a universal charge.

In the mechanism for this project, the incentives for investors (operators) would greatly differ depending on the level at which rates can be set for final customers and the amount of subsidies available. Thus far, the DOE has taken a definite stance of providing subsidies only for initial investment and not for operating costs, in order to see that operators maintain disciplined operation.

As in the case of BAPAs, rates could possibly be higher than those offered by ECs. It consequently could be difficult to find a point of compromise between the assurance of operator profits and the curtailment of discontent among customers.

[28] The standard 50-Wp model costs about 33,000 pesos without subsidies, but sells for 18,360 pesos with the subsidies.

(4) Power supply using privately owned power system (POPSs)

In areas where the demand is too small to support a power supply as a self-sufficient business, the use of systems owned by individuals for supply to neighboring homes must be considered as an option. The premise here is the use of small generators for supply of power to neighboring households by running distribution lines to them or connecting BCSs to them.

The facilities are completely privately owned and are by no means installed for business purposes. As such, the supply may not be accompanied by a definite contract relationship with the beneficiaries supplied with power, or by the setting of authorized rates. These are issued that require addressing in terms of how to assure social credibility and sustainability as a scheme for power supply.

4.5.3 Recovery of Investment Costs and Tariff Issue

As discussed above, organizational structure must be diversified to implement the future power development program. Whatever the structure is, however, recovery of the investment costs and tariff issues present additional big problems.

In implementing barangay electrification, disparity of tariff levels between EC and an autonomous organization such as BAPA has already become substantial and causes a potential problem (complaints) among consumers.

There are two basic views. One is that consumers must accept such disparities if we stand on the principle that beneficiaries must pay the cost. Another is that such disparities are not acceptable and the PGP should pursue equitability among the people throughout the province.

If we take the latter view, we must go back to the basis and discuss the issues of what the subsidy should be and how to secure the funds.

4.5.4 Necessary Support of National Government for Funding EC-Grid Power Development Plan

In addition to barangay electrification, investment of 10 billion pesos is necessary to implement the EC-grid development program. But neither NPC-SPUG nor EC can raise this money on their balance sheets. In regards to the investment of NPC-SPUG, the Universal Charge, which is far short of the necessary investment in the future, must be increased. Not only through such options as taxation, but also through the mobilization of new fund sources such as donor's money and private investment must be facilitated. Otherwise, it will not be possible to raise the large amount of required funds.

The annual average investment requirement for the EC-grid expansion in Palawan for the next 12 years from 2004 to 2015 is 860 million pesos. The necessary incremental universal charge for this expansion is estimated at 1.49 centavos per kWh, assuming that the energy sales for the whole country are 5,880 GWh and that the entire fund is raised through the universal charge being imposed nationwide.

Since the universal charge approved for imposition in missionary electrification in 2003 was only 3.37 centavos per kWh as opposed to that of 9.52 centavos in the NPC-SPUG application, it will likely be quite difficult to increase the rate of the universal charge for 12 years only for the development in Palawan. Moreover, considering that the energy sales forecast tends to be rather optimistic, the possibility of the fund being approved becomes less likely.

However, some efforts should be made to apply for higher universal charges on a continuous basis since this revenue is steady once the application is approved.

The capacity of the provincial government is too small to cope with this funding difficulty, and strong support from the national government is indispensable.

Chapter 5 Recommendations for the Achievement of the Master Plan

The followings are recommendations for achieving the Master Plan for power development in Palawan Province.

5.1 Clarification of the PGP Role and Enhancement of Organization

For the success of the Master Plan, various service models must be put into practical application. It will be impossible to raise the funds needed for electrification without mobilizing those in the private sector and the hands of individuals instead of depending solely on public-sector funds. To this end, much must be expected of the PGP as regards to encouraging various entrants to participate in the market and in preparing the conditions conducive to the operation of their business. For this reason, the PGP must more clearly define its role and the tasks to be tackled from now on.

(1) Clarification of the PGP role

The PGP ought to act as a policy-maker and it would not be advisable for it to get directly involved in the operation of businesses.

One of the main reasons is that the capabilities of official agencies are quite different from those needed by operators. This is evidenced by cases in which generation facilities owned by LGUs lie idle because of the lack of adequate O&M capabilities and budgetary backing. Furthermore, assumption of responsibility extending to O&M by the PGP in order to avoid such situations could swell the PGP organization into areas that are not its proper jurisdiction. There is also a strong possibility that it would expand the administrative cost burden.

In contrast, the role of policy-maker, which is the most desired role for PGP, is to petition the national government and assembly for action on various matters, such as policy support for the service plans of NPC-SPUG and ECs. Depending on the case, it may also have to make overtures of a political nature. Funds from the national government (including NEA subsidies, DOE budget, and funds for aid from overseas donors) are extremely important to the electrification of Palawan. The PGP must take the initiative in making the systemic (institutional) arrangements required for promoting electrification.

(2) Review of the Master Plan and drafting of an electrification program

The Master Plan is a blueprint for electrification in the province up to 2015 as part of the expanded rural electrification (ER) program on the national governmental level. However, this blueprint ought to be revised as actual progress in electrification is made. This points to the need for reviews at regular intervals.

For execution of electrification, the PGP should draft a medium-term program for specific action based on the Master Plan, and furnish support for the individual projects making up this program.

The PGP must define targets for each year up to and including 2015, and formulate individual projects needed for attaining these targets. It also must stay constantly apprised of the progress of each project already under way, and propose countermeasures or alternative projects in the event of delays or major changes. In addition, it must make overtures to concerned parties (e.g., ECs, NPC-SPUG, private enterprises, beneficiaries, the national government, and overseas aid institutions) on behalf of the project. All of these activities are vital parts of the PGP role.

The instatement of an implementing scheme for a new business models is a field where the PGP must furnish formidable support. This is especially true in the case of operations led by residents, such as BAPAs and POPSs. While these are expected to be of crucial importance for expanded electrification, resident-centered organizations tend to have extremely frail foundations in both financial and technical terms. To obtain the requisite funding and the technical capabilities needed for O&M, it is indispensable for them to have the support of local banks and ECs in Palawan. The PGP must make the requisite arrangements for such support.

(3) Necessity of establishment of a dedicated energy section in the PGP

As described above, to secure the implementation of the Master Plan proposed in the Study, the PGP must establish a diversified institutional and organizational framework for electrification, show its leadership as policymaker, and plan electrification programs and projects. In this sense, the role of the PGP is very important and critical.

In the PGP organization, however, there is no dedicated section that oversees energy issues including power development. In the current situation, only six personnel from the Planning and Development Office were assigned to be engaged in the Master Plan Study.

