2010 Transmission Development Plan

VOLUME 01: Major Network Expansions
Final Report

2010

TRANSMISSION DEVELOPMENT PLAN

Final Report

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Foreword

Following its official takeover as the operator of the nationwide transmission system in January 2009, the NATIONAL GRID CORPORATION OF THE PHILIPPINES (NGCP) has gained the right momentum to implement programs that have produced substantial reliability and economic benefits to the stakeholders in the last two years.

Looking ahead, this 2010 Transmission Development Plan (TDP) report provides insights to the plans laid out by NGCP for 2010-2019. This ten-year plan is in response to the challenges resulting from increase in demand, new generation projects, need for reliable transmission network and support to efficient market operation – all of which are considered within the established technical and regulatory framework of the electric power industry.

For 2011-2015, the network expansion projects to be implemented by NGCP are those approved by the Energy Regulatory Commission (ERC) in the Final Determination (FD) for the Third Regulatory Period. This is without prejudice to NGCP's Motion for Clarification and Partial Reconsideration on some key items under the FD. Transmission investments associated with proposed generation projects would have to be filed separately with the ERC. NGCP may also line up expansion projects for residual sub-transmission assets that have been reverted back into the regulatory asset base.

Following the agreement with the Department of Energy (DOE), NGCP used its own load forecast and generation capacity addition in the preparation of 2010 TDP Volume I. The Power Development Program (PDP) Update, which DOE will release, will be used for the 2011 TDP. This will enable more timely releases and synchronized NGCP's conduct of transmission planning studies for the TDP vis-à-vis updating of DOE PDP.

To sustain NGCP's transmission business operations, Volume II and III outline the ten year plan for operations and maintenance and system operations, respectively. More than just a statement of capital expenditure program for rehabilitation, replacement and maintenance of network facilities, volumes II and III will allow NGCP to cope with changes over the planning horizon, respond to the operational needs of its customers and adopt to the desired 'end state' of the transmission system as envisioned in the long-term plan.

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Chapter 01. Preliminaries

1.1 About NGCP

1.1.1 Organization/Operation

NGCP's functions as the Transmission Service Provider involve the transmission of electricity in response to system and market demands:

1. From generator connection points to distribution network connection points and the direct connection points of a number of large end-users.
2. Between the three major regions of the Philippines, namely: Luzon, Visayas and Mindanao, thereby increasing reliability and reducing the overall cost of generation nationally.

In order to undertake the above services, NGCP operates a substantial control and delivery network, the key elements of which include:

1. High-voltage transmission network including submarine cable, equipped with protection system;
2. The Supervisory Control and Data Acquisition system (SCADA);
3. Regional control centers;
4. Numerous substations and depots, each of which is linked back to the central system;
5. Converter stations (HVAC - HVDC); and
6. A comprehensive metering system at substations, and direct customer delivery points.

For business management purposes, NGCP's obligations can be grouped into six (6) key service areas described as follows:

1. System operations: managing the national power grid, dispatching generation and managing the system, including the arrangement for ancillary services.
2. Network reliability: providing the appropriate levels of network reliability in accordance with the reliability requirements set forth in the Grid Code.
3. Connection service: NGCP's obligations, primarily to customers and prospective customers (e.g. generators, distributors and large end users) to provide effective, timely and efficient connection services, including metering and relevant services.
4. Safety: NGCP's obligations, primarily to its stakeholders (e.g. staff, other electricity industry employees and the community) to deliver its services with appropriate priority given to human safety.
5. Environmental: NGCP's obligations, primarily to its stakeholders (e.g. the community and government) to deliver services in an environmentally responsible manner.
6. Wholesale Electricity Spot Market: NGCP's obligations in relation to the operation and development of the electricity market, by way of the provision of efficient and effective transmission services.

In addition, NGCP continues to operate a significant set of sub-transmission services from high voltage delivery points to end users. These sub-transmission assets have been offered for sale to the distribution utilities in compliance with the requirement of the Republic Act No. 9136 (Electric Power Industry Reform Act of 2001), or EPIRA.

Pursuant to ERC Resolution No. 18 series of 2009, those sub-transmission assets which have not been sold or disposed of by 31 December 2010 shall remain as NGCP's assets which shall be included into the regulatory asset base.

1.1.2 NGCP as a Regulated Entity

With the enactment of the EPIRA into a law, generation, transmission, distribution and supply are distinguished as different business activities within the Philippine electricity industry. Among these activities, transmission and distribution exhibit natural monopoly characteristics which make regulation on them appropriate. Generation and retail sale of electricity, on the other hand, can be efficient in the competitive environment as a result of the reforms introduced by the EPIRA.

As the sole transmission service provider, NGCP is regulated under the performance-based ratemaking (PBR). The PBR is a form of utility regulation that strengthens the financial incentives to lower rates or lower costs. The PBR methodology is outlined in the Rules for Setting Transmission Wheeling Rates or RTWR.

1.2 Content Overview

The 2010 TDP consists of three (3) volumes. This Volume I contains the proposed grid expansion and upgrades, which generally, are the results of system studies. The other volumes outline the capital expenditure programs of Operations and Maintenance (Volume II) and System Operations (Volume III-Part 1). Those for metering services have been integrated into Volume III but in a separate report (Volume III-Part 2).

Volume I consists of nine (9) chapters.

Chapter 1 provides an overview of NGCP's organization and operation as transmission service provider and regulated entity.

Chapter 2 explains the assessments made on the existing transmission network, gives insights on the profile of each grid and identifies the existing and potential problems/constraints/issues in the system.

Chapter 3 discusses the latest demand projections and generation capacity addition used by NGCP as input to the simulation studies to identify future transmission constraints and transmission expansion associated with load growth, new generation connections and reliability requirements. Also included in this chapter is the supply-demand outlook of each grid for the planning horizon.

The next five chapters discuss how the projects are classified, the summary of which are shown in Table 1.1.

Chapter 4 enumerates the projects that have been completed from 01 January 2009 to 30 November 2010.

Chapter 5 describes NGCP's ongoing projects in the Luzon, Visayas and Mindanao grids.

Chapter 6 identifies the projects that are needed to be completed for the period 2011-2015.

Chapter 7 provides the list of projects beyond 2015 (indicative projects).

Chapter 8 provides an overview of the status of residual sub-transmission assets in each grid.

Chapter 9 contains different appendices that contain discussions on relevant topics such as the Grid Code performance standards, and other projects requested by some sectors.

Table 1.1 2010 TDP Project Classification

CLASSIFICATION	WITH REGULATORY APPROVAL?	DESCRIPTION
1. Recently Completed Projects	Yes	Completed between 01 January 2009 to 30 November 2010
2. Ongoing Projects	Yes	Construction activities are underway
3. Projects in the Third Regulatory Period (2011-2015)	Yes	Projects to be implemented in the Third Regulatory Period and grouped into generation-associated, load growth-driven, congestion-related, and reliability/power quality projects
4. Indicative Projects	To be filed for approval	Projects with need dates between 2016-2019 including those deferred by ERC to the next regulatory period
5. Residual Sub-transmission Assets (RSTA)	To be filed for approval	Proposed upgrading/expansion of RSTA (in case not divested by end of 2010)

There are also projects requested by some sectors that have been and/or will be filed to the ERC. These projects are listed in Appendix 4.

Chapter 02. Assessment of Transmission System

2.1 Grid Profile

As of 31 December 2009, NGCP's managed transmission assets comprised of 19,425 circuit kilometers (ckt-km). About half of these assets, or 9,568 ckt-km are in Luzon. 4,600 ckt-km form part of the Visayas Grid and the remaining 5,257 ckt-km are in Mindanao. Roughly 77% (18,452 MVA) of the total 23,873 MVA substation capacities installed are in Luzon. The Visayas account for 3,161 MVA and Mindanao 2,260 MVA. These figures exclude transmission lines and transformer assets which had been decommissioned already.

Table 2.1 Summary of Existing Facilities

SUBSTATION CAPACITY (IN MVA)					
	2009	**2008**	**2007**	**2006**	**2005**
PHILIPPINES	23,873	24,214	24,732	24,489	24,607
Luzon	18,452	18,861	19,411	19,121	19,236
Visayas	3,161	3,154	3,171	3,268	3,371
Mindanao	2,260	2,200	2,150	2,100	2,000
TRANSMISSION LINE LENGTH (IN CKT-KM)*					
	2009	**2008**	**2007**	**2006**	**2005**
PHILIPPINES	19,425	19,778	20,129	20,236	20,236
Luzon	9,568	9,527	9,712	9,840	9,881
Visayas	4,600	4,745	4,856	4,845	4,807
Mindanao	5,257	5,506	5,561	5,552	5,547

* Note: There was a decrease in total transmission line length in ckt-km due to modification and divestment of various sub-transmission assets.

To ensure that voltages across the network are within the levels prescribed in the Philippine Grid Code (the "Grid Code"), capacitors and reactors have been installed in appropriate locations in the different parts of the region. Currently, there are a total of 1,081.45 MVAR capacitors distributed as follows: 600 MVAR in Luzon, 226.45 MVAR in the Visayas, and 255 MVAR in Mindanao. These exclude the capacitors at the Naga converter station, which provides the MVAR requirements thereat. The total reactors are 620 MVAR for Luzon and 555 MVAR for Visayas, or a total of 1,175 MVAR.

The dependable capacity indicated in the following sections is based on the 2009 Power Sector Situationer of the DOE. The DOE defines dependable capacity as the maximum capacity a power plant can sustain over a specified period modified for seasonal limitation less the capacity required for station service and auxiliaries.

2.1.1 Luzon

In 2009, Luzon has reached its peak demand for the year at 6,928 MW, which is 254 MW or 3.80% higher than in 2008. Historically, the peak load in the island occurred during the first semester. Meralco accounts for about 70% of this demand. From 2001-2009, Luzon exhibited 2.70% annual average compounded growth rate (AACGR).

As of end of 2009, Luzon grid has a total dependable capacity of 10,230 MW. A total of 5,379 MW (53%) are located in the south while the remaining 4,851 MW (47%) are in the north. More than half of the capacity are coal-fired (3,450 MW or 34%) and natural gas (2,700 MW, 26%). Hydro accounts for a fifth (1,999 MW, 20%) while diesel and geothermal have dependable capacity of 1,617 MW (16%) and 431 MW (4%), respectively. The existing wind farm (Northwind) in Luzon grid, on the other hand, has rated capacity of 33 MW.

2.1.2 Visayas

At 5.82% growth rate, Visayas has posted the highest AACGR among the three grids in 2001-2009. In 2009, the peak load was recorded at 1,241 MW (based on coincident peak), 65 MW or 5.52% higher than in 2008.

As of end of 2009, the Visayas grid has a total dependable capacity of 1,392 MW, more than half (792 MW or 57%) of which comes from the geothermal fields in Leyte. The Visayas islands remain highly dependent on diesel and oil as about one third of the capacity is supplied by diesel (426 MW, 31%); coal accounts for about 11% (153 MW) while hydro has about 13 MW dependable capacity.

2.1.3 Mindanao

Mindanao experienced an increase in system peak demand in 2009 with 1,303 MW or 8.27% higher than in 2008. From 2001-2009, the island registered a 3.71% AACGR.

As of end of 2009, the Mindanao grid has a total dependable capacity of 1,697 MW, 902 MW of which, or about 53%, comes from hydro resources, particularly the Agus complex in Lanao;diesel accounts for 29% (485 MW), coal contributes210 MW (12%) and geothermal, 98 MW (6%).

2.2 Features of the Transmission System

2.2.1 Luzon

In Luzon Grid, the bulk generation sources are located in the northern and southern parts of the Luzon Island while the load center is in Metro Manila which accounts for about 70% of the total Luzon load. Because of this system configuration, the transmission backbone must have capability to transfer large amount of power from both the north and south.

2.2.1.1 The Northern Transmission Corridor

The northern transmission corridor consists of several flow paths for transferring power from the sites located in the north to Metro Manila. The main path is the 500 kV double-circuit transmission line from Bolo to Nagsaag then to San Jose. The other paths are the three underlying 230 kV transmission lines consisting of the Labrador to Hermosa single circuit line, the recently upgraded San Manuel-Concepcion-Mexico double circuit line, and the San Manuel-Pantabangan-Cabanatuan-Mexico single-circuit line.

The Bolo and Nagsaag EHV substations are the receiving ends of generation from the north. The received power is then delivered to Metro Manila mainly via Mexico and San Jose substations. The 500 kV Bolo-Nagsaag-San Jose is rated at 2,850 MVA per circuit and is capable of transferring the more than 1,800 MW generation from Masinloc and Sual Coal Plants to Metro Manila. The upgraded San Manuel-Concepcion-Mexico 230 kV Line, on the other hand, is an alternate corridor which also caters the generation capacity of the hydroelectric plants delivering power to San Manuel 230 kV substation.

2.2.1.2 The Southern Transmission Corridor

The southern transmission corridor also consists of 500 kV transmission backbone and underlying 230 kV transmission lines. The southern portion of the 500 kV transmission backbone stretches from Naga in Bicol area to Tayabas, Quezon. This 500 kV backbone segment, however, is currently energized at 230 kV voltage level. The Naga substation is also the termination point for the HVDC system that could allow the exchange of up to 440 MW of power between Luzon and Visayas grids.

From Tayabas, the 500 kV backbone also stretches to Dasmariñas substation which serves as a drawdown substation for the loads in the south of Metro Manila.

Tayabas is also connected to San Jose thereby completing the link between the north and south 500 kV corridors.

The 500 kV backbone in the south facilitates the transfer of about 2,400 MW of power from Ilijan Natural Gas, Pagbilao and QPPL coal plants. The 230 kV transmission system in Batangas and Laguna area, on the other hand, caters about 2,100 MW total generation capacity of Calaca Coal and the other Natural Gas Plants (San Lorenzo and Sta. Rita).

2.2.1.3 The Metro Manila Transmission Configuration
In Metro Manila, the major 230 kV substations are Quezon, Taytay, Doña Imelda, Muntinlupa, Las Piñas and Marilao (Meralco-owned). Four (4) of these substations (Taytay, Quezon, Doña Imelda and Muntinlupa) form part of the 230 kV ring that surrounds the Laguna Lake. The Quezon-Doña Imelda-Muntinlupa segment of the ring, however, is a single-circuit line traversing within Metro Manila.

At present, there are two (2) main load sectors within Metro Manila. Sector 1 consists of Quezon, Doña Imelda and Marilao while Sector 2 consists of Taytay, Muntinlupa and Las Piñas 230 kV substations. The 115 kV distribution facilities in each sector are looped and therefore can be supplied alternately from different 230 kV substations during contingency. Upon completion of Meralco's Paco 230 kV substation (cut-in along Doña Imelda-Muntinlupa line) by 2011, Meralco will reconfigure the 115 kV network into three (3) sectors. Marilao, Quezon and Paco will be under Sector 1, Doña Imelda and Taytay under Sector 2 while Muntinlupa and Las Piñas under Sector 3.

The major supply lines for both Quezon and Taytay are the double-circuit facilities from San Jose. As no major power plants are in place in the 230 kV system near the northern side of Metro Manila, these substations rely heavily on the supply from San Jose 500 kV substation. With NGCP's recent completion of the San Jose Transformer Replacement Project, the reliability of this critical San Jose substation was significantly increased.

In the south, the power requirements are being drawn from Dasmariñas EHV substation and from the plants directly connected to the 230 kV system. Las Piñas is being supplied by a double circuit 230 kV radial line from Dasmariñas while Muntinlupa has four-circuit supply line from Biñan.

2.2.2 Visayas
The Visayas transmission system can be divided into four different sub-system or sub-grids.

First is the Eastern Visayas Area (District 1), which is composed of the islands of Leyte and Samar. Leyte is the site of 610 MW geothermal resources that comprise the 42% of the total generation capacity in the Visayas. It has two transmission corridors which separately serve Samar and Bohol, both of which rely on power generated by Leyte's steam fields.

Second is the Central Visayas Area (District 2), which is composed of the islands of Cebu and Bohol. Cebu can be well considered as the load center of the Visayas grid. In 2009, it has a coincident peak load of 559 MW which accounted for 45% of the grid's total demand. Bohol, on the other hand, had the lowest peak load for the grid with 56 MW (4.5%).

Third is the island of Negros (District 3). The load center is located in Bacolod City in the northern part, while the bulk of generation is in the southern part. The 10 MW Northern Negros Geothermal Plant provides the only source of voltage regulation in the north.

Finally, the Western Visayas Area (District 4) is the Panay island. The likely entry of the 164 MW PEDC coal-fired plant in La Paz, Iloilo will provide the island sufficient generation capacity up to at least year 2025, assuming that the diesel plants will not be retired.

The sub-grids are interconnected by submarine cables: Leyte-Cebu (2x185 MW), Cebu-Negros (2x90 MW), Negros-Panay (1X85 MW) and Leyte-Bohol (1x90 MW). The capacities indicated are the nominal rating of the interconnections.

Taking into consideration the load flow from east to west (or vice versa) of the Visayas grid, the transmission backbone of the Visayas grid extends from the far east, at the Allen CTS in Samar, all the way to Nabas substation in Panay, in the far west. This route is comprised of approximately 895 kilometers of transmission line. It is composed of the HVDC line, overhead transmission lines and submarine cables.

The bulk generation in Visayas, which is sourced from Leyte steam fields, is transmitted to the other islands through the following transmission corridors:

1. Leyte-Samar transmission corridor, which is composed of the Ormoc-Babatngon and Babatngon-Paranas 138 kV lines. The former is a single circuit line while the latter is a double circuit line;
2. Leyte-Bohol transmission corridor, which is composed of the following 138 kV lines: (i) Ormoc-Maasin-Guadalupe; (ii) the Guadalupe-C.P. Garcia submarine cable (Leyte-Bohol interconnection); and (iii) C.P. Garcia-Ubay. All of these lines, including the submarine cable, are single-circuit only; and
3. Leyte-Cebu-Negros-Panay transmission corridor, which is the longest corridor. This corridor, which has transmission lines energized at 230 kV, is considered as the main transmission backbone since it allows the supply of power to the load center of the different sub-grids.

2.2.3 Mindanao

The 663MW(dependable capacity based on DOE data) Agus Hydro Complex located in Lanao accounts for about 39% of Mindanao's total dependable capacity. Much of the generated output of the complex must be transmitted to the load centers located in southern part of the island. The load centers are located in southeast (Davao provinces) and southwest (SOCCSKSARGEN). As of end of 2009, these two areas account for about 50% of the island's total demand: Davao area, 464 MW (35%) and SOCCSKSARGEN, 199 MW (15%).

Given this characteristic and considering the 225 MW Pulangi hydro plant located in north central area, the load flow generally is from north to south. Much of the power flow passes through Balo-i-Tagoloan-Maramag-Kibawe 138 kV corridor. This is being reinforced by the ongoing Balo-i-Villanueva-Maramag-Bunawan backbone that is designed at 230 kV, the Maramag-Bunawan segment of which was energized in October 2010.

2.3 Problems and Issues

2.3.1 Luzon

As the center of commerce and trade, the demand within Metro Manila continues to grow thus necessitating the expansion of existing substations and building of new ones. Although this has been expected, NGCP faces big challenge in responding to these needs primarily due to space limitations of the 230 kV substations within the Metro and the problem in acquiring right-of-way for the new transmission lines and substations. As a common problem in an urbanized area, acquiring right-of-way for new transmission lines and area for new substations would be difficult. Moreover, the capital region is geographically unique as the land area between the Manila Bay and Laguna Lake is rather narrow (with about 10 km width only).

Developing power generating power plants within Metro Manila is actually ideal in order to reduce power imports. However, the environmental concerns, area congestion, and high cost of realty would make the implementation difficult.

The completion of the San Jose Transformer Replacement Project has provided the much-needed relief to the congestion that was experienced at San Jose Substation. Being the merging point of bulk power coming from the north and the south, San Jose has been a critical substation.

The Kalayaan-Bay corridor is another 230 kV line project in south Luzon that is intended to allow all possible generation dispatch scenarios for the associated power plants. The proposed configuration is a double circuit line that would increase the transfer capability from 300 MVA to 1200 MVA and the Calauan substation will be radially connected to Kalayaan. This has been tagged as high-priority project which will solve existing bottleneck problems and will further enhance reliability.

The transmission facilities serving the north-eastern and north-western regions of Luzon Island have no provisions for N-1 contingency. In the north-western side, the reinforcement of the facilities would be required to provide a strong connection point for the in-coming wind farm power plants in the area. In the north-eastern side, reinforcing the long single-circuit transmission line in Isabela and Cagayan is also necessary to reliably serve the increasing demand in the region. Also, to support the rich wind power generation potential of northern Luzon and to increase reliability, the implementation of the previously conceptualized 230 kV transmission loop to link together the north-eastern and the north-western backbone is being studiedfurther.

Moreover, there are generation expansion projects that will require the upgrading or reinforcement of the dedicated lines for the power plants. These include the upgrading of Magat-Santiago and QPPL-Tayabas 230 kV lines in order to provide N-1 during maximum dispatch of Magat HEP and QPPL Coal Plant, respectively. The required upgrading projects, however, have not been lined up in the TDP since these will be undertaken by the generator proponents consistent with the existing policy of the ERC.

2.3.2 Visayas

The Visayas Grid has been in critical power situation the past years. This has been aggravated because the consumers use more air-conditioning units due to intense heat from the dry and hot weather caused by the El Niño phenomenon, which resulted in the increase in demand in each of the Visayas sub-grid. Ideally, this must be met with corresponding installation of additional capacity within the island, otherwise the upgrade of existing submarine cables may be considered an option. The Visayas grid, however, cannot rely entirely on the submarine linkages to source power from one island to the other. Economics, higher system losses and voltage support requirements are important considerations in deciding which option to take. In many respect, distributed generation in the islands can better address these issues. NGCP is keenly monitoring the generation development in the islands to ensure that the network will be adequate to support new generation.

Additional transformers have been proposed for the Third Regulatory Period to provide redundancy to a number of substations and also to avert overloading during N-1. These transformers are grouped into Substation Expansion Project I, Substation Reliability Project I and Substation Reliability Project II. The first one, which is for load growth, should be completed in 2011 while the other two, which are for reliability, are scheduled to be completed in 2013 and 2014, respectively. It should be noted that most of those transformers for N-1 have been identified in the previous plans but were not implemented by TransCo due to capex limitation.

Construction of additional circuits is proposed forthe major transmission line corridors in Leyte, Cebu and Negros to comply with the N-1 requirement. As theload center, the major backbone in Cebu may need to be upgraded to 230 kV in the long term.

The lack of local generation within the islands has caused low voltage problems in many areas. The low voltage problem is very evident particularly in Negros and Panay.

The following discussions will provide an overview of the existing and potential problems and issues in each of the sub-grid:

2.3.2.1 Leyte-Samar

The outage of the single circuit Ormoc-Babatngon 138 kV line, which is the main corridor for the supply of power to Samar, will cause power outage in the island. On the other hand, the outage of the Ormoc-Maasin 138 kV line will result to power outage in Maasin substation, thus also cutting the power flow to Bohol coming from Leyte. This will result in Bohol relying on its own inland generating power plants which are not sufficient to serve the total demand of the island. The same will be experienced in Bohol, as unavailability of Maasin-Guadalupe line will result in power outage in the island. In order to prevent this and also to comply with the N-1 requirement, the Ormoc-Maasin-Guadalupe has to be expanded to a double-circuit line.

2.3.2.2 Bohol

Unless new generating facilities are installed in the island, Bohol will continue to rely heavily on Leyte for its power requirements. The island has few inland generating plants - Bohol diesel, Janopol hydro and Loboc hydro - the combined 23 MW capacity of which is not sufficient to supply the entire demand in the island. For this reason, the outage of the Leyte-Bohol interconnection will result in huge power interruptions in Bohol. For the interconnection with Leyte, initial results of the studies indicate that a second submarine cable must be in place by 2018, assuming that no new generators will be installed in Bohol.

The ongoing Bohol Backbone Project (Ubay-Corella 138 kV line) will provide the island a reliable transmission backbone. At present, the island relies on single circuit 69 kV woodpole backbone.

2.3.2.3 Cebu

Cebu has almost half of the proposed capacity addition for the Visayas grid for 2010-2015. Two generators, 2x82 MW CEDC coal-fired, are already commissioned on the first half of 2010. The other generators that are expected to come-in are the CEDC's other unit with the same capacity which is expected to be operational by end of 2010 and KEPCO's 2x100 MW coal-fired in Naga. These power plants will necessitate the expansion of Colon-Cebu 138 kV transmission line in order to accommodate the power flow from these new plants to the load centers in Cebu, which are the Cebu, Mandaue and Lapu-lapu substations. The Calung-calung-Toledo-Colon 138 kV corridor must also be reinforced due to the entry of the CEDC plant.

The operation of 2-50 MVAR reactors in Daan-bantayan substation have been adjusted: one is permanent while the other one is put to operation only during off-peak hours to resolve overvoltage. This setup increases the power flow from Leyte to Cebu to 400 MW from the previous 360 MW when the reactors are continuously on-line.

2.3.2.4 Negros

In Negros, the overhead lines that are linked to the Cebu-Negros submarine cable must be upgraded by installing additional 1-795 MCM circuit, otherwise the lines will be overloaded by 2011 during N-1 assuming that there is minimum generation in Panay. This corridor consists of the Amlan-Mabinay, Mabinay-Kabankalan and Kabankalan-Bacolod 138 kV lines.

Low voltage problems are being experienced in northern Negros, particularly in Bacolod which is the load center,due to the lack of inland generating plants, and the generators are located in the southern part far from the load center. Although this is the condition, the low voltage problem has already been remedied temporarily by disconnecting the 30 MVAR line reactor in Bacolod Substation.

2.3.2.5 Panay

Although a number of diesel plants and power barges are located in the island, they are all peaking plants and therefore cannot provide the base load requirements. The Pinamucan Diesel which was transferred from Luzon in order to address the generation deficiency has a de-rated capacity.

The likely entry of the 164 MW PEDC coal-fired plant in La Paz, Iloilo will provide the island sufficient generation capacity up to at least 2018, assuming that the diesel plants will not be retired.

The complete 138 kV looping of the Panay grid can be considered in the long term. The two ongoing projects – Northern Panay Backbone (Panitan-Nabas) and Southern Panay Backbone (Sta. Barbara-San Jose) - have paved the way for this looping to happen. At the western side, the proposed Culasi-Sibalom 69 kV transmission line has been approved already by the ERC.

2.3.3 Mindanao

Starting early 2010, Mindanao experienced a severe drought which had a tremendous impact on the electricity situation in the grid because the island relies mainly on hydropower. The El Niño phenomenon significantly reduced the dependable capacity of the hydro plants to a level even lower than the dependable capacity of oil-fired plants in the island.

Currently, the main corridors connecting the Agus complex to the grid are the Agus 2-Kibawe and Balo-i-Tagoloan 138 kV lines. The tripping of the Agus 2-Kibawe line in the past due to bombing incidents had resulted in huge power swing to the other corridors, one of which is the Maramag-Kibawe line, resulting in N-1 loading violation.

The ongoing Balo-i-Villanueva-Maramag-Bunawan transmission line projects will address this problem. With this 230 kV-designed corridor, which extends from the Agus hydro complex in the north to the Bunawan substation in the southeast, the huge hydro capacity of Agus (about 38% of the total grid) will have a reliable backbone to allow the delivery of its output to the major load centers located in southern Mindanao (about half of the island's total demand).

Security problem, as what has been experienced in the bombing of Agus 2-Kibawe and other installations, remains a serious concern. There were also foiled attempts of bombings in key facilities. Implementation of projects, as in the case of the Tacurong-Sultan Kudarat 138 kV transmission line, cannot be pursued due to security threats. Mindanao has part of its network requiring provision for N-1, but some are being addressed by ongoing and projects to be implemented. Additional transformers, with a total of about 325 MVA, under the Substation Reliability Project I, are proposed for the Third Regulatory Period to provide redundancy to a number of substations and also to avert overloading during N-1. Additional transformers will be proposed in the next regulatory period.

Another weak point is the single circuit line in the eastern corridor. Although looped, the approximately 300 km single circuit line from Butuan to Nabunturan may need to be reinforced. Ongoing studies are being conducted to determine the appropriate timing for such upgrading.

The remaining old 138 kV woodpole backbone will be replaced by steel tower, double circuit line. The ongoing Gen. Santos-Tacurong Transmission Reinforcement Project will accomplish this. Aside from replacing the old dilapidated old structures, the reinforcement will prevent occurrence of low voltage problems in Tacurong and Gen. Santos in case of outage of Gen. Santos-Matanao line.

Basically, the main problem in Mindanao is generation deficiency. Unless new power plants come in, the grid will continue to experience power shortage especially on drought season. The government is currently looking for alternative sources of power and there are even suggestions to consider nuclear power. Big, new generation capacity in the island may also trigger the need for interconnection of Mindanao with the Visayas to ensure that excess capacity will find its market. This will also allow the Visayas grid to share any reserve and export power to Mindanao.

Chapter 03. Demand Projections and Capacity Additions

The two (2) important input parameters in the preparation of the TDP are the updated load forecast and generation capacity addition program. This section discusses these parameters used in the 2010 TDP.

3.1 Second Regulatory Period Final Determination on Demand Forecasts

In the 2nd Regulatory Period FD (Section 2.11.4), the ERC adopts the DOE forecast which intends to provide a signal to the investor that the demand forecast used came from an independent body. The demand forecasts adopted by the ERC are shown in Table 3.1.

Table 3.1 Demand Forecasts Adopted by the ERC for 2006-2010

GRID	2006	2007	2008	2009	2010
Luzon	6,728	6,981	7,252	7,552	7,878
Visayas	1,154	1,214	1,289	1,364	1,448
Mindanao	1,293	1,363	1,440	1,525	1,620
TOTAL	**9,175**	**9,558**	**9,981**	**10,441**	**10,946**

3.2 TDP Power Demand Projection

The forecast for the 2010 TDP utilizes the latest demand projections of NGCP. The projections refer to the total electricity demand of the end-users including embedded generation and off-grid energy sources. NGCP prepares two sets of forecasts for the 2010 TDP: transmission-level (system peak demand or SPD) and substation capacity projections.

Basis of the transmission-level forecast

NGCP undertakes forecasting exercise in coordination with power customers and the Department of Energy (DOE). NGCP forecasts the coincident peak demand (CPD) of each grid –Luzon, Visayas and Mindanao. The CPD is the sum of generators' actual injection (measured every two seconds) into the grid. The System Peak Demand (SPD), on the other hand, is the CPD plus the demand associated with generation not injected into the grid (i.e., embedded generation). This addition to the CPD is based on the submission of embedded generators to the DOE. Hence, the SPD reflects the total (per grid) peak demand of a contiguous area/region – in this case, Luzon, Visayas and Mindanao. The SPD forecast of NGCP is comparable with the SPD forecast of DOE.

The CPD of a grid is forecasted by NGCP using econometrics – relating the peak demand with a number of economic and demographic explanatory variables. Explanatory variables range from national income (e.g., Gross Domestic Product or GDP), population and per capita income. In forecasting CPD, the national income (real GDP) is the main explanatory variable – hence, the projections are largely related with the forecasted movement of real GDP.

The Philippines experienced very modest GDP growth in 2009 at 0.9%. This may be attributed to the effects of the global financial crisis which strained demand for Philippine exports and tightened credit. However, strong signs of recovery in the Philippines have been observed in the first half of 2010 – GDP growth for the period is 7.9%. Further, robust consumption has been observed for the year coupled with the effects of fiscal stimulus initiated since last year. Additional economic activity has also been spurred by the election season. Due to the positive signs for the economy, the National Economic and Development

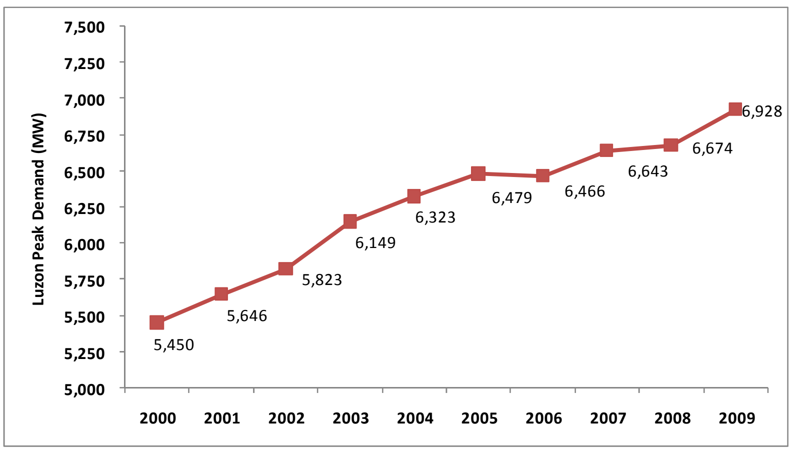
Authority (NEDA) revised its year-end GDP forecast to 5%-6% from 2.6%-3.6%. International financial institutions also increased their GDP growth forecasts for the Philippines to reflect recent optimistic developments.

The spike in national income growth is also reflected in the CPD for 2010. For the first half of 2010, Luzon CPD grew by 10.5%, Visayas CPD by 13.2% and Mindanao by 1.6%. The suppressed generation of hydropower plants due to the El Niño phenomenon may have constrained growth of demand in Mindanao. However, with the onset of the La Niña phenomenon, this scenario may change for Mindanao in the latter half of the year as the grid's peak usually occurs in November or December.

Historical demand for electricity (2000-2009)

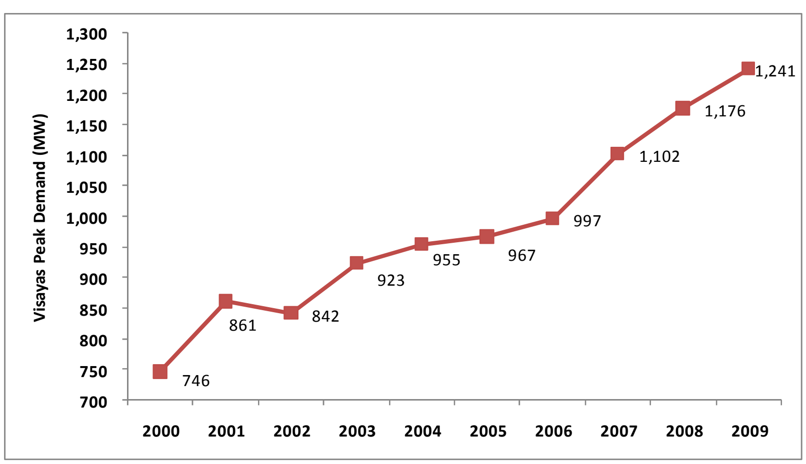
The following shows the Peak Demand (MW) for the three grids (Luzon, Visayas, Mindanao) from 2000-2009. These values do not include demand from embedded generators that werenot synchronized with the grid.

Luzon



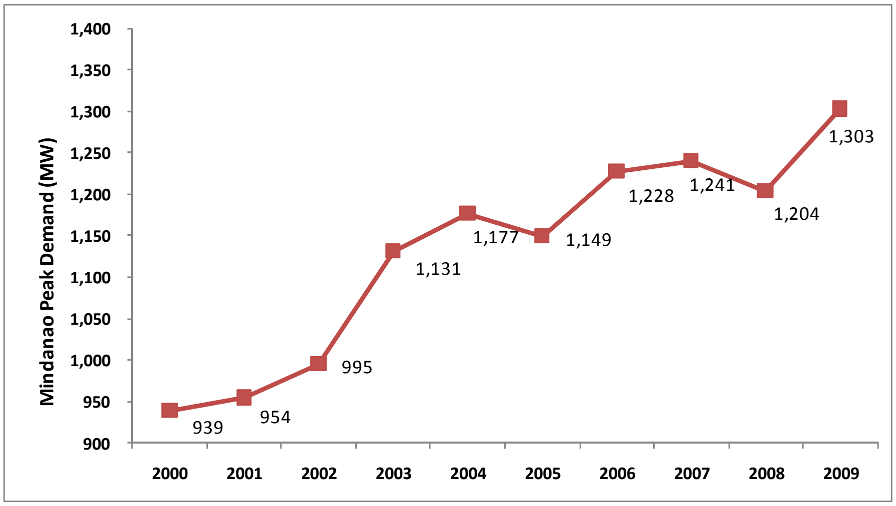
The Luzon grid has posted an Average Annual Compounded Growth Rate (AACGR) of 2.70% for the period 2001-2009. Consistent steady growth has been recorded for the Luzon grid except for the decrease in demand observed in 2006. This is due to the reduction in the power consumption of Meralco during the year, whose demand accounts for at least 70% of the system peak demand.

Visayas



The Visayas grid has posted an AACGR of 5.82% for 2001-2009, the highest among the three grids. This is largely due to the fast economic growth in the region. The fastest demand expansion has been recorded in distribution utilities in Panay, Cebu and Bohol.

Mindanao



The Mindanao grid has posted an AACGR of 3.71% for 2001-2009. After recording high annual growth rates from 2001 to 2004 (an average of 5.81%), demand growth has been sluggish from 2005 to 2009 (around 2.05%) due to the overall reduced power requirement from large non-utility customers.

TDP 2010 Projections

Power demand for the country is expected to grow at an average compounded growth rate of 4.38% for the period 2010-2014 and 3.28% for 2015-2019. The growth rate for 2010-2014 is higher than the 2009 TDP forecast for the same period, which stood at 3.22%. This largely reflects a slightly more optimistic forecast (growth projected to be 9.79%) due to spike in demand observed in 2010. Overall, demand is expected to increase from 9,654 MW in 2009 to 14,060 MW by 2019 which translates to an annual compounded growth rate of 4.38%.

Consistent with the historical trend, Visayas is expected to post the fastest growth in electricity demand (4.44% for the period) followed by Mindanao (4.28%) and Luzon (3.63%). Meralco, which accounts for at least 50% of the nation's power demand, is expected to grow at a steady rate of 3.48%.

NGCP uses this set of forecast to determine the necessary transmission expansion and the required transformer capacity additions.

Table 3.2 Summary of Projected Demand per District [1]
(Based on NGCP Forecasts)

district	area	2009 actual	2010	2011	2012	2013	2014	2015	2015	2017	2018	2019
Luzon		**7,071**	**7,799**	**7,997**	**8,206**	**8,426**	**8,672**	**8,941**	**9,218**	**9,504**	**9,799**	**10,104**
Meralco		**4,842**	**5,326**	**5,456**	**5,600**	**5,744**	**5,907**	**6,091**	**6,277**	**6,471**	**6,669**	**6,876**
NCR		3,625	3,995	4,071	4,177	4,277	4,352	4,402	4,536	4,676	4,820	4,969
North		121	133	159	166	171	178	184	190	196	202	208
South		1,096	1,198	1,192	1,223	1,262	1,275	1,277	1,316	1,356	1,398	1,441
	North Luzon	**1,650**	**1,820**	**1,875**	**1,926**	**1,981**	**2,045**	**2,106**	**2,174**	**2,244**	**2,313**	**2,386**
1	Ilocos	153	173	172	175	179	183	188	193	198	203	208
2	Mt. Province	134	141	151	153	156	159	162	165	168	172	175
3	North Central	184	200	204	209	215	229	236	244	251	260	268
4	Cagayan Valley	145	147	170	175	182	188	196	203	211	219	228
5	West Central	278	344	306	315	326	338	350	364	384	392	407
6	South Central	680	682	705	729	749	770	793	818	842	871	899
7	North Tagalog	76	133	167	170	174	178	182	186	190	195	200
	South Luzon	**580**	**654**	**665**	**680**	**700**	**721**	**743**	**767**	**790**	**817**	**842**
1	Batangas/Cavite	324	345	353	361	372	383	396	409	421	436	450
2	Laguna/ Quezon	97	116	121	123	126	130	133	137	141	146	150
3	Bicol	159	192	191	196	202	208	214	221	227	235	243
	Visayas	**1,241**	**1,367**	**1,432**	**1,479**	**1,531**	**1,587**	**1,648**	**1,711**	**1,777**	**1,845**	**1,917**
1	Leyte-Samar	188	198	205	214	223	233	243	254	266	278	291
2a	Cebu	559	634	657	677	698	722	748	773	801	830	861
2b	Bohol	56	59	61	64	66	69	72	75	79	82	86
3	Negros	215	233	246	256	267	279	291	306	318	332	347
4	Panay	223	243	262	269	276	284	293	303	312	322	333
	Mindanao	**1,346**	**1,432**	**1,540**	**1,596**	**1,648**	**1,705**	**1,767**	**1,831**	**1,898**	**1,967**	**2,039**
1	North Western	170	177	188	193	199	206	213	220	227	234	241
2	Lanao Area	186	211	226	235	243	251	260	270	281	291	301
3	North Central	218	228	251	260	269	278	288	300	313	327	341
4	North Eastern	109	111	118	121	125	129	134	138	143	148	152
5	South Eastern	464	509	550	572	590	610	632	655	678	702	728
6	South Western	199	196	208	214	222	230	239	248	256	265	275
Philippines		**9,658**	**10,599**	**10,969**	**11,281**	**11,605**	**11,964**	**12,355**	**12,760**	**13,178**	**13,612**	**14,060**

Notes:

1 Based on the transformer peak demand coincident with the System Peak
Inclusive of embedded generation

3.2.1 Demand Projections for Substation Capacity Addition

The demand projections for substation expansion take off from the maximum load projections of customers connected to the substations. In cases where a particular customer has more than one metering point, the customer's projected demand is proportionately disaggregated into different metering points according to the current maximum demand meter readings. Projected maximum loads for all metering points connected to a given transformer are then summed up. This transformer peak becomes the basis for adding transformer capacities at the substations.