It is strongly recommended that this tentative organization be strengthened as an independent and dedicated section (e.g., a provisional energy department) and also that its capacity be reinforced. This provisional energy department must carry out the following tasks:

- Periodical review and revision of the master plan;
- Planning of individual power development and electrification programs and projects;
- Preparation and analysis of necessary data for planning electrification programs and projects, and establishment of a system for such data that relevant organizations and persons can freely access;
- Coordination of and policy support for individual power projects, which are carried out by various stakeholders such as EC, NPC-SPUG, private investors, and beneficiaries;
- Promotion of development and use of new-and-renewable energies for power development;
- Provision of policy necessary for implementing the master plan, and negotiation with and petition to the national government and assembly for necessary policy and funding support; and
- Establishment and management of a scheme for fundraising required for power development (A concrete rural electrification funding scheme is shown in the section 5.3)

In addition, to see that these organizational capabilities function effectively and to improve staff skills, it is necessary to continue programs of capacity building, not only for the organization but also for each staff member.

5.2 Policy Support of the DOE and its Initiatives for Implementation of Rural Electrification

For the DOE, implementation of rural electrification is an important policy issue in power sector reform, and successful power development in Palawan Province is also a big challenge.

Undoubtedly, NPC-SPUG must continue to play a major role in implementing rural electrification for the future. But, as is clear from its budget size, the amount from the currently approved universal charge is far short of the required capital investment that will be needed in the future. The DOE must underscore the necessity of increasing the universal charge to the congress and the ERC.

Needless to say, an increase in the universal charge cannot solve all problems. At the national level, the amount of capital that the national government can provide is very limited as compared to the funding required for rural electrification. To bridge this deficit, capital mobilization from the private sector and various aid agencies is a prerequisite.

In addition to the implementation of rural electrification by grid extension, additional measures are necessary. They include the introduction of dispersed-type power sources (e.g., SHS), support for power business operated by beneficiaries (e.g., BAPA), and the realization of business using a mini-grid system by a private company. In this context, the DOE must develop new policies for establishing new schemes for rural electrification.

5.3 Establishment of RE Fund and Construction of Scheme for Mobilizing Funds

Organizations with a budgetary foundation, such as ECs and NPC-SPUG, may face some problems but are generally able to procure funds. In contrast, funding is hard to obtain for the diffusion of residential SHSs and mini-grid service, which will have a vital role to play in electrification over the coming years. Provisions must be made to mobilize funds for them.

As additional means of fund procurement, the Master Plan proposes the establishment of a rural electrification fund pool (REFP) managed by the PGP with the promotion of RE with funds from this pool.

5.3.1 Funding Sources

The REFP would be a pool that manages several funds in the interest of administering funding available from various institutions. Its objective is to use these funds for additional investments on the project basis and provision of O&M budget for existing facilities. Its major sources of base funds are as follows.

(1) Energy Regulation 1-94

Energy Regulation 1-94 (ER 1-94) is a funding source that is manageable by the PGP. To fund RE, the PGP could use the entire 0.5 centavos per kilowatt-hour from the Electrification Fund and a part of the 0.25 centavos per kilowatt-hour from the Livelihood Fund.

The Livelihood Fund was set up for the application to projects aimed at bettering the life of residents. Nevertheless, its funds may also be used for the cost of construction of house wiring to promote electrification and for operating costs required for power supply.

With the effectuation of the EPIRA implementing rules and regulations (IRR), ER 1-94 came to be applied even to small generators, which had previously been exempted from its application. As a result, even Delta-P and diesel power plants operated by NPC-SPUG in Palawan will be obliged to pay the ER 1-94 levy, and this will constitute a financial resource.

If income of 0.75 pesos per kWh by the ER1-94 levy is available, a total of 27.5 million pesos will be raised by 2015 based on the power demand forecast of the EC grid of Palawan. However, this money accounts for only 3.2% of the necessary fund requirement 848.5 million pesos. This really shows that fundraising by ER 1-94 cannot provide a fundamental solution to bridge the fund deficit of the barangay electrification plan.

However, prospective revenue by 2006 is 3.4 million pesos and this must contribute to the electrification of 9 barangays between 2004 and 2006, assuming that the unit cost of barangay electrification with a stand-alone system is 350,000 pesos per barangay. Fundraising by ER 1-94 is expected to provide substantial money to energize the remaining 20-30 un-electrified barangays (as of the end of 2003).

(2) Share of benefits from utilization and development of natural wealth

This is stipulated in Item B, Rule 29 of the IRR. It compels any agencies, corporations, or other entities engaged in the utilization and development of national wealth (i.e., natural resources) to pay to the concerned LGU whichever is higher: 1% of their sales or 40% of the national wealth taxes, royalties, fees, or charges paid to the national government.

In Palawan, the Malampaya Natural Gas Project falls under this stipulation, which consequently can be applied to royalties from the project. At present, however, there is a dispute between the PGP and the national government about whether or not the geographical location of the Malampaya gas field is actually in the province. A conclusion has not yet been reached on this question.

If the rights are recognized as belonging to the province, about 2 billion dollars in funding could be obtained by the end of 2021.

(3) Provision of funds from developed-country corporations

There are good chances for the utilization of renewable energy such as mini hydropower, photovoltaic systems and biomass within the Palawan electrification projects. By applying the Clean Development Mechanism (CDM) to these projects, it would be possible to build a scheme for the receipt of funding from companies from developed countries.

The basic idea would be to have a CDM fund established mainly by the PGP and seek contributions (i.e., a sort of equity) from companies that want to get quotas for greenhouse gas (GHG) emissions in other countries. The CDM fund could be used to fund investment for CDM projects. The GHG emission quotas would, in turn, be allocated among the investing companies, in proportion with their contribution.

The Philippines ratified the Kyoto Protocol in November 2003, and therefore has footing for the introduction of CDM schemes. A decision has already been made to set up a designated national authority (DNA) for CDM schemes within the Department of Environment and Natural Resources (DENR). The national government and aid institutions are moving head with preparations for the launch of CDM projects applying renewable energy. In this sense, the foundation for utilizing the CDM is now taking shape.

(4) Local taxes

A local tax could be imposed on distribution companies in the province. The prospective targets would be ECs.

ECs receive continuous funding for the purchase of power wholesale from NPC-SPUG, investment in distribution lines and facility O&M. This funding enables them to hold down their rates. In contrast, rates must be set at extremely high levels by electrification entities that lack schemes for such ongoing assistance (e.g., BAPAs). The local tax would be aimed at rectifying this inconsistency, if only by a slight degree.

In the following respects, however, the imposition of such a local tax would have to be preceded by in-depth studies among the concerned parties.

If, as a local tax, 1 centavo per kWh on the EC power sales were charged, a total of 32.3-million-peso income would be realized between 2004 and 2015. But this amount of fundraising would account for only 3.8% of the necessary fund requirement and, like the fundraising by ER 1-94, cannot provide a fundamental solution for bridging the fund deficit.

However, the revenue between 2004 and 2006 is estimated at 4 million pesos and can provide funds to energize 11 barangays by 2006.