The individual demand projections for each customer are derived from historical load growth and/or new information as to potential expansion or contraction of load demand of the customer. Further, expected entry of new load customers are considered in the projections including proposed connection points.

At present, except for few substations, the transformers are not connected in parallel due to incompatible impedances and voltage taps. For this reason, the projections are made on the individual transformer load instead of the total substation load as the basis for substation capacity addition. Future procurement of transformers will be standardized so that paralleling could be made possible.

3.2.2 Demand Projections for Transmission Expansions

The system peak demand projections for each grid are used in determining the necessary transmission expansion projects. However, for these figures to be usable in the transmission network analysis software, it has to be broken down into individual substation load. The individual substation maximum demand projections determined in Section 3.2.1 are used to establish the percentage of the system peak demand that will be assumed for a specific substation.

3.3 Generation Capacity Addition

3.3.1 Supply Expansion Plan

The supply expansion plan being prepared by the DOE is formulated to ascertain the required capacity additions in the next ten years and at the same time fulfill the key reliability and security standards as promulgated by the Grid Code, such as minimum reserve margins, loss of load probability (LOLP), among others.

The generation capacity line up from the DOE being used in the TDP takes the following into consideration:

1. the dependable capacity of all existing power plants considering the scheduled power plant retirements;
2. the committed projects; and
3. the generic capacities which represent the additional requirements or balancing capacities to address the anticipated gap between demand and supply.

These generic capacities are based on the best entrant or the most efficient supply options available.

Interconnection uprating projects are also incorporated in the generation planning model. Expected capacity additions are determined by the conduct of capacity expansion simulations.

(The DOE has not yet released the latest required and committed generation capacity addition as of this writing)

3.3.2 Generation Proponents

Table 3.3.2 shows the list of proposed generating plants in the Luzon, Visayas and Mindanao grid based on NGCP's own survey of generator proponents, Grid Impact Studies and the DOE's Generation Facilities data.

Table 3.3.2 Generation Capacity Addition

COMM. YEAR	PROPOSED POWER PLANT	MW CAP	LOCATION
LUZON			
2011	Ambuklao Plant Repowering	105	Ambuklao, Benguet
2012	Mariveles Coal	600	Mariveles, Bataan
	Tanawon Geothermal	50	Tanawon, Sorsogon
	Kalayaan III Expansion	360	Kalayaan, Laguna
	Aparri-Buguey Wind	40	Cagayan Valley
	Burgos Wind- Phase 1 & 2	86	Burgos, Ilocos Norte
	Caparispisan and Balaoi Wind	80	Pagudpod, Ilocos Norte
	Northwind Project- Phase 3 & 4	45	Ilocos Norte
	Pamploma Wind	40	Cagayan Valley
	Pagudpud Wind	40	Ilocos Norte
	Pasuquin Wind Farm	120	Ilocos Norte
2013	RP Energy Coal	300	Subic, Zambales
	Maibarara Geo- 1st Unit	20	Los Baños, Laguna
	Puting Bato Greenfield	135	Calaca, Batangas
	Calaca Expansion 1	300	Calaca, Batangas
	San Gabriel Nat Gas	550	Batangas
	Bayog Wind	70	Ilocos Norte
	Buduan Wind Power	57	Ilocos Norte
	Burgos Wind- Phase 3	100	Burgos, Ilocos Norte
	Claveria Wind	15	Claveria, Cagayan
	Gonzaga Wind	15	Gonzaga, Cagayan
	Sanchez Mira Wind	15	Cagayan
2014	Binga Expansion	25	Binga
	QPPL Expansion	500	Mauban, Quezon
	Rangas Geothermal	40	Rangas, Sorsogon
	Kayabon Geothermal	40	Kayabon, Sorsogon
	Agaga Wind	37.5	Ilocos Norte
	Sapat Wind	37.5	Pasuquin, Ilocos Norte
2015	Maibarara Geo- 2nd Unit	20	Los Baños, Laguna
	Magat Expansion	180	Magat, Isabela
	Masinloc Expansion 1	300	Zambales
2017	Pagbilao Coal Expansion	375	Pagbilao, Quezon
	Calaca Expansion 2	300	Calaca, Batangas
2018	Masinloc Expansion 2	300	Zambales
Sub-total		**5,298 MW**	

COMM. YEAR	PROPOSED POWER PLANT	MW CAP	LOCATION
VISAYAS			
2010	Toledo Coal-fired	164*	Toledo, Cebu City
2011	Toledo Coal-fired	82	Toledo, Cebu City
	KEPCO Coal-fired	200	Naga, Cebu
	PEDC Coal-fired	164	La Paz, Iloilo
2012	GGPC Multi-fuel Biomass	35	Mina, Iloilo
	Nasulo Geothermal	20	Nasuji, Valencia, Negros Oriental
	San Lorenzo Wind	54	Guimaras
2013	Pulupandan Wind	15	Negros Occidental
	Villasiga Hydro	8	Sibalom, Antique
2014	Dauin Geothermal	40	Negros Oriental
Sub-total		**782 MW**	
MINDANAO			
2012	Tagoloan Hydro	20	Similao, Bukidnon
2013	Agus III Hydro	225	Lanao Del Norte
2014	Mindanao III Geothermal	50	Mt. Apo, Kidapawan North Cotabato
	Kamanga Coal-fired Plant	100	Maasim, Saranggani
2015	Odiongan River (Upper, Middle, Lower)	22	Gingoog, Misamis Oriental
	Tamugan HEP	20	Davao City
	Sita (1,2,3) HEP	42.3	Davao City
	Puyo River HEP	30	Jabonga Agusan Del Norte
	Amacan (Geo)	20	Amacan, North Davao
2016	Siguil (1,2,3) MHP	20	Maasim, Saranggani
	Lake Mainit HEP	25	Agusan Del Norte
	Impasugong	20	Impasugong, Bukidnon
2018	Bulanog Batang HEP	150	Talakag, Bukidnon
	Lakewood (Geo)	40	Lakewood, Zamboanga Del Sur
2019	Pulangi V	300	Bukidnon
	Tran River	30	Lebak, Maguindanao
	Ampiro (Geo)	30	Misamis Occidental
Sub-total		**1,144.3 MW**	
Total		**7,224.3 MW**	

*already energized

3.4 Supply-Demand Outlook

This section discusses the supply-demand outlook for each grid. The potential capacity additions are based on the line up provided by the DOE and from NGCP's own information as gathered from the different proponents. NGCP conducted a survey to seek update from various generation proponents on the progress of their projects and expected commissioning date.

The required capacity of the system refers to the projected peak demand plus the ERC-approved reserve margin. The reserve margin, which is a percentage of the peak demand, for each grid is shown below.

Table 3.4 Required Reserve Margin

	Luzon	Visayas	Mindanao
Load Following and Frequency Regulation	2.8%	2.8%	2.8%
Spinning Reserve	10.3%	10.3%	9.1%
Back-up Reserve	10.3%	10.3%	9.1%
Total Reserve Margin	**23.4%**	**23.4%**	**21%**

For Luzon and Mindanao grids, drought has significant impact on the supply scenario considering that hydro power accounts for 20% of total dependable capacity in Luzon and 53% in Mindanao. This is not the case in the Visayas since hydro capacity accounts for only 1%.

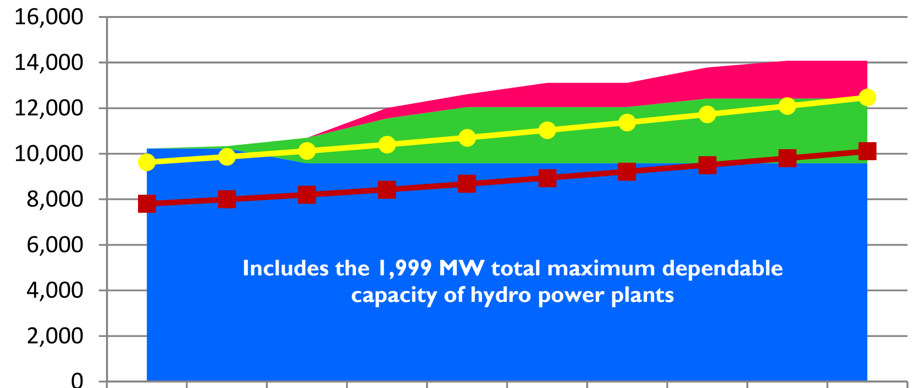
In the supply-demand outlook for Luzon and Mindanao for 2010-2019, two scenarios are shown: (1) the normal condition where the hydro power plants are assumed to be at their maximum dependable capacity; and (2) drought condition where the total supply is based on the reduced capacity of hydro power plants.

It is important to note that in long-term transmission planning, the normal condition is considered in the simulation studies to ensure the adequacy of the system to accommodate the maximum generation capacity of the system.

3.4.1 Luzon

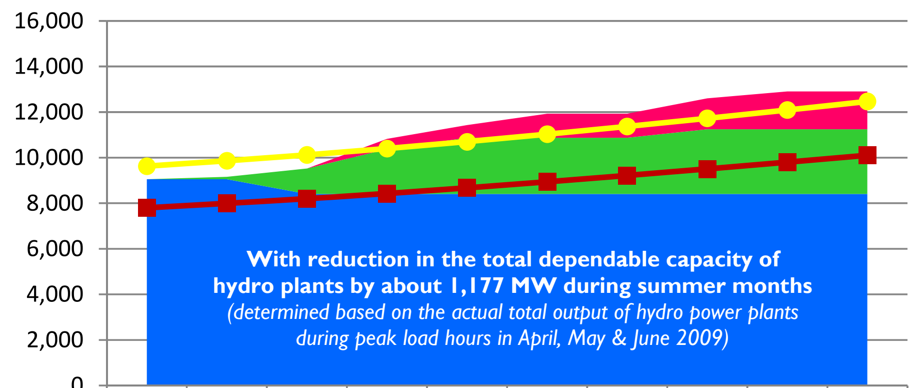
Between 2010 and 2019, Luzon expects about 5,298 MW additional capacity. This capacity includes the initially listed wind power plant projects (a total of 798 MW) in northern Luzon.

To date, 2,840 MW have completed Grid Impact Study and will be sufficient to meet the required capacity of the system up to 2019. As can be seen in figure 3.4.1(a), 2012 is a critical year for the Luzon grid for the proposed capacity to come on stream, otherwise power shortage will be experienced. It should be noted that the supply-demand outlook presented does not include the generation capacity additions from new wind farms.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Indicative (Cumulative)	0	0	0	455	560	1,060	1,060	1,360	1,660	1,660
With GIS (Cumulative)	0	105	1,115	1,965	2,465	2,465	2,465	2,840	2,840	2,840
Dependable Capacity	10,230	10,230	9,584	9,584	9,584	9,584	9,584	9,584	9,584	9,584
Required Capacity	9,624	9,868	10,126	10,398	10,701	11,033	11,375	11,728	12,092	12,468
Peak Demand	7,799	7,997	8,206	8,426	8,672	8,941	9,218	9,504	9,799	10,104

Figure 3.4.1(a)Luzon Supply-Demand Outlook based on Normal Condition, 2010-2019

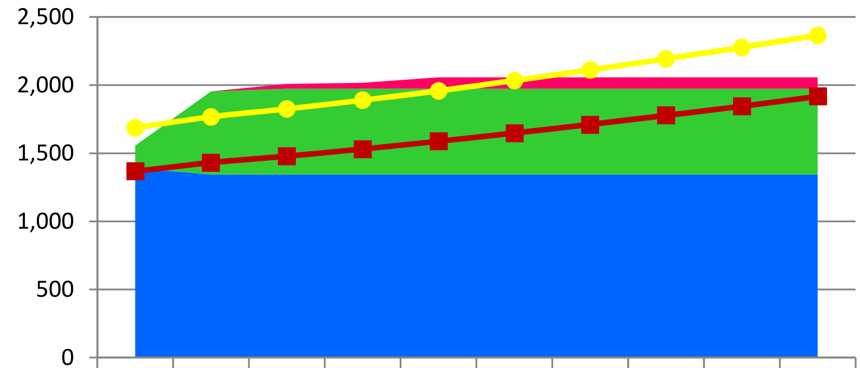


	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Indicative (Cumulative)	0	0	0	455	560	1,060	1,060	1,360	1,660	1,660
With GIS (Cumulative)	0	105	1,115	1,965	2,465	2,465	2,465	2,840	2,840	2,840
Dependable Capacity	9,053	9,053	8,407	8,407	8,407	8,407	8,407	8,407	8,407	8,407
Required Capacity	9,624	9,868	10,126	10,398	10,701	11,033	11,375	11,728	12,092	12,468
Peak Demand	7,799	7,997	8,206	8,426	8,672	8,941	9,218	9,504	9,799	10,104

Figure 3.4.1(b)Luzon Supply-Demand based on Drought Condition, 2010-2019

3.4.2 Visayas

As end of 2009, the dependable capacity of the Visayas grid is just enough to meet the required capacity of the system. This leads to a situation where the generating plants cannot afford to go on preventive maintenance otherwise the very thin reserve will not be able to meet the demand. As shown in figure 3.4.2, 2010 is a critical year for the grid. If the proposed capacity addition would not go on stream, then the situation in the Visayas will go from bad to worse.



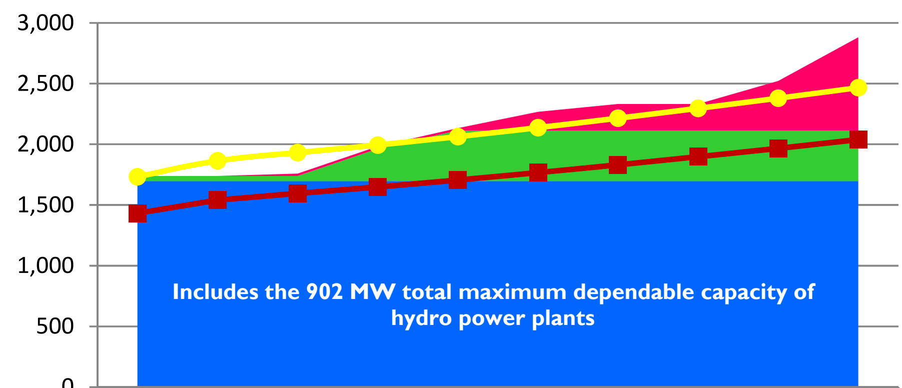
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Indicative (Cumulative)	0	0	35	43	83	83	83	83	83	83
With GIS (Cumulative)	164	610	630	630	630	630	630	630	630	630
Dependable Capacity	1,392	1,344	1,344	1,344	1,344	1,344	1,344	1,344	1,344	1,344
Required Capacity	1,687	1,767	1,825	1,889	1,958	2,034	2,111	2,193	2,277	2,366
Peak Demand	1,367	1,432	1,479	1,531	1,587	1,648	1,711	1,777	1,845	1,917

Figure 3.4.2Visayas Supply-Demand Outlook, 2010-2019

The above supply outlook did not consider the de-rating of diesel plants over time and their retirement once the new generating plants, the coal plants in particular, become available. These factors will be considered for sensitivity analysis.

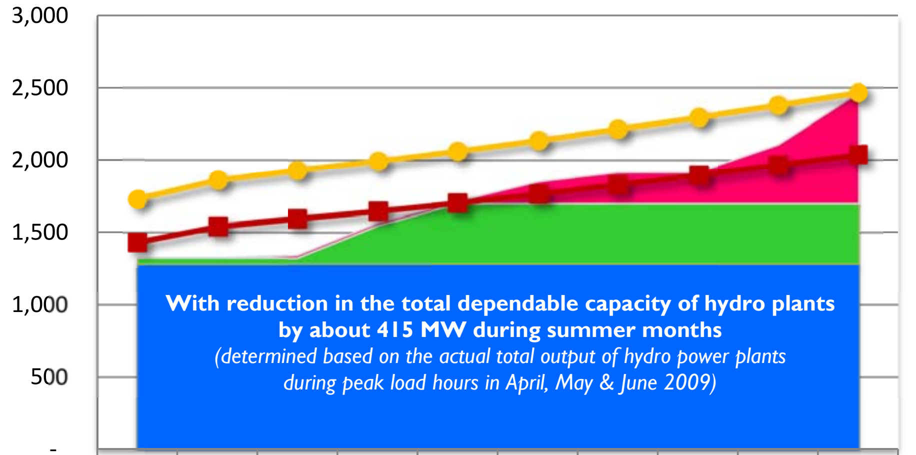
3.4.3 Mindanao

2010-2012 will be critical years for Mindanao grid as the existing dependable capacity would just be enough to meet the required capacity for the said years. Notably, as shown in figure 3.4.3(a), the additional generation capacity will not go on stream until 2013. Should all the potential capacity materialize, Mindanao shall have sufficient capacity up to 2019.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Indicative (Cumulative)	0	0	20	20	20	154	219	219	409	769
With GIS (Cumulative)	42	42	42	267	417	417	417	417	417	417
Dependable Capacity	1,697	1,697	1,697	1,697	1,697	1,697	1,697	1,697	1,697	1,697
Required Capacity	1,733	1,864	1,931	1,994	2,063	2,138	2,215	2,296	2,380	2,467
Peak Demand	1,432	1,540	1,596	1,648	1,705	1,767	1,831	1,898	1,967	2,039

Figure 3.4.3(a) Mindanao Supply-Demand Outlook based on Normal Condition, 2010-2019



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Indicative (Cumulative)	-	-	20	20	20	154	219	219	409	769
With GIS (Cumulative)	42	42	42	267	417	417	417	417	417	417
Dependable Capacity	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282	1,282
Required Capacity	1,733	1,864	1,931	1,994	2,063	2,138	2,215	2,296	2,380	2,467
Peak Demand	1,432	1,540	1,596	1,648	1,705	1,767	1,831	1,898	1,967	2,039

Figure 3.4.3(b) Mindanao Supply-Demand Outlook based on Drought Condition, 2010-2019

Chapter 04. Recently Completed Projects

For the purpose of this TDP, recently completed projects refer to those projects completed between the period 01 January 2009 to 30 November 2010. For the said period, NGCP completed a total of 461.22 circuit-km of overhead transmission lines and installed 1,600 MVA additional substation capacity and 195 MVAR reactive power support. Table 4(a) shows a summary list of the recently completed projects, including the components of ongoing projects that have been completed already.

Table 4(a) Recently Completed Projects

PROJECT NAME	MVA	MVAR	CKT-KM	DATE OF COMPLETION
San Jose Transformer Replacement	600			September 2010
Maramag-Bunawan 230 kV T/L			212.76	October 2010
Visayas Capacitor Project I		105		November 2010
COMPLETED COMPONENTS OF ONGOING PROJECTS				
Biñan-Muntinlupa Line 4/ Biñan-Muntinlupa T/L Upgrade			14.3	July 2010
Concepcion-Mexico / Luzon Transmission Line Upgrading I			74.84	June 2009
Doña Imelda S/S/ Luzon Transmission Equipment Upgrade	300			September 2010
San Jose S/S (Reactor) / Luzon Transmission Equipment Upgrade		90		December 2009
San Manuel-Concepcion / Luzon Transmission Line Upgrading I			159.32	June 2009
Taytay S/S/ Luzon Transmission Equipment Upgrade	300			May 2010
New Nabas S/S / Northern Panay Backbone Project	100			August 2010
Matanao, New Loon and Maco S/S / Mindanao Substation Expansion-2005	300			May 2010
Total	**1,600**	**195**	**461.22**	

4.1 San Jose Transformer Replacement

This project involves the replacement of the existing 500/230 kV transformer banks at San Jose Substation which had been in critical conditions. Any failure in the existing transformers in this substation would result in a more expensive generation dispatch condition as the generation from the coal plants delivering power to the 500 kV system will be constrained. In order to maintain the provision for N-1 contingency, the replacement units also aim to increase the capacity of the substation from 2400 MVA to 3000 MVA.

4.2 Maramag – Bunawan 230 kV Transmission Line

This project is the extension of Balo-i-Villanueva 230 kV Transmission Line Project aimed to strengthen the existing transmission system, thereby ensuring the stability, reliability and efficiency transmission of power in the entire Mindanao Grid. The proposed 230 kV transmission network, which will be initially energized at 138 kV level, will serve as the transmission corridor from northern to southern Mindanao where the output of the Agus Hydroelectric Power Complex and Pulangi IV Hydroelectric Plant can be transmitted.

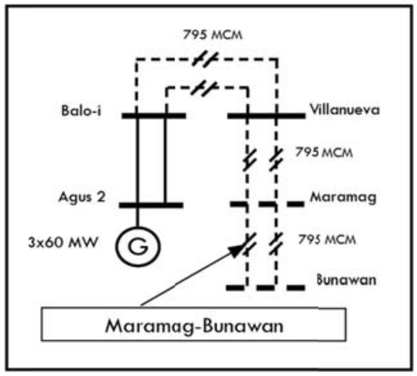


Table 4.1 Maramag - Bunawan 230 kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Maramag-Bunawan	230 kV ST-DC, 2-795MCM, 106 km
Maramag 69 kV Tie line	69 kV SP/CP-SC1-336.4MCM, 1.5km
Substation	
Maramag S/S (New)	1-75 MVA 138/69/13.8 kV 9-138 kV PCB + Accessories 3-69 kVPCB + Accessories
Bunawan S/S (Expansion)	1-50MVA 138/69/13.8kvTransformer 3-138 kV PCB + Accessories 1-69 kV PCB + Accessories
Togoloan S/S (Expansion)	1-100MVA 138/69/13.8kV

4.3 Visayas Capacitor Project 1

This project, which was classified by ERC as sub-transmission asset, involves the installation of 14-7.5 MVAR capacitors in different locations.

Based on the results of latest simulations, the installation of a number of capacitors will not only have impact to one electric cooperative but will also benefit others, and even NGCP's own substation. In such cases, the capacitors should be reclassified as Transmission Assets. NGCP is still waiting for ERC's clarification on this.

Table 4.2 Visayas Capacitor Project I

SUBSTATION LOCATION	DESCRIPTION
Danao (Cebu)	1- 7.5 MVAR Capacitor
Amlan (Negros)	2- 7.5 MVAR Capacitor
Kabankalan (Negros)	1- 7.5 MVAR Capacitor
Bacolod (Negros)	1- 7.5 MVAR Capacitor
Cadiz (Negros)	1- 7.5 MVAR Capacitor
Nabas (Panay)	1- 7.5 MVAR Capacitor
Sta. Barbara (Panay)	1- 7.5 MVAR Capacitor
San Jose (Panay)	1- 7.5 MVAR Capacitor
Maasin (Leyte)	1- 7.5 MVAR Capacitor
Babatngon (Leyte)	2- 7.5 MVAR Capacitor
Paranas (Samar)	2- 7.5 MVAR Capacitor

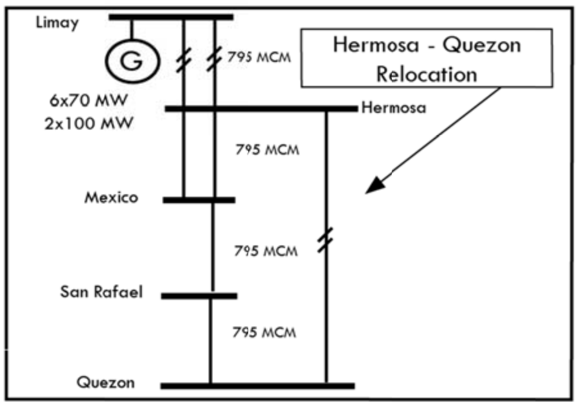
Chapter 05. Ongoing Projects

This chapter discusses in detail the ongoing projects being implemented by NGCP. The projects are classified as Non-network and Network projects. The latter is classified further as follows:

1. Generation-associated;
2. Load growth-driven;
3. Congestion-related; and
4. Reliability and Power Quality.

5.1 Non-Network Projects

5.1.1 Hermosa-Quezon 230kV Transmission Line Relocation



The project involves the relocation of a portion of Hermosa-Quezon 230 kV transmission line, with a total length of 14.73 km. The structures, a combination of steel poles and towers, will be relocated along North Luzon Expressway parallel to the viaduct portion from San Simon to Pulilan tollway exits.

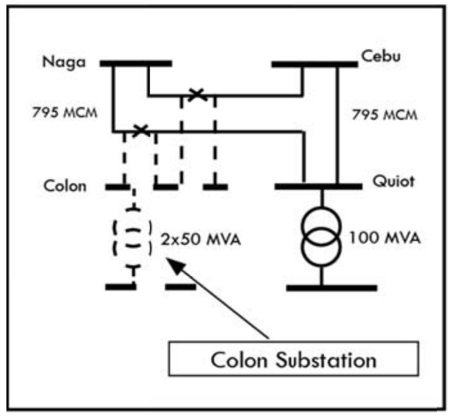
This was requested by the Department of Public Works and Highways due to its ongoing road widening activity (from two to six lanes). This road widening is one of the priority projects of the government to decongest traffic at the Manila North Road (formerly McArthur Highway) and provide comfort and alternative route to motorists using the highway. Originally targeted for completion by October 2007, the implementation of the project has to give way to the force majeure projects in southern Luzon as the facilities damaged by the 2006 typhoons have to be prioritized.

Table 5.1.1 Hermosa-Quezon 230 kV T/L Relocation

PROJECT COMPONENT	DESCRIPTION
Dismantling/Retiring of Steel poles	
Calumpit, Bulacan	2.49 km, 11 steel poles
Apalit, Pampanga	6.73 km, 43 steel poles
Pulilan, Bulacan	5.51 km, 31 steel poles
Relocation (12.5 km)	
Viaduct portion	5 km, 18 towers
Remaining portion	7.5 km, 36 steel poles

5.2 Generation-Associated Projects

5.2.1 Colon Substation



The Colon Substation is intended to provide a termination point for the Cebu-Negros Uprating. The substation will also establish the asset boundary between NGCP assets and the power plant by separating the control of Salcon Power Complex from NGCP's substation.

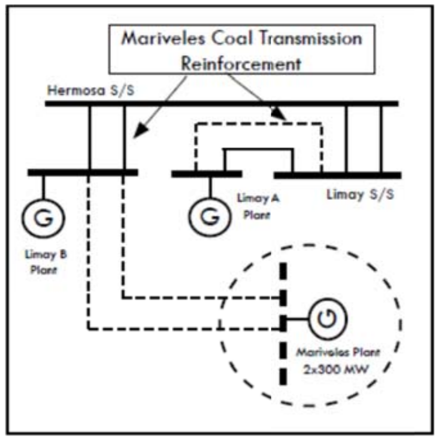
In addition, the substation will serve as the receiving station of the proposed KEPCO 200 MW coal-fired power plant as the Naga substation is already congested and can hardly accommodate any expansion.

Table 5.2.1 Colon Substation

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Cebu-Quiot-Colon Cut-in Line	138 kV ST-DC, 1-795 MCM, 0.5 km
Samboan L1 and L2 Extension	138 kV ST-DC, 1-795 MCM, 1.5 km
Toledo and Samboan L3 Extension	138 kV ST-DC1, 1-795 MCM, 1.5 km
Naga-Colon Tie-line (Reconductoring)	138 kV ST-DC, 1-410 mm^2 TACSR, 1.0 km
Colon 69 kV Line Extension (VECO and Sibonga Feeders)	69 kV SP/CP-DC, 1-336.4 MCM, 1.5 km
Substation	
Colon	2-50 MVA 138/69/13.8 kV transformer 16-138 kV PCB + Accessories 4-69 kV PCB + Accessories
Naga (Expansion)	2-138 kV PCB + Accessories

5.2.2 Mariveles Coal Transmission Reinforcement

This project involves the associated grid reinforcements needed to allow the full dispatch of both the proposed Mariveles 600 MW Coal-Fired Power Plant (CFPP) and Limay Combined-Cycle Power Plant (CCPP).



The Mariveles CFPP will be delivering power to the grid through the Limay B-CCPP switchyard, which will be split (isolated) from Limay A-CCPP in order to avoid the need to replace all existing breakers thereat due to increased fault level.

The grid reinforcement involves the reconductoring of the existing Hermosa-Limay B-CCPP 230 kV line (using the existing towers) to maintain the N-1 provision of the line during maximum dispatch of both Mariveles CFPP and Limay B-CCPP units. Additionally, the interrupting capacities of some PCBs at San Jose and Hermosa will also be exceeded and should be replaced. The replacement of these PCBs has been prioritized by NGCP and to date, it is an ongoing project..

The Provisional Authority (PA) to implement the project was secured in March 2008 while the permanent approval for the proposed project was issued by the ERC in August 2008. The project had been delayed thereon due to the non-issuance of Notice to Proceed but will now be implemented because the generation project is already locked-in and committed to be in service on 2012.

Without the project, more than 300 MW generation capacity may be constrained in order to maintain in order to maintain the n-1 provision for Hermosa-Limay B 230 kV Line. Also, the Hermosa and San Jose 230 kV substations will be at risk if the circuit breakers with interrupting capabilities below the expected fault level will not be replaced.

Table 5.2.2 Mariveles Coal Transmission Reinforcement

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Limay-Limay A-CCPP Tie Line Upgrade	230 kV, SP-DC, 1-410 mm^2 TACSR, 0.95 km
Hermosa-Limay B-CCPP Line Upgrade	Reconductoring with 2-410 mm^2 TACSR, 44.6 km
Mariveles-Limay	230 kV, ST-DC, 4-795 MCM, 19 km.
Substation	
San Jose	9-230 kV PCB + Accessories (Original components of Luzon PCB Replacement Project)
Hermosa	7-230 kV PCB + Accessories (Original components of Luzon PCB Replacement Project)
Limay B Switchyard	4-230 kV PCB + Accessories

5.3 Load Growth-Driven Projects

Table 5.3 Load Growth-Driven Projects

PROJECT NAME	PURPOSE	ETC
LUZON		
Dasmariñas Substation Expansion	To provide N-1 capability to the substation due to load growth	2011
Dasmariñas-Rosario 115 kV Transmission Line	To provide sufficient line capacity and with better line availability	2013
Luzon Substation Expansion I	To provide additional transformer capacity to meet load growth	2011
VISAYAS		
Bohol Backbone Transmission	To accommodate load growth, address voltage problems and improve system reliability and flexibility in Bohol	2012
Negros V Transmission Line	To provide new transmission corridor to accommodate load growth and attain higher reliability	2013
Negros-Panay Interconnection Uprating (Phase 1)	To improve the voltage profile in Panay and in Negros Occidental, accommodate load growth and improve the system reliability and operational flexibility of the Panay Grid	2011
Northern Panay Backbone	To provide 138 kV backbone in Panay to avert overloading of 69 kV lines	2011
Paranas-Calbayog Transmission Line	To provide new transmission corridor to accommodate load growth and attain higher reliability	2011
Southern Panay Backbone	To accommodate load growth and address the low voltage problem in Southern Panay	2012
MINDANAO		
Aurora-Polanco 138 kV T/L	To accommodate load growth and improve system reliability	2012
Balo-i-Villanueva 230 kV T/L	To provide new transmission corridor to Agus Hydro for higher reliability	2011
Mindanao Substation Expansion- 2005	To upgrade existing substations to meet load growth	2011
Zamboanga-Pitogo 138 kV T/L	To provide new transmission corridor to meet load growth and attain higher reliability	2010

5.3.1 Luzon

5.3.1.1 Dasmariñas Substation Expansion

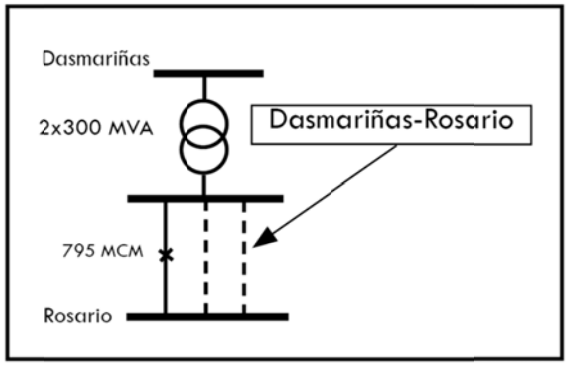
This project is a component of Luzon Transmission Line Upgrading I which originally aims to provide N-1 (as the third 300 MVA transformer) at the substation but will now be installed as a replacement to the damaged unit in Dasmariñas.

While the completion of Meralco's Amadeo 230 kV substation has relieved the loading at Dasmariñas, the installation of a third transformer unit in Dasmariñas is still required to maintain N-1 provision for the transformers as load continues to grow in the coming years.The Dasmariñas EHV Substation Expansion, which is a new project in the Third Regulatory Period, will address this requirement.

Table 5.3.1.1 Dasmariñas Substation Expansion

PROJECT COMPONENT	DESCRIPTION
Substation	
Dasmariñas (Expansion)	1-300 MVA, 230/115 kV 7-230 kV PCB + Accessories 6-115 kV PCB + Accessories

5.3.1.2 Dasmariñas-Rosario 115 kV Transmission Line



This project involves the construction of a 16 km, 115 kV transmission line mounted on steel poles and steel towers, including the corresponding expansion of Dasmariñas and Rosario Substations through the installation of additional switching facilities.

The project aims to improve line availability and provide additional capacity to the existing Dasmariñas-Rosario 115 kV wood pole line. The improvement of power supply reliability in the area would further encourage more investors to put up business in Cavite Ecozone.

Table 5.3.1.2 Dasmariñas – Rosario Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Dasmariñas - Rosario	115kV , ST/SP-DC, 1-795 MCM, 14.5 km
Substation	
Dasmariñas (Expansion)	2-115 kV PCB + Accessories
Rosario (replacement of PCB)	1-115 kV PCB + Accessories

5.3.1.3 Luzon Substation Expansion 1

This project involves the installation of additional transformers to accommodate load growth and provide N-1 at various substations. The project components prioritization was based on the latest update on the substation loading forecast. In Mexico, there are five (5) existing 100 MVA transformers and to increase the substation capacity, three (3) of which will be replaced with higher capacity units (2-300 MVA transformers). The replaced unit will then be deployed toother substations needing capacity additions: Bauang, San Rafael and Naga. Cabanatuan substation, on the other hand, will have new 200 MVA transformer unit. To provide N-1, additional 50 MVA capacity will be installed in Bantay while the existing 20 MVA unit in Laoag will be replaced with a new 50 MVA transformer. Biñan substation, on the other hand, will have new 300 MVA transformer unit which was recommended to be deferred to Fourth Regulatory Period in the Final Determination.

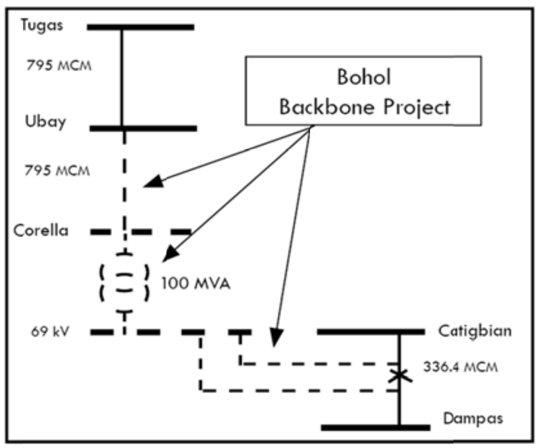
Table 5.3.1.3 Luzon Substation Expansion I

SUBSTATION	ADDITIONAL TRANSFORMERS
Mexico	2-300 MVA 230/69 kV
Bauang (from Mexico)	1-100 MVA 230/69 kV
San Rafael (from Mexico)	1-100 MVA 230/69 kV
Naga (from Mexico)	1-100 MVA 230/69 kV
Cabanatuan	1-200 MVA 230/69 kV
Laoag	1-50 MVA 115/69 kV
Bantay	1-50 MVA 115/69 kV
Biñan*	1-300 MVA 230/115 kV

* awaiting reply on the Motion for Reconsideration filed to ERC

5.3.2 Visayas

5.3.2.1 Bohol Backbone Transmission



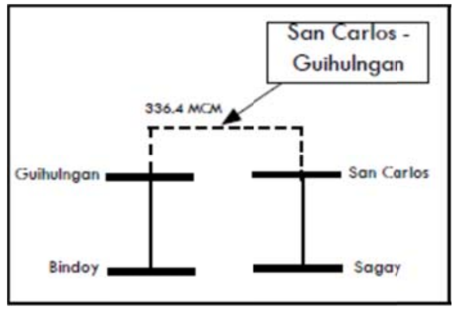
The project involves the installation/construction of a total of 96 kilometers of 138 kV overhead transmission line utilizing steel tower structures and the installation of a 100 MVA power transformer at the new Corella Substation. In addition, the Ubay Substation will be upgraded.

The project is expected to be completed by 2012. The proposed Ubay-Corella 138 kV line is necessary to prevent the overloading of Ubay-Trinidad 69 kV line during outage of Ubay-Alicia 69 kV transmission line, and vice versa, starting 2011. On the other hand, the new substation in Corella will provide a new delivery point in Bohol and prevent the overloading of Ubay Substation starting 2011.

Table 5.3.2.1 Bohol Backbone Transmission

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Ubay – Corella	138 kV ST-DC1, 1-795 MCM, 95 km
69 kV Tie-line (Tagbilaran-Catigbian Line)	69 kV SP/CP-DC, 1-336.4 MCM, 0.5 km
Substation	
Ubay	2-138 kV PCB + Accessories
Corella	1-100 MVA 138/69/13.8 kV Transformer 1-138 kV PCB + Accessories 3-69 kV PCB + Accessories

5.3.2.2 Negros V Transmission Line

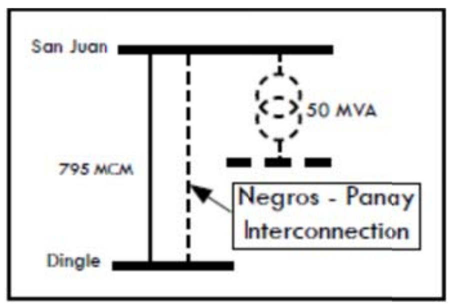


This project is intended to accommodate increasing power demand in the northeastern part of Negros island by building a 69 kV transmission loop from Cadiz to Amlan and to ensure the security of power supply to western Negros.

Table 5.3.2.2 Negros V Transmission Line

PROJECT COMPONENT	DESCRIPTION
Substation	
San Carlos-Guihulngan	69 kV ST-SC, 1-336.4 MCM, 52 km

5.3.2.3 Negros-Panay Interconnection Uprating (Phase 1)



Phase 1 of this project or the network upgrading in Panay side is recommended to help improve the voltage profile in Panay and in Negros Occidental. Even with the additional generation in Panay, the high impedance of the single-circuit Dingle-Barotac Viejo 138 kV line will limit the voltage regulation particularly in Negros. It should be noted that Panay and Negros have been prone to voltage variations.

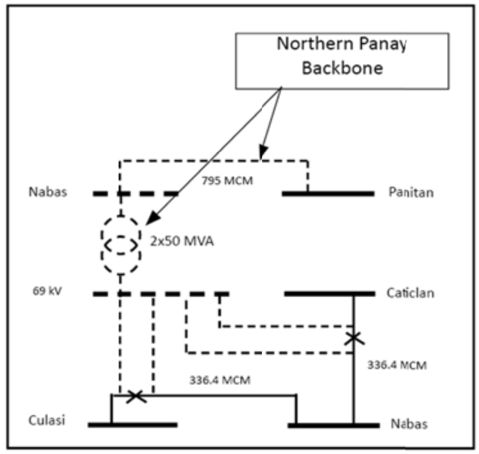
As indicated in the 2009 TDP, Phase 1 aims to accommodate load growth and address the low voltage problem and improve the system reliability and operational flexibility of the Panay Grid.

The entire Negros-Panay Interconnection Project was approved but optimized down to only 25% by the ERC in the Second Regulatory Period. NGCP has already bid out Phase 1 on 5 April 2010 and subsequently awarded the project to the qualified contractor on 25 May 2010.