It cannot be denied that BAPAs also receive assistance for initial investment in that they are furnished with facilities from LGUs and ECs virtually free of charge. Putting initial investment aside, the continuation of the service requires the retrieval of depreciation and repair costs, but arrangements have not yet been made for such funding, and this is creating problems for business continuity (in fact, such problems are already surfacing). If all of these costs were transferred to customers under the beneficiary burden principle, the BAPA rate levels, which are already high at about 15 pesos per kilowatt-hour, could jump to 30-40 pesos with the addition of depreciation costs. Due to such circumstances it would, in effect, not be practical to transfer all costs on to beneficiaries, and some kind of solution is therefore needed.

Another issue has to do with the reform and related actions to correct the structure of cross-subsidization that has been practiced for electric utilities thus far in the Philippines. Naturally, some may question the appropriateness of reallocating subsidies through such a scheme.

5.3.2 Application of Funds

Expenditures from the REFP resting on the aforementioned sources would be made through the following prospective framework.

(1) Promotion of SHS diffusion through the SHS fund

Sales of SHS are already being assisted by grant aid from the Dutch government. This aid is supporting their diffusion, which is smoothly proceeding.

Under these circumstances, measures are being taken for the provision of loans to individuals from financial institutions and the avoidance of the related risk of non-performing debt with aid from the UNDP-GEF in the context of the PNRELSP. There is also a movement for the use of APL from the World Bank to provide a financial source for the flow of funds from commercial banks to local banks. These steps are aimed at paving the way for financing for individuals who have a low credit rating and would find it hard to borrow from ordinary commercial banks, by putting local banks and micro-credit in the middle.

In light of the risk of failure to repay loans, the establishment of a loss reserve fund to hedge the risk of default has been proposed in the PNRELSP.

At any rate, SHSs have a critical role to play in the electrification of Palawan, and some institutional arrangements must be made to expand the extension of loans for them to individuals and to hedge risks in order to secure these loans.

To support SHS sales, the PGP must institute such a SHS fund in a manner consistent with the existing institutional mechanisms and use the fund to furnish assistance to dealers and funding to residents (e.g., public loans and partial subsidization of down-payments).

(2) O&M fund as a reserve for retrieval of depreciation costs and O&M expenses for reinvestment in facilities

Provisions have already been made for the loan of power generation facilities to BAPAs by LGUs or ECs. These provisions are expected to expand over the coming years.

Thus far, LGUs and ECs have lent facilities to resident organizations either for no fee or for only a nominal fee, and the facility costs have not been recovered through rates. The problem with this setup lies in the limited service life of the facilities; unless depreciation costs are retrieved, funding has to be procured all over again for facility reinvestment. This reveals a need for the preparation of a financial scheme enabling the recovery of the cost of facilities lent to BAPAs.

If the facilities are owned by the ECs, they are counted as assets on the EC balance sheet and are amortized in the context of EC financial affairs. As a result, even if depreciation costs cannot be retrieved from BAPAs, the EC can recover them from its rates (tariff revenue).

If the facilities are owned by LGUs, on the other hand, different problems would be involved. Because governments do not have balance sheets, they also lack the concept of depreciation. In addition, presently the Palawan LGUs take only 1 peso in facility leasing fees from BAPAs, and this is obviously far from the genuine retrieval of depreciation costs. Furthermore, arrangements have not been made for the recovery of O&M costs from rates. As such, there is no mechanism for balancing expenditures (costs) and income (cost recovery). It will consequently become impossible to keep electrification projects in operation if the government does not make budget appropriations for them every year.

In addition, there is some cause for apprehension about the emergence of a problem in the future in which LGUs come to own even more facilities and continue to lend them to BAPAs under the current conditions. This would lead to a steady swelling of the funds needed for reinvestment and routine O&M costs. As a result, the financial burden on the PGP would become heavier each year.

The objective of the O&M fund would be to resolve these problems and assume the burden of costs that cannot be transferred to rates.

(3) Investment fund for general projects

This fund would be instituted to provide funds for additional investment in electrification or for the expansion of installed facilities. Its range of application should be as wide as possible, in order to furnish the funds needed for construction of facilities owned by LGUs and lent to BAPAs, and furnish part of the funds for investment by private enterprises.

(4) Investment fund for CDM projects

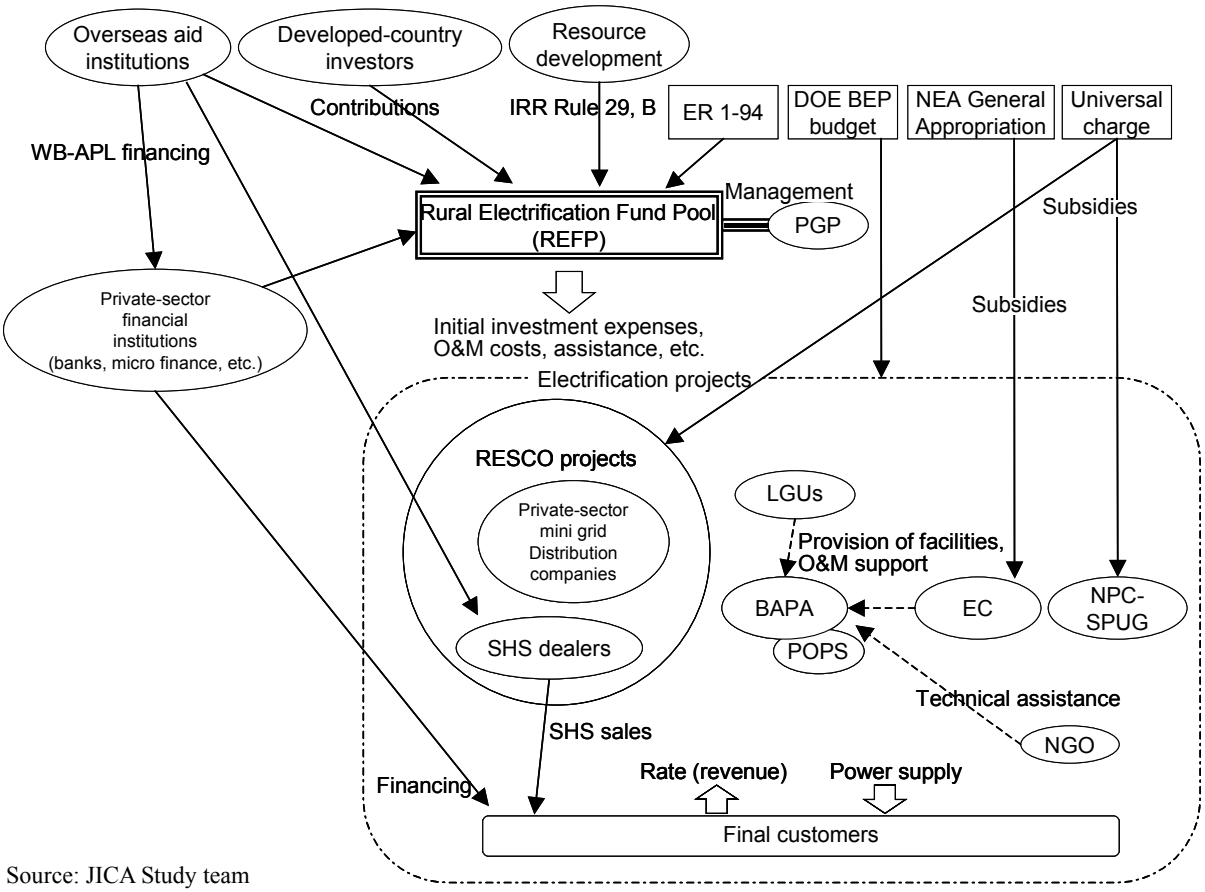
As described in the section on funding sources, this fund would be confined to CDM projects. It would collect contributions from overseas companies and apply funds to specific projects.