Table 5.3.2.3 Negros-Panay Interconnection Uprating (Phase 1)

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Barotac Viejo CTS-Dingle S/S	138 kV, 1-795 MCM ACSR, ST-DC1, 35 km
Substation	
Dingle S/S Expansion	2 x 138 kV PCB + accessories
Barotac Viejo Substation (New)	1 x 50 MVA, 138/69-13.8 kV Transformer 4 x 138 kV PCB + accessories 3 x 69 kV PCB + accessories

5.3.2.4 Northern Panay Backbone Transmission

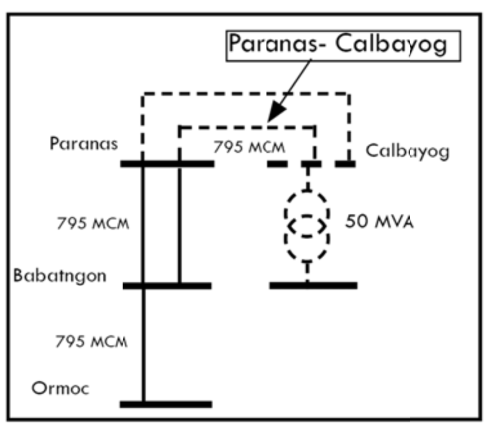


The project involves the installation/construction of a total of 97 kilometers of 138 kV and 69 kV overhead transmission line utilizing steel tower structures and aims to: (1) accommodate load growth and address the low voltage problem; (2) improve the system reliability and operational flexibility; and (3) extend service to un-electrified areas.

Table 5.3.2.4 Northern Panay Backbone Transmission

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Panitan-Nabas	138 kV ST-DC1, 1-795 MCM, 95 km
Nabas S/S Cut-in to Nabas-Culasi 69 kV T/L	69 kV ST-DC, 1-336.4 MCM, 1.0 km
Nabas S/S Cut-in to Nabas-Caticlan 69 kV T/L	69 kV SP-SC, 1-336.4 MCM, 1.0 km
Substation	
Nabas (New)	2-50 MVA 138/69/13.8 kV Transformer 3-138 kV PCB + Accessories 5-69 kV PCB + Accessories
Panitan (Expansion)	1-138 kV PCB + Accessories

5.3.2.5 Paranas-Calbayog Transmission Line



To support the long term power requirements of Samar and improve the delivery of quality and reliable power in the island, NGCP is constructing the 138 kV Paranas-

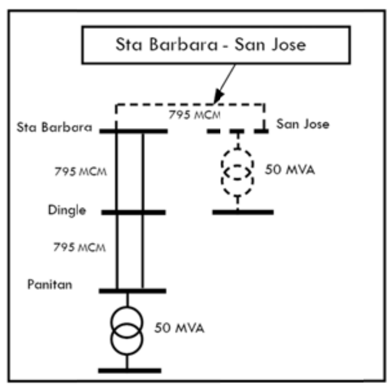
Calbayog transmission line. The new line will replace the old 69 kV woodpole transmission line and will address the overloading of Paranas Substation.

The absence of reliable transmission infrastructure is probably one of the factors that hamper the economic development of the island. For years, Northern Samar relies on the 69 kV woodpole structures, which are susceptible to tripping that caused power interruptions. Without this project, Calbayog will have a load curtailment.

Table 5.3.2.5 Paranas-Calbayog 138 kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Paranas-Calbayog	138 kV, ST-DC, 1-795 MCM, 65 km
69 kV tie line	69 kV, SP/CP-DC, 1-336.4 MCM ACSR/AS, 0.2 km
Substation	
Paranas S/S	1 x 138 kV PCB + Accessories
Calbayog S/S	1 x 50 MVA, 138/69/13.8 kV Transformer 3 x 138 kV PCB + Accessories 3 x 69 kV PCB + Accessories

5.3.2.6 Southern Panay Backbone Transmission



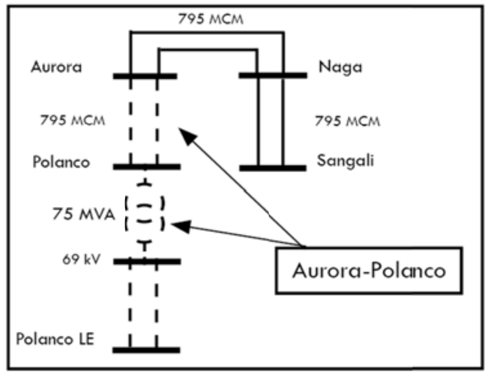
The project is part of the Panay Power Transmission Backbone which involves the installation/construction of a total of 97 kilometers of 138 kV and 69 kV overhead transmission line utilizing steel tower structures. The new transmission backbone will accommodate load growth and address the low voltage problem in southern Panay. In particular, the new facilities will avert the overloading of the Sta. Barbara-Sibalom 69 kV transmission line and the Sta. Barbara Substation.

Table 5.3.2.6 Southern Panay Backbone Transmission

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Sta. Barbara- San Jose	138 kV ST-DC1, 1-795 MCM, 95 km
San Jose Substation to Cut-in to San Jose -Sibalom 69 kV Line	69 kV ST-DC, 1-336.4 MCM, 2.0 km
Substation	
San Jose Substation (New)	1-50 MVA 138/69/13.8 kV Transformer 2-138 kV PCB + Accessories 3-69 kV PCB + Accessories
Sta. Barbara (Expansion)	2-138 kV PCB + Accessories

5.3.3 Mindanao

5.3.3.1 Aurora-Polanco 138 kV Transmission Line



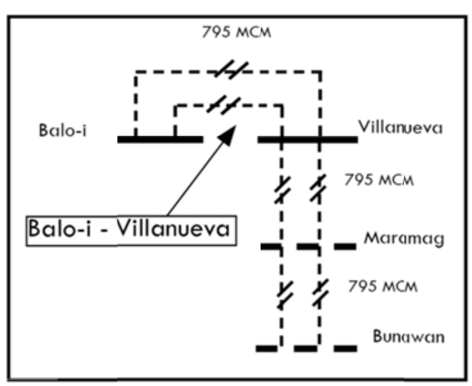
The proposed Aurora-Polanco 138 kV line and the new Polanco Substation are intended to serve the growing power demand of Dipolog City and neighbouring load centers. These new facilities will ensure a continuous and reliable power supply in the area. At present, the City of Dipolog including its neighbouring cities and towns, draw their power requirements from Aurora Substation through a very long 69 kV single circuit woodpole transmission line with a capacity of 47 MW.

Without the proposed facilities, the Aurora-Dipolog 69 kV transmission line and Aurora Substation will be overloaded starting 2011.

Table 5.3.3.1 Aurora-Polanco 138 kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Aurora-Polanco	138 kV ST-DC, 1-795 MCM, 79 km
Polanco-Polanco (LES)	69 kV SP/CP-DC 1-336.4 MCM, 11 km
Cut-in 69 kV Line	69 kV SC-SP/CP 1-336.4 MCM, 4 km
Substation	
Polanco(New)	1-75 MVA 138/69/13.8 kV Transformer 5-138 kV PCB + Accessories 4-69 kV PCB + Accessories
Aurora (Expansion)	3-138 kV PCB + Accessories
Polanco LES	3-69 kV Air Break Switch

5.3.3.2 Balo-i-Villanueva 230 kV Transmission Line



The proposed project will provide additional transmission corridor to the 888 MW Agus Hydro Complex (including expected entry of Agus 3 HEP), which accounts for more than 40% of Mindanao's total dependable capacity by year 2013.At present, Agus 2-Kibawe and Balo-i-Tagoloan 138 kV lines serve as Agus Complex's link to the grid. Over time, the N-1 being provided by these lines to the Agus Complex has been lost due to the increase in demand, i.e., load flow to each of the line. As a result, the bombing of the Agus 2-Kibawe line in the past resulted in huge power swing to the other corridor, the Balo-i-Tagoloan, leading to cascaded tripping of substations and then to system collapse. This project will also serve as an initial step in developing a higher capacity transmission highway from north to south of the grid to meet the increasing demand in Davao area. Due to constraints in acquiring right-of-ways and to serve the long-term requirements of the grid, 230 kV level is deemed necessary for higher transmission capacity. However, this 230 kV-designed transmission line will be energized initially at 138 kV.

Table 5.3.3.2 Balo-i-Villanueva 230 kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Balo-i-Villanueva	230 kV ST-DC, 2-795 MCM, 120 km
Substation	
Villanueva(New)	16-138 kV PCB + Accessories
Balo-i	5-138 kV PCB + Accessories

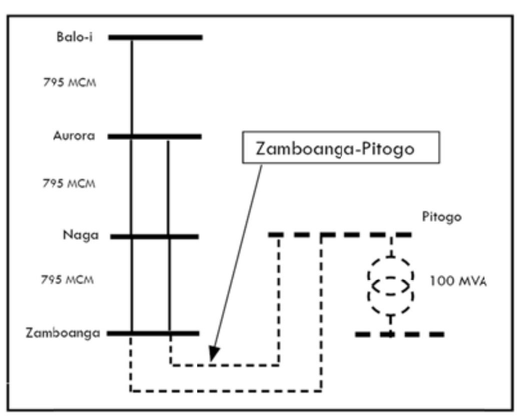
5.3.3.3 Mindanao Substation Expansion-2005

The project involves the installation of additional transformers at the substations identified in Table 5.3.3.3in order to meet load growth. In recent years, load growth in these substations' coverage areas has significantly increased and expected to continue. The new transformers would also provide N-1 capability to the other substations to mitigate supply interruption during planned and unplanned outages of transformers.

Table 5.3.3.3 Mindanao Substation Expansion- 2005

PROJECT COMPONENT	DESCRIPTION
Naga	1-50 MVA 138/69/13.8 kV 1-138 kV PCB + accessories
Butuan	1-100 MVA 138/69/13.8 kV 2-138 kV PCB + accessories 3-69 kV PCB + accessories

5.3.3.4 Zamboanga-Pitogo 138 kV Transmission Line



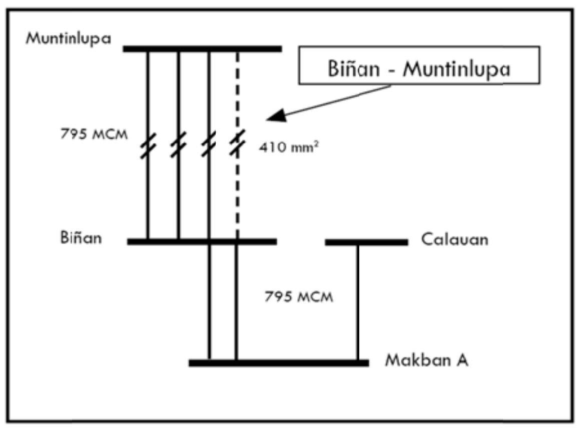
This is the remaining component of Zamboanga City 138 kV Transmission Line Project which consists of 33.5-km 138 kV double circuit, steel pole transmission line to be constructed from the existing Zamboanga substation to new substation in Pitogo. This augmentation will provide reliable bulk power services to western Mindanao. The project is also intended to remedy operational problem such as line outages, and at the same time meet the projected increase in power demand in the area.

Table 5.3.3.4 Zamboanga City 138 kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Zamboanga-Pitogo	138 kV SP-DC, 1-795 MCM, 33.5 km

5.4 Congestion-Related Project

5.4.1 Biñan-Muntinlupa Transmission Line Upgrade



This project involves the construction of the fourth Biñan-Muntinlupa 230 kV transmission line (14 km) circuit (already completed), and the installation of switching facilities at both Biñan and Muntinlupa substations. The project aims to provide provision for N-1 during maximum dispatch of generating plants in south Luzon by increasing the transfer capacity of the Biñan-Muntinlupa transmission corridor. The overloading during N-1 condition is triggered by the tripping of any Biñan-Muntinlupa 230 kV circuits.

Table 5.4.1 Biñan-Muntinlupa Transmission Line Upgrade

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Biñan – Muntinlupa line 4	230 kV, SP-SC, 2-410 mm^2 TACSR, 14 km
Substation	
Biñan S/S Expansion	1-230 kV PCB + Accessories
Muntinlupa S/S Expansion	1-230 kV PCB + Accessories

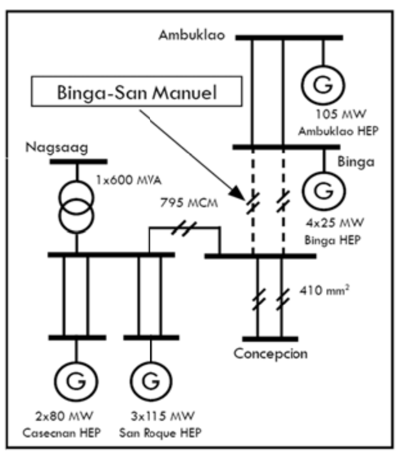
5.5 Reliability and Power Quality Projects

Table 5.5 Reliability and Power Quality Projects

PROJECT NAME	PURPOSE	ETC
LUZON		
Binga-San Manuel 230 kV T/L (Stage 1)	To provide N-1 during maximum dispatch of the generating plants in north Luzon	2012
Binga-San Manuel 230 kV T/L (Stage 2)		2013
Luzon PCB Replacement	To replace old PCBs to improve reliability	2012
Luzon Transmission Equipment Upgrade	To install the second Labrador-Bolo EHV tie-line and reactors at 500 kV substations in north Luzon	2011
VISAYAS		
Visayas PCB Replacement	To replace old and antiquated PCBs	2011
MINDANAO		
Gen. Santos-Tacurong 138 kV T/L	To replace old facilities to meet load growth and attain higher reliability	2011
Mindanao PCB Replacement	To replace old and antiquated PCBs	2011
Mindanao Shunt Reactors and Capacitors	To correct the overvoltage during off-peak condition	2011
Sultan Kudarat and Nabunturan S/S Expansion (Mindanao Mobile Transformer Project)	To accommodate load growth and improve system reliability	2012
Villanueva-Maramag 230 kV Transmission Line	To complete the transmission corridor from northern to southern Mindanao	2011

5.5.1 Luzon

5.5.1.1 Binga-San Manuel 230 kV Transmission Line



This project involves the construction of a new double circuit Binga-San Manuel 230 kV transmission line (40 km) using new right–of-way, including the installation of switching facilities at Binga Switchyard and San Manuel Substation. Instead of constructing a new Binga Substation, the existing switchyard will be expanded, departing from the original plan of putting up an entirely new substation. The project aims to provide N-1 contingency during maximum dispatch of the generating plants, particularly hydro, in north Luzon. The existing line, as well as the breakers at Binga Substation, which were constructed/installed in 1956 have already surpassed its economic life. Moreover, there are developments in the power plants affecting the power flow at Binga-San Manuel line. These include the repowering of Ambuklao

HEP by 2010 to a new capacity of 105 MW (previously at 75 MW capacity) and the completion of Binga HEP expansion by 2014 to an additional capacity of 25 MW. Although approved under the Final Determination of 2nd Regulatory Period, this project was deferred during TransCo time so that its approved disbursement could be allocated to Southern Panay Backbone Project (SPBP).

Table 5.5.1.1 Binga-San Manuel 230 kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line (Stage 2)	
Binga – San Manuel T/L	230 kV, ST-DC, 2-795 MCM, 40 km
Substation (Stage 1)	
Binga Substation Expansion	1-75 MVA 230/69-13.8 kV Transformer 10-230 kV PCB + Accessories 2-69 kV PCB + Accessories
San Manuel Substation Expansion	2-230 kV PCB + Accessories

This reallocation would allow the SPBP to be prioritized, as the project was originally proposed to be implemented later than the Binga-San Manuel 230 kV Transmission Line Project.

NGCP, however, will accelerate the implementation of the substation components at Binga which include the installation of a new 75 MVA 230/69 kV transformer and a new control room. The transformer will be serving the Binga-Itogon 69 kV line (a transmission asset) to ensure continuous reliable supply to Baguio PEZA upon disconnection of the said 69 kV line from the 30 MVA 13.2/69 kV transformer inside the Binga HEP switchyard.

5.5.1.2 Luzon Power Circuit Breaker Replacement

This project includes 9 x 230 kV and 9 x 115 kV PCBs as replacement for the old units to improve reliability. The 115 kV PCBs included in this package are all classified as transmission assets.

Table 5.5.1.2 Luzon PCB Replacement

SUBSTATION LOCATION	DESCRIPTION
San Jose	9-115 kV PCB + Accessories
Labo	3-230 PCB + Accessories
Malaya	4-230 kV PCB + Accessories
Gumaca	2-230 kV PCB + Accessories

5.5.1.3 Luzon Transmission Equipment Upgrade

This project involves the following components:

1. Installation of the second Labrador-Kadampat 230 kV tie-line which was already completed in 2008 and was implemented by TEAM Energy, owner of the Sual Coal-Fired Power Plant which is directly affected by the constraints in the said tie-line. It involved the bus-in of BPPC and Bauang 230 kV lines at Kadampat substation with the remaining portion of Labrador-BPPC and Labrador-Bauang (bundled together) serving as the second Labrador-Kadampat tie-line. This project will provide N-1 in this 230 kV segment and would allow the full dispatch of Sual/Masinloc.
2. Installation of 1-90 MVAR shunt reactors at the 500 kV Bolo EHV and San Jose Substations. This will address the overvoltages in the Luzon grid during system off-peak load conditions. Several instrument transformers were

already damaged due to the excessive high voltages, prompting the emergency procurement of reactors for Bolo EHV and San Jose substations.

3. Installation of 300 MVA 230/115 kV transformers at Taytay and Doña Imelda substations which were completed third quarter of 2010. The transformers were originally included in this project but were deferred as early as the 2006 TDP due to space limitations. These were returned back as components of this project as the replacement of the burnt transformer in Taytay and the critical condition of transformer insulation in Doña Imelda substation. In 2008, TransCo filed an application with the ERC for Provisional Authority (PA) to immediately procure a 300 MVA transformer for Doña Imelda that could make way for the rehabilitation of the transformers one at a time. The additional 300 MVA capacity will eventually become a spare unit.

The components of this project have undergone "reprioritization", with all project components new, superseding the previously FD-approved components. The ERC, as expressed in their letter to TransCo in 2007, recognizes that circumstances may change within a regulatory period and that the transmission service provider is given flexibility to implement projects which are necessary in performing its mandate.

Table 5.5.1.3 Luzon Transmission Equipment Upgrade

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Labrador-Kadampat tie line 2	230 kV, ST-DC/SP-SC, 2 x 795 MCM ACSR, 0.319 km and Bauang/BPPC Bus-in at Kadampat 230 kV Substation
Sual-Kadampat	Replacement of OHGW with OPGW of existing Sual-Kadampat 230 kV T/L
Substation	
Kadampat	6-230 kV PCB + Accessories 2-230 kV PCB + Accessories (Replacement)
Bolo EHV	1 – 90 MVAR, 500 kV Shunt Reactor
San Jose	1 – 90 MVAR, 500 kV Shunt Reactor
Doña Imelda	1-300 MVA 230/115 kV Transformer
Taytay	1-300 MVA 230/115 kV Transformer

5.5.2 Visayas

5.5.2.1 Visayas Power Circuit Breaker Replacement

A Power Circuit Breaker (PCB) is a prime component of power system and is critical for the efficient and sound operation of an electric network. This equipment must be constantly dependable and responsive at any given time. The purpose of this project is to replace old/antiquated PCBs installed in a number of substation facilities including PCBs which will become inadequate in terms of their technical capability (duties, mechanical, etc.)

Under this project, the PCBs in the following substations will be replaced: Amlan, Bacolod, Compostela, Dingle, Mabinay, Panitan and Sta. Barbara.

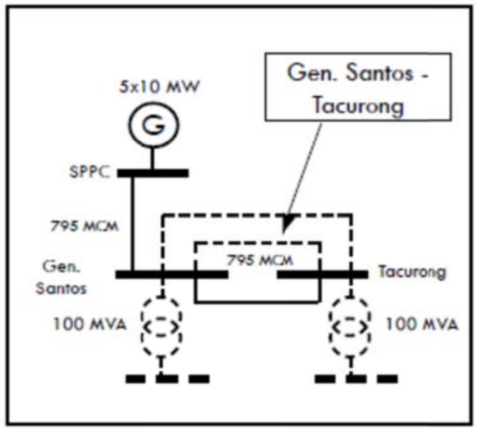
Table 5.5.2.1 Visayas PCB Replacement

SUBSTATION LOCATION	DESCRIPTION
Priority 1	
Amlan	5-138 kV PCB + Accessories
Bacolod	2-138 kV PCB + Accessories
Mabinay	3-138 kV PCB + Accessories

SUBSTATION LOCATION	DESCRIPTION
Priority 2	
Compostela	1-138 kV PCB + Accessories
Dingle	5-138 kV PCB + Accessories
Panitan	2-138 kV PCB + Accessories
Sta. Barbara	1-138 kV PCB + Accessories

5.5.3 Mindanao

5.5.3.1 Gen. Santos-Tacurong 138 kV Transmission Line



The proposed reinforcement of the Gen. Santos-Tacurong 138 kV line is intended to replace the existing 138 kV single circuit woodpole structures with a double circuit, steel tower transmission line. This will increase the reliability and power transfer capability of the bulk power system in SOCCSKSARGEN areas. The project also involves the upgrading of the Gen. Santos and Tacurong substations.

With increasing demand in the area, the grid cannot afford the continued use of the unreliable (dilapidated) woodpoles due to reliability concerns.

Table 5.5.3.1 Gen. Santos-Tacurong 138 kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Gen. Santos -Tacurong	138 kV ST-DC, 1-795 MCM, 80 km
Substation	
Gen. Santos Substation (Expansion)	1-100 MVA 138/69/13.8 kV power transformer 3-138 kV PCB + Accessories 4-69 kV PCB + Accessories
Tacurong Substation	1-100 MVA 138/69/13.8 kV power transformer 3-138 kV PCB + Accessories 4-69 kV PCB + Accessories

5.5.3.2 Mindanao Power Circuit Breaker Replacement

This project involves the replacement of 22 old and defective power circuit breakers on the substations listed below to maintain reliability and ensure safety. By June 2011, all these PCBs will be replaced.

Table 5.5.3.2 Mindanao PCB Replacement

SUBSTATION LOCATION	DESCRIPTION
Priority 1	
Bislig	1-138 kV PCB + Accessories
Tacurong	1-138 kV PCB + Accessories
Gen. Santos	1-138 kV PCB + Accessories
Zamboanga	2-138 kV PCB + Accessories
Sultan Kudarat	1-138 kV PCB + Accessories
Aurora	1-138 kV PCB + Accessories
Davao	2-138 kV PCB + Accessories
Nabunturan	3-138 kV PCB + Accessories
Priority 2	
Placer	1-138 kV PCB + Accessories
Nabunturan	1-138 kV PCB + Accessories
Davao	1-138 kV PCB + Accessories
Balo-i	2-138 kV PCB + Accessories
Naga	3-138 kV PCB + Accessories
Kibawe	2-138 kV PCB + Accessories

5.5.3.3 Mindanao Shunt Reactors and Capacitors

The original components of this project namely: Butuan-San Francisco, San Francisco-Bislig and Bislig-Nabunturan, all of which are 138 kV lines, have been deferred. In lieu of thesecomponents, shunt reactors have been proposed for Bislig and Naga Substations intended to correct the overvoltage during off-peak conditionas well as the undervoltage during peak condition.

Table 5.5.3.3 Mindanao Shunt Reactors and Capacitors

PROJECT COMPONENT	DESCRIPTION
Substation	
Bislig	3-7.5 MVAR 138 kV Shunt Reactors 3-138 kV PCB + Accessories
Naga	2-7.5 MVAR 138 kV Shunt Reactors 2-15 MVAR 138 kV Capacitors 2-138 kV PCB + Accessories

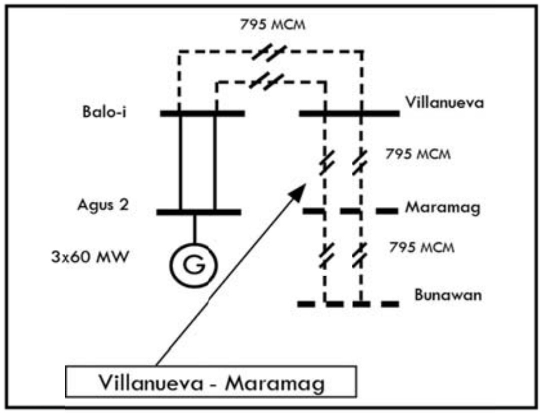
5.5.3.4 Sultan Kudarat and Nabunturan Substation Expansion

This project is fully-approved by ERC as Mindanao Mobile Transformer Project but its implementation was deferred in the 2nd Regulatory Period. It was instead replaced with Sultan Kudarat and Nabunturan's additional transformers which are originallypart of the Mindanao Substation Reliability Project 1.

Table 5.5.3.4 Sultan Kudarat and Nabunturan Substation Expansion

PROJECT COMPONENT	DESCRIPTION
Substation	
Sultan Kudarat S/S (Expansion)	1-75 MVA 138/69/13.8 kV
Nabunturan S/S (Expansion)	1-100MVA 138/69/13.8kV

5.5.3.5 Villanueva-Maramag 230 kV Transmission Line



This approximately 108-kilometer 230 kV, double circuit, steel tower, 2-795 MCM transmission project will complete the Mindanao 230 kV Transmission Backbone linking northern and southern Mindanao.The line will be initially energized at 138 kV.

Table 5.5.3.5 Villanueva-Maramag 230 kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Substation	
Villanueva-Maramag	230 kV ST-DC, 2-795 MCM, 108 km

Chapter 06.Projects for 2011-2015

This chapter contains the list of projects which NGCP intends to implement and were filed with the ERC in the Third Regulatory Period. It should be noted that to date, ERC has not issued the Final Determination.

Four (4) projects have been approved by the ERC in separate orders. These are Mariveles Coal Transmission Reinforcement and the following 69 kV transmission line projects: Eastern Albay, Sta Rita-Quinapundan and Culasi-Sibalom.

The projects for 2011-2015 are grouped as follows:

1. associated with the expansion or entry of a power plant;
2. network expansion needed to meet load growth;
3. network development needed to resolve congestion; and
4. in compliance with reliability and N-1 requirements of the Grid Code.

Projects intended to meet load growth and reliability requirements get high priority which became the basis in filing them with ERC. In the case of transformers, those projected to overload are given priority over N-1 (in most cases). In addition, the projected load should be at least 70% on the 10th year after the transformer was installed to ensure optimal utilization of assets.

NGCP's intention was to come up with a capex level that will result in reasonable transmission rates but would allow it to pursue important network upgrading and expansion.

6.1 Generation-Associated Projects

Table 6.1 Generation-Associated Projects

GENERATION PROJECT	REQUIRED GRID REINFORCEMENT(S)	ETC	REMARKS
LUZON			
Kalayaan III 360 MW	Biñan-Muntinlupa Line 4	2010	Completed
	Upgrading of Lumban EHV-Bay	2012	New Project
RP Energy Coal 300 MW	Hanjin-Olongapo Line Reinforcement	2013	New Project
San Gabriel Natural Gas 550 MW	Biñan-Muntinlupa Line 4	2010	Completed
	Upgrading of Lumban EHV-Bay Line	2012	New Project
QPPL Coal 500 MW and Pagbilao 375 MW	New 600 MVA 500/230kV transformer at Tayabas (Tayabas S/S Expansion I)	2012	New Project
	New line or reconductoring of QPPL-Tayabas Line		Connection asset
Ambuklao Repowering 105 MW / Magat Expansion (180 MW)	Reinforcement of Ambuklao-Binga	2014	Refer to Section 6.3.1
VISAYAS			
CEDC Coal 246 MW	Reinforcement of Calung-calung-Toledo-Colon Line	2013	New Project

6.1.1 Lumban EHV-Bay 230 kV Transmission Line Upgrading

This project aims to maintain the N-1 provision for the existing Kalayaan-Bay corridor that could allow all possible generation dispatch scenarios for the associated power plants. There are two proposed generation projects in the area that would further necessitate the upgrading of the Kalayaan-Bay 230 kV transmission line, namely: San Gabriel 550 MW Natural Gas power plant in Batangas and the 360 MW expansion of Kalayaan Pumped Storage Hydroelectric plant in Laguna. The overloading of the Kalayaan-Bay corridor occurs during maximum generation of southern plants (Makban, San Lorenzo, Sta. Rita and Calaca) while Kalayaan is at low dispatch, allowing the output of those plants to flow through the said line. While this may be addressed by limiting the generation of the said plants, this is not a solution being considered as the dispatch schedule is not within NGCP's control.

Kalayaan-Bay Line is an important corridor in providing operational flexibility particularly during maintenance of the associated transmission lines. It also complements the Biñan-Muntinlupa upgrading project by strengthening this alternate corridor for the generated power from the natural gas plants and the Makban geothermal plant. It helps supply Taytay Substation and also supplies Kalayaan plant during its operation as a pump load.

Even at off-peak hours, overloading also occurs when the natural gas plants (San Lorenzo and Sta. Rita) are still at high output and the Kalayaan units are operating as pumps. The proposed upgrading is a 4-795 MCM ACSR, ST-DC line, with Calauan to be supplied radially from Kalayaan using the existing 1-795 MCM ACSR ST-DC line. The upgrading is also expected to reduce system loss during pumping of Kalayaan units (up to 640 MW load) as the Kalayaan-Bay corridor provides the shortest route from generation sources.

If not implemented, there will be no full flexibility in the dispatch of the power plants (Calaca, Sta. Rita, San Lorenzo, Makban and Kalayaan) in the area. Also, there will be no operational flexibility during transmission line maintenance.

In implementing the project, the existing Lumban EHV substation (with tie-line to Kalayaan substation) will be used as the termination for the new line.

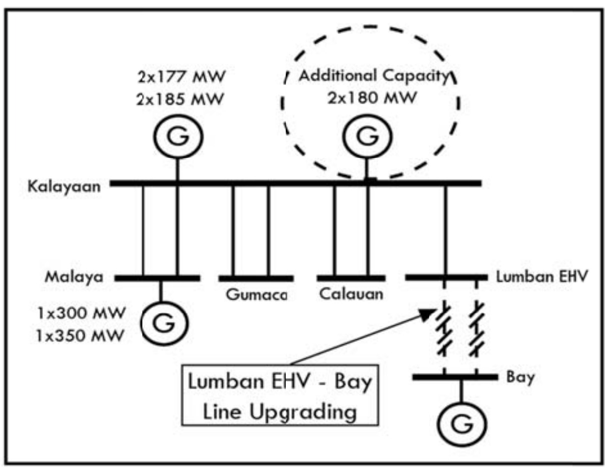
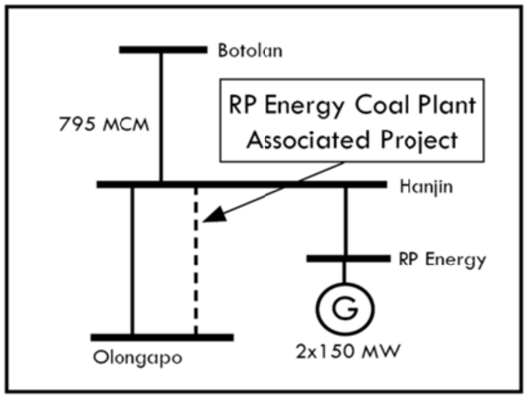


Table 6.1.1 Lumban EHV-Bay Transmission Line Upgrading

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Lumban EHV-Bay	230 kV, ST-DC 4-795 MCM ACSR, 40 km
Substation	
Lumban EHV	11-230 kV PCB + Accessories

6.1.2 RP Energy Coal Plant-Associated Project

This project, which involves the construction of the second circuit for the Hanjin-Olongapo 230 kV line, is associated with the proposed connection of RP Energy 300 MW Coal plant at Hanjin substation. The overloading of the existing Hanjin-Olongapo line will occur not only during N-1 but even during normal condition when the associated power plants are at maximum dispatch. Instead of reconductoring the existing 27 km line, the installation of a second circuit for Hanjin-Olongapo line was considered in order to maintain a continuous circuit in the western 230 kV corridor of Central Luzon and maintain the reliability of supply at Hanjin and Botolan substations during the construction period.

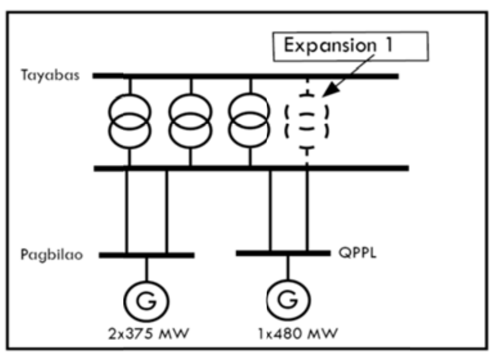


It should be noted that the connection of RP Energy may require the reclassification of some assets, particularly the assets owned by Hanjin, i.e., the 230 kV line from the cut-in point along the Olongapo-Botolan 230 kV line to the Hanjin switchyard. Such reclassification is subject to regulatory approval.

Table 6.1.2 RP Energy Coal Plant-Associated Project

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Hanjin-Olongapo	230 kV ST-DC 1-795 MCM ACSR, 27 km (single-circuit termination)
Substation	
Hanjin GIS	2-230 kV GIS + accessories
New Olangapo Switching Station	5-230 kV PCB + accessories

6.1.3 Tayabas Substation Expansion 1

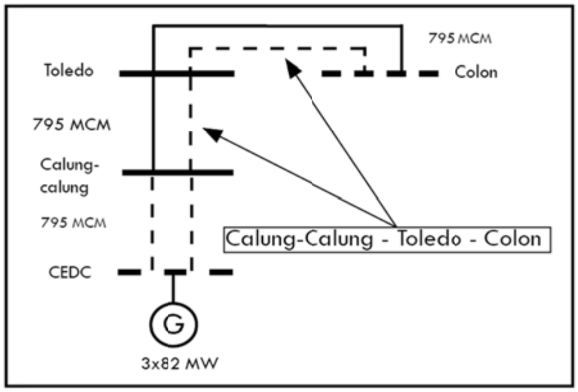


The expansion of Tayabas Substation involves the installation of additional 600 MVA 500/230kV transformer. Upon completion of the project, Tayabas EHV will be at 2,400 MVA total substation capacity. This project is needed to allow all possible generation dispatch scenarios for QPPL and Pagbilao coal plants in Quezon and the power plants in Bicol region to maintain the provision for N-1 at Tayabas EHV Substation.

Table 6.1.3 Tayabas Substation Expansion 1

PROJECT COMPONENT	DESCRIPTION
Substation	
Tayabas	1-600 MVA 500/230kV 1-500 kV PCB + Accessories

6.1.4 Calung-calung-Toledo-Colon 138 kV Transmission Line



Upon the completion of CEDC 3x82 MW coal-fired power plant in 2010, Calung-calung-Toledo-Colon transmission lines need to be reinforced in order to accommodate the said power plant. As of September 2010, two units are in operation already. The project involves the construction of 9.5 kilometers Calung-calung-Toledo and 17.6 kilometers Toledo-Colon line, with 138 kV steel tower, double circuit, single-strung overhead transmission line.This project also involves the line extension and termination of VECO's 138 kV line from CEDC to NGCP's Colon Substation. NGCP is still waiting for the ERC's decision on the reclassification of the said line to transmission asset under ERC Case No. 2010-064 MC.

The reinforcement will cater the estimated 40 MW injected power to the grid by the 100 MW embedded generator connected atToledo Substation. The other 60 MW will be consumed by the embedded loads with modest growth rates. These loads are Carmen Copperand the remaining CEBECO III load.

The project also entails the expansion of Calung-calung, Toledo and Colon substations.

Table 6.1.4 Calung-calung-Toledo-Colon 138 kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Calung-calung – Toledo	138 kV, ST-DC1, 1-795 MCM, 9.5 km
Toledo -Colon	138 kV, ST-DC1, 1-795 MCM, 17.6 km
VECO(Naga) -Colon S/S	138 kV SP-SC, 2-795 MCM, 0.3 km
Substation	
Calung-calung (Expansion)	4-138 kV PCB + Accessories
Toledo (Expansion)	9-138 kV PCB + Accessories
Colon (Expansion)	2-138 kV PCB + Accessories

6.2 Load Growth-Driven Projects

Table 6.2 Load Growth-Driven Projects

PROJECT NAME	PURPOSE	ETC
LUZON		
Luzon Substation Expansion II	To provide additional transformer capacity to meet load growth	2015
Luzon Substation Expansion III	To provide additional transformer capacity to meet load growth	2013
Luzon Substation Expansion IV	To provide additional transformer capacity to meet load growth	2014
New Antipolo 230 kV Substation	To serve as a new delivery point in Metro Manila and relieve Taytay S/S	2014
VISAYAS		
Colon-Cebu Transmission Line	To provide additional transformer capacity to meet load growth	2012
Visayas Substation Expansion I	To provide additional transformer capacity to meet load growth	2011
MINDANAO		
Mindanao Substation Expansion II	To provide additional transformer capacity to meet load growth	2014

6.2.1 Luzon

6.2.1.1 Luzon Substation Expansion II

This project involves substation capacity expansion to meet load growth of and provide N-1 contingency to various substations in North Luzon. It includes the installation of the third 300 MVA transformer unit for Mexico and additional 100 MVA capacity for the group of steel plant loads, like the Melters Steel Corporation (7.13% growth rate), being served by the substation. The additional capacity will be enough even if the operation of the embedded generators in the area will discontinue. Private distribution utilities connected to Mexico Substation, on the other hand, are anticipated to have significant growth rate for 2010-2015 - Angeles Electric Corporation (6.75%), Pampanga I Electric Cooperative, Inc. (2.95%) Clark Electric Distribution Corporation (2.73%), Pampanga Rural Electric Cooperative (2.02%) and Pampanga III Electric Cooperative, Inc. (1.84%).

The 2-75 MVA transformers at La Trinidad, on the other hand, will be replaced with 2-150 MVA to increase the capacity and provide N-1 contingency for the substation. One of the replaced units will then be installed at Ambuklao to serve the Ambuklao-Beckel 69 kV line (a transmission asset) to further improve the reliability of supply to the customers in the area.

For Concepcion, the additional transformer (the third 100 MVA unit) will be coming from the replaced unit in Mexico Substation. Other customers in the area with projected high growth rate for 2010-2015 are Texas Instrument with 16.84%, Tarlac I Electric Cooperative- 2.83%, Tarlac II Electric Cooperative- 3% and Tarlac Electric Inc.- 2.60%.

Load curtailment will be experienced during transformer outage at the concerned substations. Load curtailment will be higher if some embedded generators cease to operate due to expensive fuel or are under maintenance shutdown.

Table6.2.1.1 Luzon Substation Expansion II

SUBSTATION	PROPOSED ADDITIONAL TRANSFORMER
Mexico	1-300 MVA 230/69 kV; 1-100 MVA 230/69 kV
Concepcion (from Mexico)	1-100 MVA 230/69 kV
La Trinidad	2-150 MVA 230/69 kV
Ambuklao (from La Trinidad)	1-75 MVA 230/69 kV
Santiago	3-230 kV PCB + Accessories

6.2.1.2 Luzon Substation Expansion III

This project involves the installation of transformers at Batangas, Calaca and Bay substations to maintain the provision for N-1 due to high load.

Two units are to be installed (2-300 MVA) in Batangas Substation as replacements for the 2-100 MVA transformers which will at the same time provide N-1 contingency for the substation. One of the replaced units will be installed at Bay Substation for N-1. Majority of the connected customers in Batangas Substation are expected to grow by more than 2% in the next 5 years. The growth rate of the big customers are: Atlantic Gulf & Pacific Company (3.91%), Bobcock-Hitachi (3.09%), San Miguel Foods, Inc. (3.78%), Puyat Steel Corporation (2.33%), Keppel Philippine Shipyard (2.49%), Ibaan Electric & Engineering Corporation (3.53%), BATELEC II (2.61%), Lima Land (3.41%), Philtown (3.51%), Republic Cement (3.26%) and Coco-Chemical Industries (2.48%).

In Calaca, on the other hand, a new 100 MVA transformer (replacing the 50 MVA unit) will be installed in parallel with the existing 100 MVA transformer. Connected loads in the substation have AACGR of more than 2% for the next 5 years: BATELEC I (3.02%) and Steel Corporation of the Philippines (2.73%).

Table 6.2.1.2 Luzon Substation Expansion III

SUBSTATION	PROPOSED ADDITIONAL TRANSFORMER
Las Pinas*	1-300 MVA 230/115 kV
Batangas	2-300 MVA 230/69 kV
Calaca	1-100 MVA 230/69 kV
Bay (from Batangas)	1-100 MVA 230/69 kV

*awaiting reply on the Motion for Reconsideration filed to ERC

6.2.1.3 Luzon Substation Expansion IV

This project involves the installation of additional transformers at various substations to continuously meet the load growth of the customers being served. The total capacity of the new transformers to be installed under this project is 950 MVA. This includes the installation of the 4th transformer unit for Muntinlupa substation in Metro Manila. For Bayombong and Daraga substations, the units to be installed will be coming from the replaced units in other substations.