It should be noted that, because of the small scale of electrification projects on Palawan, the application of the CDM to each project individually would be unrealistic, owing to the cost of obtaining authorization for each project separately. For this reason, the PGP must lead efforts to design a project that could serve as a model, obtain CDM authorization for it, and implement many others of the same type.

Projects for which the application of this fund is desired could be automatically made into CDM projects by following (in other words, copying) this model designed for such application.

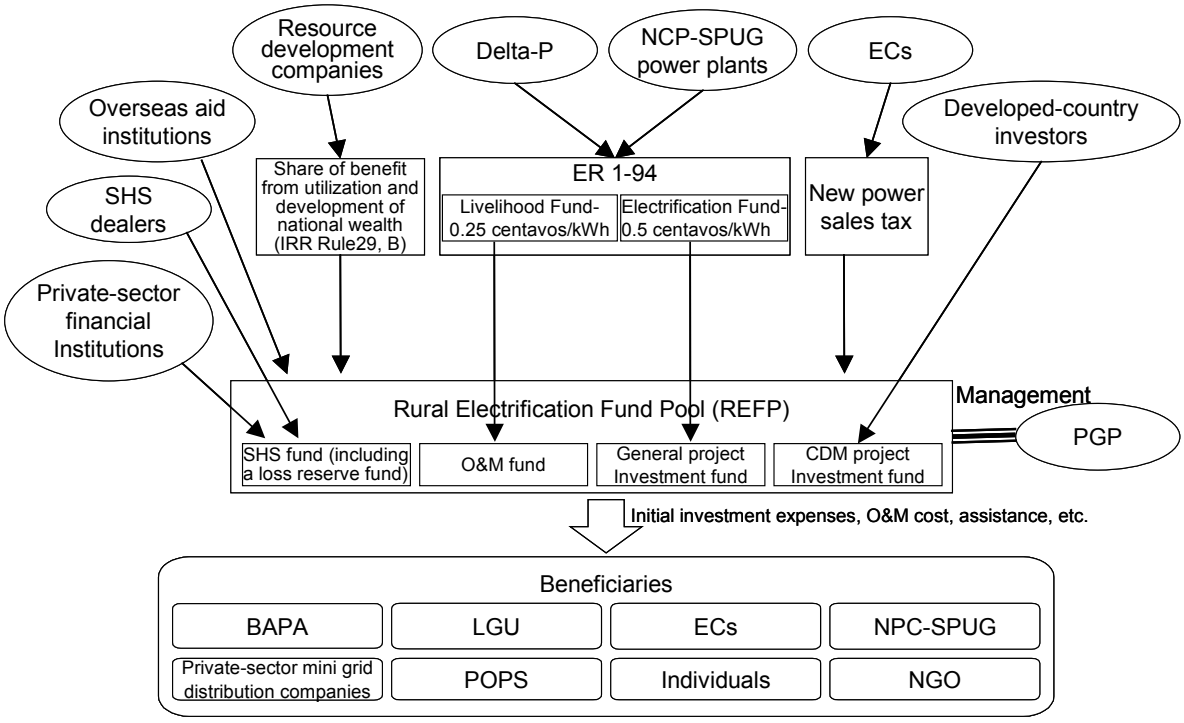
With such preparations, the work of obtaining CDM authorization would be completed with the design of the initial model project. In this manner, the concerned parties could avoid the redundant work of repeatedly obtaining authorization at the stage of project implementation.

CDM application requires considerable time and expense for the establishment of the baseline, assessment of the GHG-reducing effect and procedures for obtaining authorization as a CDM project. This work therefore should be undertaken quickly, beginning right from the stage of instituting the fund.



Source: JICA Study team

Figure 5.1 Setup for Promotion of Electrification on Palawan



Source: JICA Study team

Figure 5.2 REFP Scheme

5.4 Future Direction of Assistance for the Realization of the Master Plan

The following proposals regarding the future assistance for the realization of the Master Plan are set out in this section.

(1) Assistance for hydropower development
(2) Assistance for transmission development and system operation
(3) Assistance for improvement of the sustainability of BAPA

PGP shall make a master plan including a power demand forecast, a power development plan, and etc. on their own account, using the results of technology transfer in the Study and to address the technology and funds needed for the Master Plan, which is disclosed to stakeholders such as aid agencies, private companies, NGOs, etc., from ODA and private investment. Although a master plan, a blueprint for power development, provides information on the outlines of candidate projects, the profitability or environmental impact of each project is not shown in the plan. Therefore, PGP needs to establish a climate favorable for stakeholders' participation in power development in Palawan such as providing more practical information on the results of a feasibility study.

5.4.1 Assistance for Hydropower Development

The power development plan up until 2015 in the Study includes 71.55 MW of diesel power development and 7, 17.75 MW, candidate sites of hydropower development, although all the power plants are diesel-fuelled in Palawan at present. Small-scale hydropower, one of the domestic energy sources, has a low impact on the environment, a low CO_2 emission, and a high priority as a power source in the Philippines and Palawan. The candidate hydropower projects proposed in the Study are economically efficient based on the least cost simulation and benefit for the Palawan province, therefore, the development of these projects should be advanced.

However, a feasibility study reflecting the actual condition of the candidate sites is necessary to advance the projects, because the feasibility of a hydropower project heavily depends on the properties of a proposed site.

The four candidate sites which are proposed in the Study are from results of a map study and require a pre-feasibility study at least in future. Although the pre-feasibility or feasibility study has already been conducted for the other three sites, it is appropriate to re-examine its scale or design, based on the present environmental conditions if necessary.

Figure 5.1 Study Level of Candidate Hydropower Development

No.	Site	Capacity (kW)	Cost (Million US$)	Year in the MP	Level
1	Babuyan	5,600	17.7	2007	FS, 1992
2	Cabinbin	800	1.2	2006	Pre-FS, 1999
3	Batang Batang	6,700	20.0	2015	FS, 2000
4	**Malatgao**	**2,200**	**5.3**	**2006**	**Map study**
5	**Barong Barong**	**620**	**1.5**	**2006**	
6	**Talakaigan**	**990**	**2.5**	**2006**	
7	**Baraki**	**840**	**3.2**	**2009**	
	Total	17,750	51.4		

In view of the fact that the Study team has only transferred technologies for the formulation of the Master Plan in the Study to PGP, its capability to assess the feasibility of a hydropower project is inadequate and its financial situation is stringent. PGP needs to strengthen the implementation structure and capacity of promoting hydropower development through technology transfers regarding the feasibility assessment and the promotion policy of a hydropower development for the realization of the Master Plan.

5.4.2 Assistance for Transmission Development and System Operation

The Study suggests that the investment costs for the EC-grid power development plan from 2004 to 2015 will amount to more than 10 billion pesos and capital mobilization from the private sector and various aid agencies as well as an increase in the Universal Charge is a pre-requisite to achieve the plan. Organizations with a budgetary foundation, such as ECs and NPC-SPUG, may face problems but are generally able to provide funds. Otherwise, to achieve the Master Plan, it is important to proceed with transmission development in accordance with power development. In this regard, the projects planned in a few years should be implemented as quickly as possible, because projects involving the EC-grid power development requires considerable lead time compared to mini-grid system or stand-alone system projects.

Table 5.2 shows the proposed projects of transmission development and system operation planned in the Study. The projects involving the extension of the northern part of the backbone grid is now under construction and therefore the necessity of assistance for them is low. However, the five projects planned for up until 2009, the development of voltage step-up of tie line to 69kV, 69/13.8kV Abo-Abo S/S (new), 69/13.8kV Narra S/S Tr. (expansion), 69/13.8kV Puerto Princesa S/S (new) and ALD system (new), were only studied at a desk level and therefore it is necessary to support these projects with a pre-feasibility study for the smooth implementation of the Master Plan.

Table 5.2 Transmission Development Plan for the Backbone Grid

Year	Transmission Line	Substation
2006	69kV Puerto Princesa City - Roxas T/L 69kV Roxas - Taytay T/L	69/13.8kV Roxas S/S 69/13.8kV Taytay S/S **69/13.8kV Abo-Abo S/S**
2008	Doubled Circuit of 13.8kV Tie Line	**69/13.8kV Narra S/S Tr.**
2009	**Voltage step-up of Tie Line to 69kV**	**69/13.8kV Puerto Princesa S/S**
2012		69/13.8kV Brooke's Point S/S Tr.
2013		69/13.8kV Narra S/S Tr.
2014		69/13.8kV Puerto Princesa S/S Tr.
2015	69kV Taytay-El Nido T/L	69/13.8kV El Nido S/S

Note : excluding access lines to hydropower plants

Table 5.3 System Operation Plan for the Backbone Grid

Year	Project	Note
2009	**ALD System**	**System Stabilizing Equipment**
2015	Palawan Dispatching Center	SCADA/ EMS System

5.4.3 Assistance for Improvement of the Sustainability of BAPA

As mentioned in Section 4.5.2, electricity supply through mini-grids like BAPA and installation of stand-alone systems instead of EC-grid extension, which are easy to manage and require lower investment, will have a vital role to play for the electrification of a fairly large proportion of the remaining un-electrified barangays, because they have lower economic feasibility due to the distance from the existing EC-grids and the low density of power demand.

There are no technical or financial problems preventing BAPA from supplying electricity. However, BAPAs generally lack the technical foundation needed for operation and maintenance (O&M) as required for running the works and also tend to have a weak financial status. Consequently, it cannot be concluded that the sustainability BAPA is assured. The most significant problem is the lack of a large-scale overhaul and absence of a reserve for reinvestment.

Table 5.4 Existing BAPA in Palawan

	Barangay	Municipality	Start of Operation
1	Bgy. Port Barton	San Vicente	September 1, 2001
2	Bgy. Sta. Teresita	Dumaran	October 1, 2001
3	Bgy. Poblacion	Dumaran	October 1, 2001
4	Bgy. Liminangcong	Taytay	December 17, 2001
5	Bgy. Manamoc	Cuyo	-
6	Bisucay Island	Cuyo	-

Source: BAPA Evaluation Report, PGP

PGP became aware of operational and maintenance problems in a BAPA program throughout the Study and has been conducting an evaluation of existing BAPAs. However, the results of the evaluation identified only the technical and financial problems mentioned above due to the limited experience of the BAPA program, the insufficient accumulation of data and know-how of BAPA management and the lack of human resources in PGP.

BAPA needs a new BAPA scheme that overcomes the problems to secure its sustainability. The experience and capacity for project formation and implementation of PGP is, however, insufficient to develop the new scheme. Therefore, PGP requires technology transfers on the development of the new BAPA scheme, including technology which assists with project evaluation, the concept of a burden on the beneficiaries of BAPA, the securing and operational management of reserves for reinvestment, the accumulation of data and know-how, etc. In addition to the above, technologies on the formulation of a project to revitalize economic activities and for the improved livelihood in the area where BAPA is established are needed to strengthen their financial status.

In the Study, a mini-grid system in which micro hydropower, a source of renewable energy, provides electricity, was examined. Moreover, the possibility of a future mini-grid system development for the provision of electricity to several barangays, was also examined. Therefore, PGP needs to strengthen its capability of evaluating diverse BAPA projects.

Appendix I

Candidate Power Plants for the Backbone Grid Generation Development Plan

(Diesel Power Plant)

Abbreviation		D005	D015	D050	D100	D200
Rated Capacity	kW	500	1,500	5,000	10,000	20,000
Unit Capacity	kW	1x500	1x1,500	1x5,000	2x5,000	2x10,000
Dependable Capacity	kW	450	1,350	4,500	9,000	18,000
Construction Cost	$/kW	1,600	1,452	1,399	1,353	1,310
Fuel Type		Diesel	Base Scenario : Diesel Option Scenario : Bunker C			
Fuel Cost	$/Gcal	3,082	Base Scenario : 3,082 Option Scenario : 2,097			
Construction Period	Kcal/kWh	2,780	2,595			
Incremental Heat Rate	Kcal/kWh	2,288	1,995			
Fixed O&M Cost	$/kW-month	8.12	4.86	2.76	2.00	1.45
Variable O&M Cost	c/kWh	2.20				
Life Time	Year	15				
Construction Period	Year	2				

(Hydropower Plant)

Abbreviation		BYN	BRBR	MTG	TAL	CBB	BRK	BB
Site Name		Babuyan	Barong Barong	Malatgao	Talakaigan	Cabinbin	Baraki	Batang Batang
Rated Capacity	KW	5,600	620	2,200	990	800	840	6,700
Storage Capacity	MWh	50.0	0 (Run-of-River Type)					
Construction Cost	$/kW	3,765.9	2,329.6	2,423.4	2,516.8	2,641.0	3,802.1	3,267.5
Annual Generation	GWh	24.18	3.77	13.34	6.08	5.08	5.18	27.40
Fixed O%M Cost	$/kW-month	0.89	2.89					
Life Time	Year	40						
Construction Period	Year	3	2					