This package includes one additional transformer in South Luzon at Daraga Substation. The connected loads in this substation are forecasted to increase their demand as the nearby province, Camarines Sur, became the third most visited tourist destination in the country as of the first quarter of 2010 based on the Department of Tourism's quarterly report. This can be seen from Albay Electric Cooperative's 4.92%, Sorsogon I Electric Cooperative's 2.95% and Sorsogon II Electric Cooperative's 3.59% forecast growth rates for 2010-2015.

The remaining transformers are to be placed in the different substations in North Luzon. In Limay Substation, the connected big loads, Bataan Refining Corporation and Bataan Economic Zone, are expected to grow at an annual average of 3%. In Labrador Substation, on the other hand, the connected cooperatives have relatively higher AACGR: 4.17% for Dagupan Electric Corporation, 3.44% for Pangasinan I Electric Cooperative and 2.29% for Central Pangasinan Electric Cooperative.

In Tuguegarao Substation, one of its connected loads, CAGELCO II, has high forecast with 9.45% AACGR because of the entry of the new airport at Lallo, Cagayan which will complement the Port Irene Seaport, an emerging international transhipment hub and tourism destination in northeastern part of Luzon. Other connected load is CAGELCO I with 3.07% growth rate. Santiago Substation, meanwhile, has a modest 2% growth rate for its loads: Isabela Electric Cooperatives

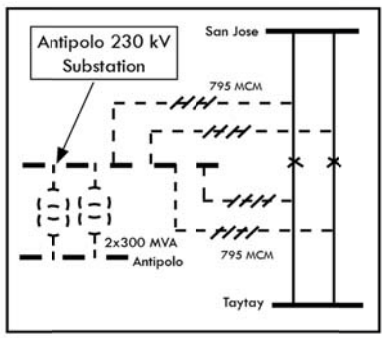
I and II, and Quirino Electric Cooperative. The Nueva Viscaya Electric Cooperative connected in Bayombong substation, on the other hand, has roughly 3% AACGR.

Labrador Substation will be installed with new 100 MVA to cater the load growth of its connected loads: Central Pangasinan Electric Cooperative (2.29%), Pangasinan I Electric Cooperative (3.44%) and Dagupan Electric Corporation (4.17%).

Table 6.2.1.3 Luzon Substation Expansion IV

SUBSTATION	PROPOSED TRANSFORMER
Muntinlupa	1-300 MVA, 230/115 kV
San Manuel	1-200 MVA, 230/69 kV
Bayombong (from La Trinidad)	1-75 MVA, 230/69 kV
Limay	1-50 MVA, 230/69 kV
Tuguegarao	1-100 MVA, 230/69 kV
Santiago	2-100 MVA, 230/69 kV
Labrador	1-100 MVA, 230/69 kV
Daraga (from Batangas)	1-100 MVA, 230/69 kV

6.2.1.4 New Antipolo 230 kV Substation



This involves the new 230 kV substation that will bus-in along the existing San Jose-Taytay 230 kV line (a 4-795 MCM ST-DC corridor).

As load increases in Metro Manila and with the expansion limitation of Doña Imelda and Taytay substations (to serve Meralco's Sector 2), developing a new 230 kV delivery substation is necessary. By year 2012, Taytay which is at 4-300 MVA capacity will be overloaded already during N-1 condition.

Initially, Antipolo 230 kV substation will be at 2-300 MVA capacity with capacitor banks to be installed for voltage support. To draw supply from Antipolo, MERALCO will have to put up line connections from their existing 115 kV substations near the area such as Masinag, Parang and Marikina.

Outage of one transformer unit in Taytay substation will necessitate dropping of loads within Metro Manila in order to avoid transformer overloading. Also, voltage problems will be experienced if the 2-100 MVAR capacitors will not be installed.

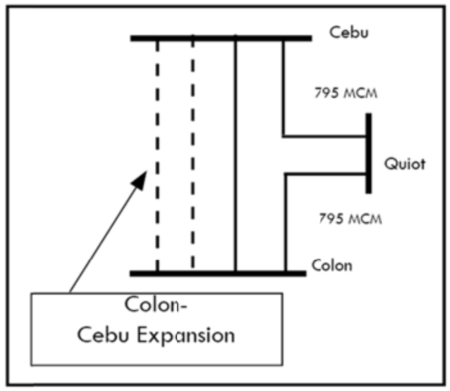
In the Final Determination, the 2-300 MVA transformers and the 115 kV switchyard were reclassified as sub-transmission assets.

Table 6.2.1.4 New Antipolo 230 kV Substation

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Extensions from the bus-in point along San Jose- Taytay	230 kV, ST-DC 4-795 MCM ACSR, 8 km
Substation	
Antipolo	2-300 MVA 230/115 kV Transformers 12-230 kV PCB + Accessories 6-115 kV PCB + Accessories 2-100 MVAR 230 kV Capacitor

6.2.2 Visayas

6.2.2.1 Colon-Cebu Transmission Line



The proposed additional circuits are expected to be in place by 2012. The transmission corridor is composed of a double circuit transmission line with 1-795 MCM conductor per circuit, with Quiot Substation cutting in at one circuit. Evidently, a cut-in substation presents an unbalance loading between the two circuits. With two sizable coal plants (3x82 MW CEDC Coal Fired Power Plant and 2x100 MW KEPCO Coal Fired Power Plant) coming-in in Cebu to inject power to the Colon Substation, and with the expected increase in demand at the Cebu load centers (Cebu, Mandaue and Mactan substations in particular) the Colon-Cebu transmission corridor will be overloaded. The Colon-Quiot line will carry the most power.

The project involves the construction of 138 kV double circuit transmission line that utilizes two bundle of 795 MCM conductor per circuit from Colon directly to Cebu. This new line will only be designed at 138 kV. A 230 kV transmission line from Compostela to Colon will be proposed to reinforce the future backbone of Cebu.

Several electric cooperatives and directly connected industries with a combined load of approximately 400 MW will benefit from the project. Most of them play a crucial role in the economic development of Cebu. The biggest among them are the Visayan Electric Company (305 MW) and Mactan Electric Company (48 MW). The other big customers include Mactan Enerzone Corp. (Aboitiz Land, Inc.) about 22 MW, General Milling Corporation-Cebu (5 MW) and Water Front A/P Hotel and Casino (2 MW).

Table 6.2.2.1 Colon-Cebu Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Colon-Cebu	138 kV, ST-DC, 2-795 MCM, 25 km
Substation	
Cebu Substation	2-138 kV PCB + Accessories
Colon Substation	4-138 kV PCB + Accessories

6.2.2.2 Visayas Substation Expansion I

The demand in the Visayas Grid is expected to grow at an Annual Average Compounded Growth Rate (AACGR) of 4.44% from 2010-2019 based on the NGCP's latest high demand projection. Three substations were identified to become overloaded under normal condition namely Ormoc (Leyte), Calung-calung (Cebu) and Kabankalan (Negros) substations. The project involves the installation of one (1) unit of 50 MVA transformer for each substation.

The Ormoc Substation is serving a combined load of about 21 MW of three electric cooperatives: Biliran, Don Orestes Romualdez and Leyte III, These cooperatives have AACGR for 2010-2015 of 2.76, 3.53 and 11.87%, respectively. The industrial customers connected to Ormoc which will benefit from the expansion include SC Global Coco Products, Specialty Pulp Manufacturing and Visayan Oil Mills.

The Calung-calung Substation, on the other hand, serves the power requirements of Balamban Enerzone Corporation (about 19 MW), which is expected to increase the highest by 14.12% up to 2015.

In Negros, overloading will be caused by the 2.95% growth rate in Negros Occidental Electric Cooperative which is directly connected to Kabankalan Substation.

The additional substation capacities are expected to be in place by 2012 to accommodate the projected load growth.

Table 6.2.2.2 Visayas Substation Expansion I

SUBSTATION	PROPOSED ADDITIONAL TRANSFORMER
Ormoc (Leyte)	1-50 MVA, 138/69kV
Calung-calung (Cebu)	1-50 MVA, 138/69kV
Kabankalan (Negros)	1-50 MVA, 138/69kV

6.2.3 Mindanao

6.2.3.1 Mindanao Substation Expansion II

This project involves the acquisition of 100 MVA new transformer unit at Gen. Santos. The 50 MVA unit at Gen. Santos will be transferred to Zamboanga.

Table 6.2.3.1 Mindanao Substation Expansion II

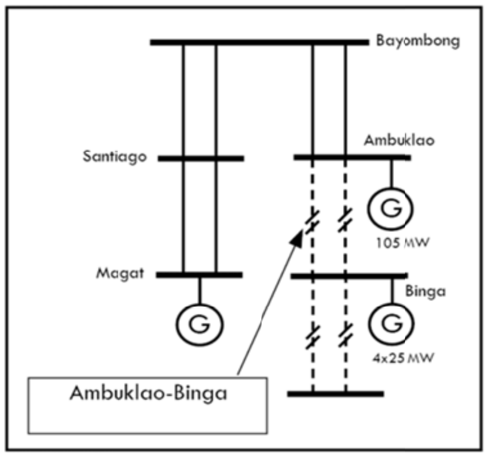
SUBSTATION	PROPOSED ADDITIONAL TRANSFORMER
Gen. Santos	1-100 MVA, 138/69 kV
Zamboanga (from Gen. Santos)	1-50 MVA, 138/69 kV

6.3 Congestion-Related Projects

Table 6.3 Congestion-Related Projects

PROJECT NAME	PURPOSE	ETC
LUZON		
Ambuklao-Binga 230 kV T/L Upgrading	To maintain the provision for N-1 taking into consideration the generation capacity additions from associated Hydroelectric Plants	2016
San Jose-Quezon Line 3	To increase transfer capacity and maintain the N-1 provision	2014

6.3.1 Ambuklao-Binga 230 kV Transmission Line Upgrading



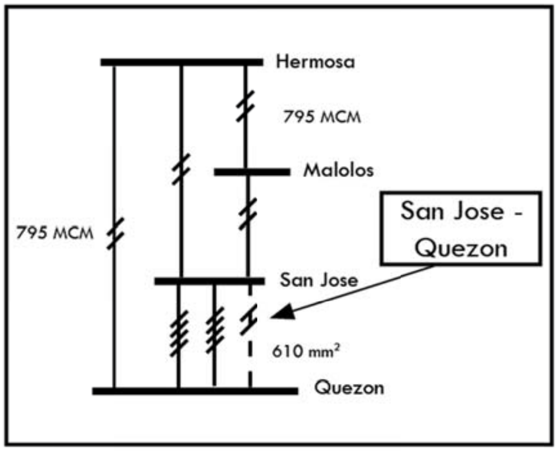
This project aims to upgrade the existing line in order to maintain the provision for N-1 taking into consideration the repowering of Ambuklao plant to a new capacity of 105 MW and the proposed expansion of Magat plant (180 additional capacity). Thus, during maximum generation of both plants, this project will resolve the overloading under N-1 line contingency conditions.

The project involves the construction of a 230 kV 2-410 mm^2 TACSR ST-DC transmission line from Ambuklao to Binga Substations that will increase the capacity of the corridor from 2x300 MVA to 2x1100 MVA. This will address the high forecasted growth rate of the customers connected at La Trinidad substation namely: Baguio City Economic Zone,Mountain Province Electric Cooperative,Benguet Electric Cooperative, Inc. and Philex Mining Corporation with growth rates of 4.37, 2.52, 3.49 and 1.14%, respectively. The Line 1 of the existing Ambuklao-Binga 230 kV corridor is more than 50 years old already having been commissioned in 1956. Line 2, on the other hand, was commissioned in 1981.

Table 6.3.1 Ambuklao-Binga 230 kV Transmission Line Upgrading

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Ambuklao-Binga	230 kV ST-DC 2-410 mm^2 TACSR, 11 km
Substation	
Ambuklao	6-230 kV PCB + accessories
Binga	5-230 kV PCB + accessories (already included in the Binga-San Manuel 230 kV T/L Project)

6.3.2 San Jose-Quezon Line 3 Transmission Line



This project involves the construction of the third circuit for San Jose-Quezon 230 kV transmission corridor. This will increase the transfer capacity of the line to address the overloading problem during tripping of one of the San Jose-Quezon circuits at peak load condition. Without this project, the dispatch of the power plants delivering power to the 500 kV system will have to be limited to maintain the N-1 provision for the line which may also require load dropping within Metro Manila.

The San Jose-Quezon 230 kV lines have a Special Protection System (SPS) that initiates generation shedding and load dropping during outage of both circuits of this corridor. This is to protect the grid from severe disturbances that could lead to a system blackout.

This project shall also complement the capacity addition (from 4-600 MVA to 4-750 MV) at San Jose EHV with the completion of the transformer replacement project thereat, thus improving the overall reliability and security of the grid.

Table 6.3.2 San Jose-Quezon Line 3 Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
San Jose-Quezon	230 kV, ST/SP-SC 2-610 mm^2 TACSR,22 km
Substation	
San Jose	2-230 kV PCB + Accessories
Quezon	1-230 kV PCB + Accessories

6.4 Reliability and Power Quality Projects

PROJECT NAME	PURPOSE	ETC
LUZON		
Dasmariñas EHV Substation Expansion	To maintain the provision for N-1 contingency	2012
Eastern Albay 69 kV Line	To maintain the provision for N-1 contingency	2014
Luzon Substation Reliability I	To provide N-1 transformers at various substations	2014
Luzon Voltage Improvement I	To maintain the voltage profile at various substations within the prescribed limits	2013
Luzon Voltage Improvement II	To maintain the voltage profile at various substation within the allowable limits	2014
Magapit Capacitor	To improve the voltage profile at Magapit Substation	2012
San Esteban-Laoag 230 kV T/L	To strengthen the existing corridor to provide N-1 and to support the wind farm connections	2013
San Jose-Angat 115 kV Line Upgrading	To improve the reliability of the existing corridor.	2014
Santiago-Tuguegarao 230 kV Line 2	To provide N-1 for the existing transmission corridor serving Isabela and Cagayan	2015
VISAYAS		
Cebu-Mandaue-Lapu-lapu Transmission Line	To provide N-1 for the existing corridor	2015
Culasi-Sibalom 69 kV Transmission Line	To provide N-1 for the existing corridor	2014
Ormoc-Babatngon Transmission Line	To provide N-1 for the existing corridor	2014
Ormoc-Maasin Transmission Line	To provide N-1 for the existing corridor	2014
Sta. Rita-Quinapundan 69 kV Transmission Line	To provide N-1 for the existing corridor	2014
Visayas Substation Reliability I	To provide N-1 transformers at various substations	Compostela S/S-2011 2013
Visayas Substation Reliability II	To provide N-1 transformers at various substations	2014
MINDANAO		
Butuan-Placer 138 kV Transmission Project	To provide N-1 capability to the transmission corridor	2013
Maramag-Kibawe 138 kV Transmission Line (Line 3)	To maintain reliability in the southern Mindanao area as additional contingency in case of outage of Agus 2-Kibawe	2014
Matanao-Gen. Santos 138 kV T/L	To provide N-1 capability to the transmission corridor	2013
Mindanao Substation Reliability I	To provide N-1 transformers at various substations	2014
Tacurong-Sultan Kudarat 138 kV T/L(Sultan Kudarat Capacitor Project)	To provide new transmission corridor from North Cotabato to Maguindanao	2013

6.4.1 Luzon

6.4.1.1 Dasmariñas EHV Substation Expansion

This project involves the installation of additional capacity both in the 500 kV and 230 kV substations in Dasmariñas. The 600 MVA capacity expansion at the EHV substation is required in order to maintain the provision for N-1 contingency during maximum dispatch of Ilijan, QPPL and Pagbilao plants (including their generation capacity expansions: 500 MW for QPPL by 2014 and 375 MW for Pagbilao plant by 2017). Similarly, the third 230/115 kV transformer in Dasmariñas will be required in order to maintain the provision for N-1 as the loads, particularly in Metro Manila, being served by the substation continue to grow.

This project also involves the replacement of the 230 kV circuit breakers at Dasmariñas as the resulting fault level at the substation will already exceed the interrupting capabilities of the existing breakers.

Table 6.4.1.1 Dasmariñas EHV Substation Expansion

PROJECT COMPONENT	DESCRIPTION
Substation	
Dasmariñas	1-600 MVA 500/230 kV Transformer Bank 2-500 kV PCB + Accessories 14-230 kV PCB + Accessories
	1-300 MVA 230/115 kV Transformer 1-230 kV PCB + Accessories 2-115 kV PCB + Accessories

6.4.1.2 Eastern Albay 69 kV Line

This is a 69 kV transmission line looping project from Tabaco City to Daraga (via Sto. Domingo) both in the province of Albay. It aims to provide reliable power delivery service to customers located in the three municipalities and two cities in the eastern and southeastern parts of Albay. The project would also provide oppurtunity for direct connection of big industries, e.g., coconut oil mills, cordage manufacturers, etc. including the PEZA-registered Misibis Resort and Spa located in an ecotourism zone at Cagraray Island in Bacacay, Albay. The project may likewise encourage investors to participate in the development of renewable energy sources, such as small hydropower and windpower plants situated in the economically-depressed area with big potential for economic growth.

Table 6.4.1.2 Eastern Albay 69 kV Line

PROJECT COMPONENT	DESCRIPTION
(Stage 1) Transmission Line	
Tabaco Substation–Sto. Domingo	69 kV, SP/ CP - SC, 1-336.4 MCM, 18 km
Substation	
Sto. Domingo (New)	1 x 10 MVA, 69/13.8 kV Power Transformer 2 x 69 kV PCB + Accessories
Tabaco (Expansion)	2 x 69 kV Air Break Switch
(Stage 2) Transmission Line	
Daraga Substation–Sto. Domingo	69 kV, ST/ SP - SC, 1-336.4 MCM, 20 km
Substation	
Sto. Domingo	1 x 69 kV PCB + Accessories
Daraga	1 x 69 kV PCB + Accessories

6.4.1.3 Luzon Substation Reliability I

This project involves the installation of a total of 320 MVA transformer capacity to provide redundancy to various substations with single transformer unit only. The transformers for Labo and San Esteban are new units while the rest will be coming from the replaced transformers in other substations.

If not implemented, all of the connected loads in the mentioned substation will have no power supply during transformer failure resulting in unserved energy. In occasions of prolonged transformer outage due to needed repair or rehabilitation, more unserved energy will be incurred.

Table 6.4.1.3 Luzon Substation Reliability I

SUBSTATION	PROPOSED ADDITIONAL TRANSFORMER
Tayabas (from Biñan)	1-100 MVA, 230/115 kV
Botolan (from Cabanatuan)	1-50 MVA, 230/69 kV
Gumaca (from Calaca)	1-50 MVA, 230/69 kV
Labo	1-50 MVA, 230/69 kV
San Esteban	1-50 MVA, 115/69 kV
Currimao (from Laoag)	1-20 MVA, 115/69 kV

6.4.1.4 Luzon Voltage Improvement I

This project has been reclassified as Transmission Asset in the ERC Order Case No. 2005-041RC on July 12, 2010 in response to the Motion for Consideration filed by National Transmission Corporation in 2006. ERC agreed that the installation of the capacitor banks at the high voltage buses of various substations in Luzon to maintain the Grid Code's prescribed allowable voltage level is to benefit not only the substation supporting the installation but the neighbouring substations as well.

The project involves the installation of shunt reactors in Naga substation and capacitor banks in four (4) substations, namely: Doña Imelda, Cabanatuan, Marilao and Muntinlupa. The shunt reactors in Naga aim to address the overvoltage problem being experienced in the area during off-peak load condition with Tiwi plant at minimum generation. Also, the reactors will address the overvoltage during the switching of the filters in Naga HVDC Station. The capacitor components of this project, on the other hand, will improve the voltage profile during normal conditions and address the potential undervoltages during N-1 contingency conditions. Space availability is a major concern for Doña Imelda and Muntinlupa. In Marilao, a separate adjacent lot will be acquired. NGCP is also considering a bigger lot for the site of a possible 500 kV Marilao drawdown substation. Naga and Cabanatuan have available space to accommodate the installation of the required voltage support equipment.

Though opening of one of the circuits of the Naga-Tayabas 230kV line will mitigate the overvoltages being experienced in Naga Substation during off-peak period, it exposes the transmission line to a vulnerable condition due to reduction in the level of reliability.