Appendix II

Whole Barangay Electrification Program from 2004 to 2006 (1/6)

<ABORLAN>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Sagpangan	Stand-alone	2004	20 households	0.35
Culandanum (a)	Stand-alone	2005	20 households	0.35

<AGUTAYA>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Diit	Stand-alone	2004	20 households	0.35
Villafria	Stand-alone	2004	20 households	0.35
Villasol	Stand-alone	2004	20 households	0.35
Algeciras	Mini-grid	2006	87 kW	3.70
Conception (a)	Mini-grid	2006	63 kW	3.20
Maracanao	Stand-alone	2006	20 households	0.35
Matarawis	Stand-alone	2006	20 households	0.35

<ARACELI>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Dagman	Stand-alone	2005	20 households	0.35
Lumacad	Stand-alone	2005	20 households	0.35
Mauringuen	Stand-alone	2005	20 households	0.35
Osmena (a)	Stand-alone	2005	20 households	0.35
Taloto	Stand-alone	2005	20 households	0.35
Balogo	Stand-alone	2006	20 households	0.35
Dalayawon	Stand-alone	2006	20 households	0.35
Madoldolon	Stand-alone	2006	20 households	0.35
San Jose De Oro	Stand-alone	2006	20 households	0.35
Santo Nino (a)	Stand-alone	2006	20 households	0.35

<BALABAC>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Catagupan	Stand-alone	2004	20 households	0.35
Ramos	Stand-alone	2004	20 households	0.35
Salang	Stand-alone	2004	20 households	0.35
Agutayan	Stand-alone	2005	20 households	0.35
Bugsuk (New Cagayancillo)	Stand-alone	2005	20 households	0.35
Indalawan	Stand-alone	2005	20 households	0.35
Malaking Ilog	Stand-alone	2005	20 households	0.35
Melville	Stand-alone	2005	20 households	0.35
Pandanan	Stand-alone	2005	20 households	0.35
Pasig	Stand-alone	2005	20 households	0.35
Rabor	Stand-alone	2005	20 households	0.35
Sebaring	Stand-alone	2005	20 households	0.35
Bancalaan	Mini-grid	2006	87 kW	4.60
Mangsee	Mini-grid	2006	63 kW	4.10

Whole Barangay Electrification Program from 2004 to 2006 (2/6)

<BATARAZA>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Buliluyan	Stand-alone	2004	20 households	0.35
Igang igang	Stand-alone	2004	20 households	0.35
Iwahig	Stand-alone	2004	20 households	0.35
Ocayan	Stand-alone	2004	20 households	0.35
Sapa	Stand-alone	2004	20 households	0.35
Sarong	Stand-alone	2004	20 households	0.35
Taratak	Stand-alone	2004	20 households	0.35
Bulalacao (a)	EC-grid extension	2005	20 kW	3.90
Malihud	EC-grid extension	2005	19 kW	4.80
Malitub	Stand-alone	2005	20 households	0.35
Puring	Stand-alone	2005	20 households	0.35
Tabud	Stand-alone	2005	20 households	0.35
Tagnato	Stand-alone	2005	20 households	0.35
Tagolango	Stand-alone	2005	20 households	0.35
Culandanum (b)	Mini-grid	2006	50 kW	4.30
Rio Tuba	Mini-grid	2006	108 kW	7.50
Sandoval (a)	Mini-grid	2006	34 kW	5.20
Sumbiling	Mini-grid	2006	34 kW	3.60
Tarusan	EC-grid extension	2006	41 kW	3.90

<BROOKE'S POINT>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Imulnod	EC-grid extension	2004	18 kW	2.00

<BUSUANGA>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Cheey	Stand-alone	2004	20 households	0.35
Halsey	Stand-alone	2005	20 households	0.35
Maglalambay	Stand-alone	2005	20 households	0.35
Burabod	Stand-alone	2006	20 households	0.35

<CAGAYANCILLO>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Magsaysay (a)	Stand-alone	2005	20 households	0.35
Mampio	Stand-alone	2006	20 households	0.35
Nusa	Stand-alone	2006	20 households	0.35

<CULION>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Binudac	Stand-alone	2004	20 households	0.35

Whole Barangay Electrification Program from 2004 to 2006 (3/6)

<CUYO>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Caponayan	Stand-alone	2005	20 households	0.35
Lubid	Stand-alone	2005	20 households	0.35

<DUMARAN>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Capayas	Stand-alone	2004	20 households	0.35
Ilian	Stand-alone	2004	20 households	0.35
Santo Tomas	Stand-alone	2004	20 households	0.35
Tanatanaon	Stand-alone	2004	20 households	0.35
San Juan (b)	Stand-alone	2005	20 households	0.35
Santa Maria	Stand-alone	2005	20 households	0.35

<EL NIDO (BACUIT)>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Barotuan	Stand-alone	2004	20 households	0.35
Bebeladan	Stand-alone	2004	20 households	0.35
Mabini (b)	Stand-alone	2004	20 households	0.35
Manlag	Stand-alone	2004	20 households	0.35
New Ibajay	Stand-alone	2004	20 households	0.35
Pasadena	Stand-alone	2004	20 households	0.35
San Fernando	Stand-alone	2004	20 households	0.35
Sibartan	Stand-alone	2004	20 households	0.35
Villa Libertad	Stand-alone	2004	20 households	0.35
Villa Paz	Stand-alone	2005	20 households	0.35
Bucana	Mini-grid	2006	63 kW	5.30
Teneguiban	Mini-grid	2006	50 kW	6.70

<LINAPACAN>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Nangalao	Stand-alone	2004	20 households	0.35

<MAGSAYSAY>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Canipo	Stand-alone	2005	20 households	0.35
Cocoro	Stand-alone	2005	20 households	0.35
Alcoba	Stand-alone	2006	20 households	0.35

Whole Barangay Electrification Program from 2004 to 2006 (4/6)

<PUERTO PRINCESA CITY (CAPITAL)>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Babuyan*	EC-grid extension	2004	22 kW	3.60
Bahile	Stand-alone	2004	20 households	0.35
Conception (c)	Stand-alone	2004	20 households	0.35
Langogan	Stand-alone	2004	20 households	0.35
Macarascas	Stand-alone	2004	20 households	0.35
San Rafael (b)	Stand-alone	2004	20 households	0.35
Simpocan	Stand-alone	2004	20 households	0.35
Tagabinit	Stand-alone	2004	20 households	0.35
Bagong Bayan (b)	Stand-alone	2005	20 households	0.35
Binduyan	Stand-alone	2005	20 households	0.35
Buena Vista (b)	Stand-alone	2005	20 households	0.35
Marufinas	Stand-alone	2005	20 households	0.35
New Panggangan	Stand-alone	2005	20 households	0.35
Tanabag	Stand-alone	2005	20 households	0.35
Cabayugan	Mini-grid	2006	34 kW	3.40
* Upgraded Barangay: Bgy. Babuyan has already electrified by a Stand-alone system in 2003.				

<QUEZON>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Kalatagbak	Stand-alone	2004	20 households	0.35
Calumpang	Stand-alone	2004	20 households	0.35
Maasin (b)	Stand-alone	2004	20 households	0.35
Sowangan	Stand-alone	2004	20 households	0.35
Tagusao	Stand-alone	2004	20 households	0.35
Malatgao (b)	EC-grid extension	2005	23 kW	3.60
Aramaywan (b)	Mini-grid	2006	34 kW	5.20
Isugod	Mini-grid	2006	34 kW	4.00
Quinlogan	Mini-grid	2006	50 kW	4.50

<RIZAL (MARCOS)>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Canipaan	Mini-grid	2006	50 kW	4.70
Culacian (b)	Mini-grid	2006	50 kW	3.00
Iraan (b)	Mini-grid	2006	108 kW	9.30
Latud	Mini-grid	2006	34 kW	6.50
Panalingaan	Mini-grid	2006	87 kW	5.80
Ransang	Mini-grid	2006	87 kW	6.90

Whole Barangay Electrification Program from 2004 to 2006 (5/6)

<ROXAS>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Caramay	Stand-alone	2004	20 households	0.35
Dumarao	Stand-alone	2004	20 households	0.35
Nicanor Zabara	Stand-alone	2004	20 households	0.35
Sandoval (c)	Stand-alone	2004	20 households	0.35
Tinitian	Stand-alone	2004	20 households	0.35
Tumarabong	Stand-alone	2004	20 households	0.35
Antonino	Stand-alone	2005	20 households	0.35
Bagong Bayan (c)	Stand-alone	2005	20 households	0.35
Barangay VI (Pob) (Johnson)	Stand-alone	2005	20 households	0.35
Santo Tomas (Iraan)	Stand-alone	2005	20 households	0.35
Jolo	Stand-alone	2005	20 households	0.35
Mendoza	Stand-alone	2005	20 households	0.35
Rizal (b)	Stand-alone	2005	20 households	0.35
Salvacion (b)	Stand-alone	2005	20 households	0.35
San Isidro (c)	Stand-alone	2005	20 households	0.35
San Miguel (b)	Stand-alone	2005	20 households	0.35
San Nicolas (c)	Stand-alone	2005	20 households	0.35
Taradungan	Stand-alone	2005	20 households	0.35
Barangay V (Pob) (Porao Is)	Stand-alone	2006	20 households	0.35

<SAN VICENTE>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Binga	Stand-alone	2004	20 households	0.35
Kemdeng	Stand-alone	2005	20 households	0.35
New Canipo	Stand-alone	2005	20 households	0.35
Caruray	Mini-grid	2006	50 kW	4.40

<SOFRONIO ESPANOLA>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Iraray	Stand-alone	2004	20 households	0.35
Pulot Interior (Pulot II)	Stand-alone	2004	20 households	0.35
Punang	Stand-alone	2004	20 households	0.35
Labog	Mini-grid	2006	50 kW	5.00

Whole Barangay Electrification Program from 2004 to 2006 (6/6)

<TAYTAY>

Barangay	Electrification Method	Target Year	Capacity (kW)	Investment Cost (million Php)
Alacalian	Stand-alone	2004	20 households	0.35
Bantulan	Stand-alone	2004	20 households	0.35
Libertad	Stand-alone	2004	20 households	0.35
Paglaum	Stand-alone	2004	20 households	0.35
Paly (Paly Is)	Stand-alone	2004	20 households	0.35
Pancol	Stand-alone	2004	20 households	0.35
San Jose (d)	Stand-alone	2004	20 households	0.35
Tumbod	Stand-alone	2004	20 households	0.35
Baras	Stand-alone	2005	20 households	0.35
Batas	Stand-alone	2005	20 households	0.35
Depla	Stand-alone	2005	20 households	0.35
Meytegued	Stand-alone	2005	20 households	0.35
Minapla	Stand-alone	2005	20 households	0.35
Old Guinlo	Stand-alone	2005	20 households	0.35
Pamantolon	Stand-alone	2005	20 households	0.35
Sandoval (d)	Stand-alone	2005	20 households	0.35
Silanga	Stand-alone	2005	20 households	0.35
Talog	Stand-alone	2005	20 households	0.35
New Guinlo	Mini-grid	2006	34 kW	4.30

Appendix III

Household Electrification Improvement Program from 2007 to 2015 (1/3)

<ABORLAN> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	430	-	430	-	430	18	-	-	1,308
Investment Cost	-	7.5	-	7.5	-	7.5	0.3	-	-	22.9

<AGUTAYA> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	430	-	119	-	-	-	-	-	-	549
Investment Cost	7.5	-	2.1	-	-	-	-	-	-	9.6

<ARACELI> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	390	-	-	-	-	-	-	-	390
Investment Cost	-	6.8	-	-	-	-	-	-	-	6.8

<BALABAC> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	430	-	430	-	199	-	-	-	-	1,059
Investment Cost	7.5	-	7.5	-	3.5	-	-	-	-	18.5

<BATARAZA> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	430	-	430	-	430	430	430	390	-	2,540
Investment Cost	7.5	-	7.5	-	7.5	7.5	7.5	6.8	-	44.4

<BROOKE'S POINT> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	430	-	430	-	430	430	860	550	3,130
Investment Cost	-	7.5	-	7.5	-	7.5	7.5	15.0	9.6	54.8

<BUSUANGA> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	430	-	430	-	430	132	-	-	-	1,422
Investment Cost	7.5	-	7.5	-	7.5	2.3	-	-	-	24.9

<CAGAYANCILLO> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	147	-	-	-	-	-	-	-	147
Investment Cost	-	2.6	-	-	-	-	-	-	-	2.6

Household Electrification Improvement Program from 2007 to 2015 (2/3)

<CORON> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	430	-	430	430	-	430	173	-	1,893
Investment Cost	-	7.5	-	7.5	7.5	-	7.5	3.0	-	33.1

<CUYO> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	274	-	-	-	-	-	-	-	274
Investment Cost	-	4.8	-	-	-	-	-	-	-	4.8

<DUMARAN> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	430	-	430	-	417	-	-	-	-	1,277
Investment Cost	7.5	-	7.5	-	7.3	-	-	-	-	22.3

<EL NIDO (BACUIT)> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	430	-	430	-	430	430	119	-	-	1,839
Investment Cost	7.5	-	7.5	-	7.5	7.5	2.1	-	-	32.2

<LINAPACAN> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	430	-	430	-	62	-	-	-	-	922
Investment Cost	7.5	-	7.5	-	1.1	-	-	-	-	32.2

<MAGSAYSAY> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	126	-	-	-	-	-	-	-	126
Investment Cost	-	2.2	-	-	-	-	-	-	-	2.2

<NARRA> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	430	-	430	-	430	411	-	-	1,701
Investment Cost	-	7.5	-	7.5	-	7.5	7.2	-	-	29.8

<PUERTO PRINCESA CITY (CAPITAL)> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	-	430	430	-	430	430	860	1,279	3,859
Investment Cost	-	-	7.5	7.5	-	7.5	7.5	15.0	22.4	67.5

Household Electrification Improvement Program from 2007 to 2015 (3/3)

<QUEZON> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	430	-	430	430	440	430	343	-	2,503
Investment Cost	-	7.5	-	7.5	7.5	7.7	7.5	6.0	-	43.8

<ROXAS> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	430	-	430	430	-	860	162	-	2,312
Investment Cost	-	7.5	-	7.5	7.5	-	15.0	2.9	-	40.5

<SAN VICENTE> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	430	-	430	272	-	-	-	-	-	1,132
Investment Cost	7.5	-	7.5	4.8	-	-	-	-	-	19.8

<TAYTAY> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	430	-	430	-	430	430	430	860	224	3,234
Investment Cost	7.5	-	7.5	-	7.5	7.5	7.5	15.0	3.9	56.6

<CULION> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	430	-	430	210	-	-	-	-	3,234
Investment Cost	-	7.5	-	7.5	3.7	-	-	-	-	18.7

<RIZAL (MARCOS)> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	430	-	430	430	-	430	430	860	665	3,675
Investment Cost	7.5	-	7.5	7.5	-	7.5	7.5	15.0	11.6	64.3

<SOFRONIA ESPANOLA> (Unit: million Php)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Target HH to Electrify	-	430	-	430	430	375	-	-	-	1,665
Investment Cost	-	7.5	-	7.5	7.5	6.6	-	-	-	29.1

Appendix IV

Power Demand Forecast of each EC-Grid (1/3)

Mainland Palawan

<Backbone Grid[29]>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	103,597	121,626	138,067	157,007	178,856	204,099	233,305	267,141	306,397	351,998	405,038	466,802
Gross Gen. (MWh)	117,723	138,210	156,894	178,416	203,244	231,930	265,118	303,567	348,176	399,995	460,267	530,457
Peak Demand (kW)	21,517	25,263	28,680	32,616	37,156	42,401	48,469	55,498	63,653	73,125	84,143	96,971

<EL NIDO Grid>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	571	656	754	868	1,000	1,154	1,333	1,541	1,784	2,068	2,400	2,788
Gross Gen. (MWh)	635	729	838	964	1,111	1,282	1,481	1,712	1,983	2,298	2,667	3,098
Peak Demand (kW)	361	414	476	548	632	729	842	973	1,127	1,306	1,516	1,761

<TAYTAY Grid>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	638	-	-	-	-	-	-	-	-	-	-	-
Gross Gen. (MWh)	709	-	-	-	-	-	-	-	-	-	-	-
Peak Demand (kW)	373	-	-	-	-	-	-	-	-	-	-	-

<ROXAS Grid>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	3,095	-	-	-	-	-	-	-	-	-	-	-
Gross Gen. (MWh)	3,439	-	-	-	-	-	-	-	-	-	-	-
Peak Demand (kW)	758	-	-	-	-	-	-	-	-	-	-	-

<SAN VICENTE Grid>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	333	379	432	494	564	646	741	850	978	1,126	1,298	1,498
Gross Gen. (MWh)	370	421	480	548	627	718	823	945	1,086	1,251	1,442	1,664
Peak Demand (kW)	314	357	407	465	532	609	698	802	922	1,062	1,224	1,412

[29] The backbone grid includes the municipality of Puerto Princesa City, Narra, Brooke's Point, and Bataraza. The municipality of Roxas and Taytay will be connected to the backbone grid in 2005.

Power Demand Forecast of each EC-Grid (2/3)

Island Municipalities

<BUSUANGA Grid>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	3,970	4,558	5,254	6,085	7,083	8,294	9,775	11,605	13,888	16,762	20,412	25,090
Gross Gen. (MWh)	4,563	5,240	6,039	6,994	8,142	9,533	11,235	13,339	15,964	19,267	23,462	28,838
Peak Demand (kW)	968	1,112	1,282	1,484	1,728	2,023	2,384	2,831	3,388	4,089	4,980	6,120

<CULION Grid>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	529	607	700	811	944	1,105	1,302	1,546	1,850	2,233	2,720	3,343
Gross Gen. (MWh)	588	675	778	901	1,049	1,228	1,447	1,718	2,056	2,481	3,022	3,714
Peak Demand (kW)	324	372	428	496	578	676	797	946	1,132	1,366	1,664	2,045

<LINAPACAN Grid>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	165	189	218	253	294	344	406	482	576	696	847	1,041
Gross Gen. (MWh)	183	210	242	281	327	383	451	535	641	773	941	1157
Peak Demand (kW)	129	148	171	198	231	270	318	378	452	546	664	817

<CUYO Grid>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	3,344	3,784	4,285	4,859	5,516	6,268	7,130	8,120	9,258	10,568	12,077	13,816
Gross Gen. (MWh)	3,716	4,204	4,762	5,399	6,128	6,964	7,922	9,023	10,287	11,742	13,418	15,351
Peak Demand (kW)	1,152	1,303	1,476	1,673	1,899	2,158	2,455	2,797	3,188	3,639	4,159	4,758

<ARACELI Grid>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	272	308	351	399	455	519	593	679	778	892	1,024	1,178
Gross Gen. (MWh)	302	343	390	444	506	577	659	754	864	991	1,138	1,309
Peak Demand (kW)	145	165	188	214	244	278	317	363	416	477	548	630

Power Demand Forecast of each EC-Grid (3/3)

<BALABAC Grid>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	272	308	351	399	455	519	593	679	778	892	1,024	1,178
Gross Gen. (MWh)	302	343	390	444	506	577	659	754	864	991	1,138	1,309
Peak Demand (kW)	145	165	188	214	244	278	317	363	416	477	548	630

<CAGAYANCILLO Grid>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	91	103	118	134	152	174	199	227	260	299	343	394
Gross Gen. (MWh)	94	107	121	138	157	179	205	234	268	308	353	406
Peak Demand (kW)	45	51	58	66	76	86	99	113	129	148	170	195

<AGUTAYA Grid>

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Sales (MWh)	138	156	178	203	231	264	302	346	397	455	523	602
Gross Gen. (MWh)	142	161	183	209	238	272	312	357	409	469	540	621
Peak Demand (kW)	68	77	88	101	115	131	150	172	197	226	260	299

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NSO Web Site, *http://www.census.gov.ph*

PCSD Web Site, *http://www.pcsd.ph/*

PD WIRE & CABLE Web Site, *http:// pdwireandcable.com/*