Table 6.4.1.4 Luzon Voltage Improvement I

PROJECT COMPONENT	DESCRIPTION
Naga	2-25 MVAR 230 kV Reactor
Doña Imelda	1-100 MVAR 230 kV Capacitor
Marilao	3-50 MVAR 230 kV Capacitor
Muntinlupa	2-50 MVAR 115 kV Capacitor
Cabanatuan	1-70 MVAR 230 kV Capacitor

6.4.1.5 Luzon Voltage Improvement II

This project involves the installation of a total of 600 MVAR capacitor banks at Biñan, Dasmariñas and Mexico substations in order to improve voltage regulation and keep the voltages in the area within the Grid Code prescribed limits both during normal and N-1 conditions. One of the worst N-1 events for the voltage profile is the outage of Dasmariñas-Ilijan 500 kV line. The increasing load will necessitate the installation of the said capacitor banks by year 2014.

Table 6.4.1.5Luzon Voltage Improvement II

PROJECT COMPONENT	DESCRIPTION
Dasmariñas	2-100 MVAR, 230 kV Capacitors
Biñan	2-100 MVAR, 230 kV Capacitors
Mexico	2-100 MVAR, 230 kV Capacitors

6.4.1.6 Magapit Capacitor

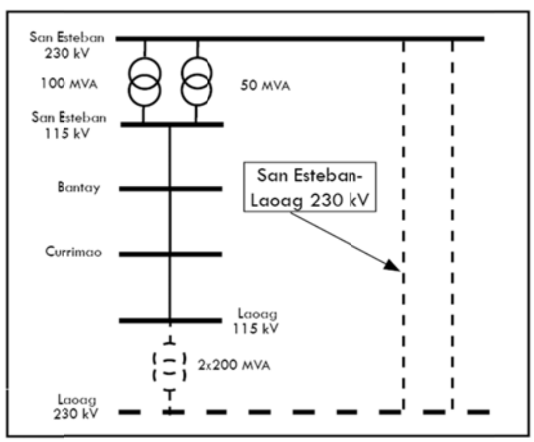
This project is the first stage of the Northeastern Transmission Development. It aims to improve the power quality and reliability of supply particularly in Cagayan which is presently being served by a very long 69 kV line. The project involves the installation of 69 kV capacitors at Magapit as the immediate measure in addressing the voltage problems being experienced in the area. While the proposed extension of the transmission line from Tuguegarao to Magapit will improve the voltage profile in the area, its implementation will take years considering the 78 km long new right-of-way required. There are loads in the area being served by a very long 69 kV line (more than 100 km), thus the need to provide voltage support equipment.

A total of 125 MW proposed capacity addition in Cagayan area has been tapped by NorthWind and First Max Power with their wind farm projects until 2013. Thus if not implemented, the area will not have a strong connection point for the wind farm generation. Also severe voltage problems will be experienced by the loads in the succeeding years.

Table 6.4.1.6 Magapit Capacitor

PROJECT COMPONENT	DESCRIPTION
Stage 1: Capacitors	
Magapit	3-5 MVAR 69 kV Capacitors 3-69 kV PCB + Accessories

6.4.1.7 San Esteban- Laoag 230 kV Transmission Line



The first stage of this two-stage project is being accelerated ahead of the other and is already under construction to date. It involves the construction of 500 meters of 115 kV transmission line and expansion/reconfiguration of the existing Laoag Substation and the installation of control and protection equipment at Laoag, Currimao, Bantay and San Esteban substations. This is intended to accommodate the installation of the connection facility for the two wind power projects: the 86 MW EDC and 80 MW of Northern Luzon UPC Asia Corporation, both of which will connect to Laoag Substation.

The second stage involves the construction of a double-circuit line from San Esteban to Laoag Substation and the construction of new Laoag 230 kV substation. The initial plan was to energize the line at 115 kV but due to increasing wind power capacity that will connect to Laoag Substation and the expansion limitation of San Esteban 115 kV Substation, the line will be energized outright at 230 kV. Currently, there is only one circuit supplying Bantay (from San Esteban), Currimao (from Bantay) and Laoag (from Currimao). Therefore, any outage of line between these stations would result in interruption of power at the receiving stations.

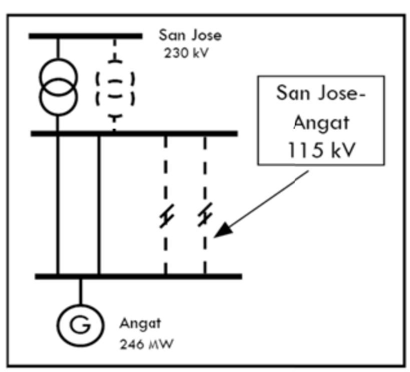
Moreover, this project will strengthen the existing corridor as Ilocos has been identified as one of the areas with high potential for wind power generation. Aside from the existing wind farm (33 MW with additional 8.25 MW capacity) in the area, a total of 513 MW wind generation capacity will be connecting to Laoag within 2010 to 2014.

This project will have a great impact in Ilocos if not implemented. Having only a single 115 kV circuit from San Esteban to Laoag, there will be no N-1 reliability for both the load and generation in the northwestern part of the Luzon grid.

Table 6.4.1.7 San Esteban-Laoag 230kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Stage 1: Associated with Wind Farm Projects	
Transmission Line	
Diversion of Currimao 115 kV Line @ Laoag Substation Expansion Area	SP-SC, 1-795 MCM, 0.50 km
Substation	
Laoag S/S Expansion (Reconfiguration)	7 – 115 kV PCB + Accessories 1 x 7.5 MVAR, 115 kV Capacitor Bank
Stage 2: 230 kV Transmission System	
Transmission Line	
San Esteban-Laoag	230 kV, ST-DC, 1-795 MCM, 120 km
Substation	
Laoag (New)	6-230 kV PCB + Accessories 2-115 kV PCB + Accessories 2 x 200 MVA, 230/115-13.8 kV Transformer
San Esteban (Expansion)	5 x 230 kV PCB + Accessories

6.4.1.8 San Jose-Angat 115 kV Line Upgrading



This project aims to ensure the reliability of the existing 115 kV transmission lines connecting Angat HEP to the grid. San Jose-Angat Lines 1 and2 were built in 1967 while Line 3 (woodpole) was built in 1960. The proposed project is to construct a new double-circuit line using the existing right-of-way of San Jose-Angat Line 3.

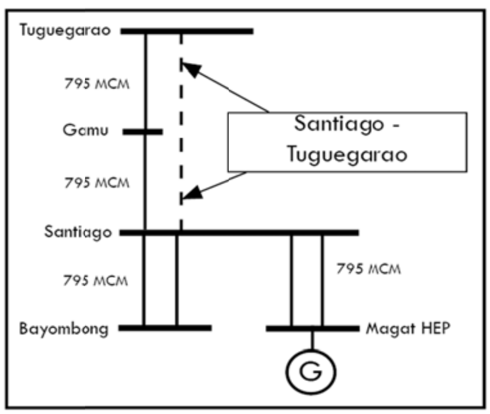
The capacity already anticipates the future retirement of Lines 1 and2 which will be 50 years old already by 2017. Since there are customers connected to the existing lines through tap connection, they will be served by the existing Lines 1 and 2 (radially from San Jose substation) upon completion of the upgrading project. A 115 kV switching station along the upgraded line will be necessary later to provide a connection point for the customers.

With this project, the San Jose-Angat 115 kV line will become more reliable corridor. The 300 MVA capacity per circuit of the proposed project would be sufficient to provide N-1 contingency during maximum dispatch of the 246 MW Angat Hydro. If not implemented, constraints will be experienced when Line 3 fails.

Table 6.4.1.8 San Jose-Angat 115 kV Line Upgrading

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
San Jose-Angat	115 kV ST-DC 2-795 MCM, 18 km
Substation	
San Jose	2-115 kV PCB + Accessories

6.4.1.9 Santiago-Tuguegarao 230 kV Line 2



This project involves the installation of a second circuit from Santiago to Tuguegarao substations bypassing Gamu Substation. This new line will provide reliability as tripping of the existing Santiago-Gamu and Gamu-Tuguegarao 230 kV lines will no longer result in the isolation of the customers at the load end substations in the area.

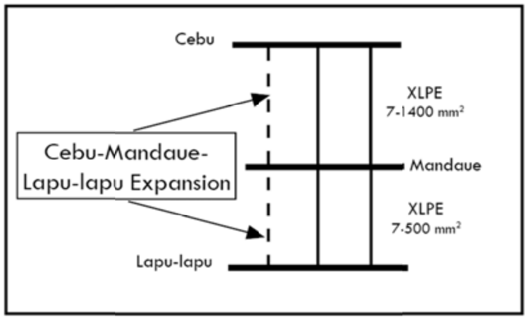
The project will benefit the northeastern part of the grid by providing reliable power supply. This shall also serve as the first step in strengthening this part of the grid as Cagayan is also among the areas identified to be rich in renewable energy potentials particularly wind.

Table 6.4.1.9 Santiago-Tuguegarao 230 kV Line 2

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Santiago-Tuguegarao Line 2	230 kV, ST-SC, 1-795 MCM, 118 km
Substation	
Santiago	2-230 kV PCB + Accessories
Tuguegarao	1-230 kV PCB + Accessories

6.4.2 Visayas

6.4.2.1 Cebu-Mandaue-Lapu-Lapu Transmission Line



The existing Cebu-Mandaue-Lapu-lapu transmission line is the transmission corridor carrying the power supply to the two major substations, namely Mandaue and Lapu-lapu, which serve the load center of Metro Cebu. Cebu-Mandaue transmission line is a double circuit line utilizing 3-1400 mm^2 XLPE underground cable per circuit. On the other hand, Mandaue-Lapu-lapu is a double circuit utilizing 3-500 mm^2 XLPE underground cable per circuit. This transmission corridor is expected to be overloaded during single outage contingency by 2011 with the Cebu-Mandaue 138 kV line carrying a heavier power flow compared to the Mandaue-Lapu-lapu 138 kV line.

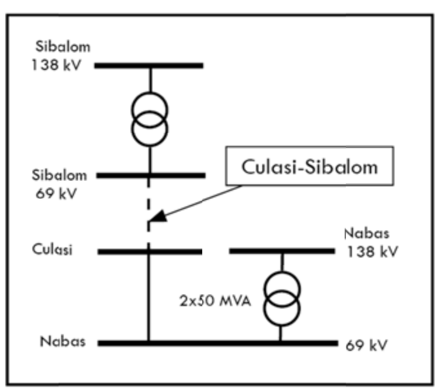
This project involves the construction of a third circuit utilizing the same conductor as the existing cables to comply with the N-1 provision of the Grid Code. With this project, the reliability of power supply to Mandaue and Lapu-lapu load center substations will be improved.

General Milling Corporation-Cebu, Mactan Enerzone Corporation and Visayan Electric Company are some of the distribution utilities and directly connected customers that will benefit from the project. This improvement will support the economic activities in this area.

Table 6.4.2.1 Cebu-Mandaue-Lapu-lapu Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Cebu-Mandaue	138 kV , SC, 3-1400 mm^2, 7.2 km
Mandaue-Lapu-lapu	138 kV , SC, 3-500 mm^2, 1.5 km
Substation	
Mandaue	1-138 kV PCB + Accessories
Lapu-lapu	1-138kV PCB + Accessories

6.4.2.2 Culasi-Sibalom 69 kV Transmission Line



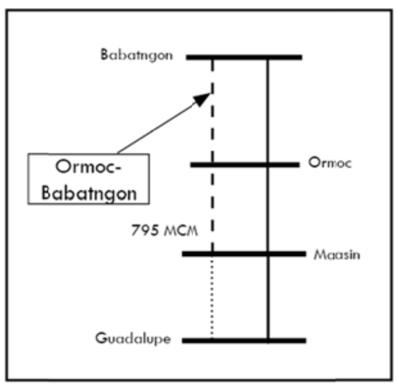
The proposed Culasi-Sibalom T/L was approved by the ERC as transmission asset in its order dated 09 February 2009, ERC Case No. 2007-532MC. Approximately 86 kilometers in length, the transmission line will provide alternate power source to Sibalom Substation, as well as connect North and South Panay on the western side. In the Order, ERC has also decided the reclassification of its connected lines, in the North (Panitan-Nabas Culasi) and South (Sta. Barbara-Sibalom), as transmission assets.

Capiz, Antique and Aklan Electric Cooperatives (CAPELCO, ANTECO and AKELCO) are the distribution utilities connected in north side while Iloilo I and Antique Electric Cooperatives (ILECO I and ANTECO) are connected in the South side. These customers will benefit from this project once the 69 kV loop is completed.

Table 6.4.2.2 Culasi-Sibalom Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Culasi Load End- Sibalom	69 kV ST-SC, 1-336.4 MCM, 86 km
Substation	
Sibalom	2-69 kV PCB + Accessories
Culasi Load End	1-69 kV Air Break Switch

6.4.2.3 Ormoc-Babatngon Transmission Line



Leyte-Samar corridor is composed of Ormoc-Babatngon 138 kV, a single circuit line and Babatngon-Paranas 138 kV, a double circuit line. Since the Ormoc-Babatngon 138 kV is a single circuit line, an outage of this line will result in blackout in Samar. Samar has no internal generation and is dependent from the geothermal generation in Leyte. To prevent this and at the same time comply with N-1 provision of the Grid Code, the Ormoc-Babatngon 138 kV has to be expanded to double circuit line.

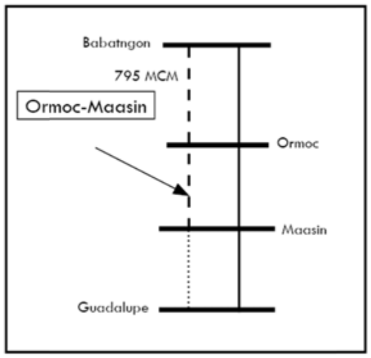
This project involves the construction of the 78.54 km of 138 kV steel tower overhead transmission line utilizing 1-795 MCM ACSR conductor as second circuit of the existing Ormoc-Babatngon 138 kV line. This project also involves the expansion of Ormoc and Babatngon substations.

Leyte II Electric Cooperative is one of the customers directly connected to Babatngon Substation that will benefit from the project. This project will support the increase in demand of LEYECO II due to the additional load coming from the connection of Robinson's Mall.

Table 6.4.2.3 Ormoc-Babatngon Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Ormoc-Babatngon	138 kV, ST-DC1, 1-795 MCM, 78.54 km
Substation	
Ormoc	1-138 kV PCB + Accessories
Babatngon	1-138kV PCB + Accessories

6.4.2.4 Ormoc-Maasin Transmission Line



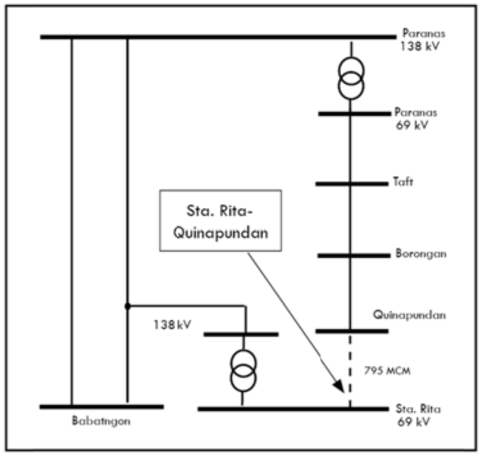
The Leyte-Bohol corridor includes the Ormoc-Maasin 138 kV line, Maasin-Guadalupe CTS 138 kV line, the Guadalupe CTS-C.P. Garcia CTS submarine cable (Leyte-Bohol interconnection) and the C.P. Garcia CTS-Ubay SS 138 kV line. All these lines in the corridor, the Ormoc-Maasin 138 kV in particular, are all single circuit lines. An outage of the Ormoc-Maasin 138 kV line will result to power outage in Bohol as well as Southern Leyte. An initial step to prevent it is the expansion of the Ormoc-Maasin 138 kV to double circuit line. This will also make the line compliant to N-1 provision of the Grid Code.

Leyte IV Electric Cooperative in southern Leyte and the Bohol island will be assured of higher power supply reliability once the project is completed. It will also benefit the eco-tourism activities in Bohol since the island relies heavily on the power supply from Leyte.

Table 6.4.2.4 Ormoc-Maasin Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Ormoc-Maasin	138 kV, ST-DC2, 1-795 MCM, 113.97 km
Substation	
Ormoc	1-138 kV PCB + Accessories
Maasin	3-138kV PCB + Accessories

6.4.2.5 Sta.Rita-Quinapundan 69 kV Transmission Line



This project was approved by the ERC in its order dated 09 February 2009, ERC Case No. 2007-520MC. The proposed line is intended primarily to make Quinapundan Substation closer to its power source and thus provide power that is more reliable.

At present, the Quinapundan substation gets its power from NGCP's 138 kV Paranas substation via a long stretch of 69 kV wood pole line (Paranas-Taft-Borongan- Quinapundan) that is approximately 191 kilometers long. This corridor is prone to tripping. And because of its distance, low voltage problems and high system loss are also experienced in the area. This project aims to loop the 69 kV line to the existing Sta. Rita substation. Although still a long route, approximately 103 kilometers long, the line shall provide an alternate corridor to the Eastern Samar substations (Paranas, Taft, Borongan and Quinapundan). In case of tripping along Calbayog-Taft line, this will also relieve the Paranas substation from overloading.

The delivery substations of Eastern Samar Electric Coopereative, Inc. (ESAMELCO) particularly the Taft, Borongan and Quinapundan Substations will benefit from this project.

Table 6.4.2.5 Sta. Rita-Quinapundan 69 kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Sta. Rita Load End–Quinapundan Load End	69 kV, ST-SC, 1-795 MCM, 103 km
Substation	
Sta. Rita Load End (Expansion)	2-69 kV PCB + Accessories
Quinapundan Load End	2-69 kV Air Break Switch

6.4.2.6 Visayas Substation Reliability I

This project entails the installation of 650 MVA substation capacity to address overloading of various substations during N-1. These transformers will improve system security and reliability of the grid.

The additional 150 MVA 230/138 kV transformer for Compostela needs to be installed ahead of the others, the reason why NGCP sought Provisional Authority from ERC to proceed with its accelerated implementation. The existing load at Compostela Susbtation has reached a critical level such that if one of the three transformers fails, the two remaining transformers will be overloaded. These are critical transformers as they form part of the Visayas transmission backbone. The bulk power coming from the Leyte geothermal power plants passes through going to the Cebu, Negros and Panay grids.

For the other 7 substations, four have only one transformer, namely: Cadiz, Babatngon, Maasin and Samboan. The loss of a single transformer at any of these substations will interrupt the supply of power to consumers. Therefore, the addition of a second transformer at these substations will establish N-1 capability.

Table 6.4.2.6 Visayas Substation Reliability I

SUBSTATION	PROPOSED ADDITIONAL TRANSFORMER
Compostela (Cebu)	1-150 MVA, 230/138 kV
Ormoc (Leyte)	1-150 MVA, 230/138 kV
Amlan (Negros)	1-50 MVA, 138/69 kV
Bacolod (Negros)	1-100 MVA, 138/69 kV
Cadiz (Negros)	1-50 MVA, 138/69 kV
Babatngon (Samar)	1-50 MVA, 138/69 kV
Maasin (Leyte)	1-50 MVA, 138/69 kV
Samboan (Leyte)	1-50 MVA, 138/69 kV

6.4.2.7 Visayas Substation Reliability Project II

This project involves the installation of additional transformers to address overloading of various substations during N-1. For Sta. Barbara, the existing 30 MVA transformer will be pulled-out upon installation of the two 50 MVA transformers. The 30 MVA transformer maybe redeployed by O&M as needed. Among the grids, Visayas has the highest projected growth rate at 4.44% for 2010-2019.

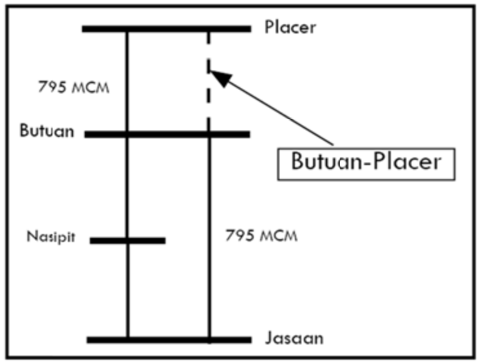
This project is intended to provide capacity additions to various substations to address the overloading during N-1 condition or outage of one transformer. This will ensure the reliability of the substations and comply with the N-1 provision of the Philippine Grid Code.

Table 6.4.2.7 Visayas Substation Reliability II

SUBSTATION	PROPOSED ADDITIONAL TRANSFORMER
Mandaue (Cebu)	1-100 MVA, 138/69 kV
Lapu-lapu (Cebu)	1-100 MVA, 138/69 kV
Ormoc (Leyte)	1-50 MVA, 138/69 kV
Sta. Barbara (Panay)	2-50 MVA, 138/69 kV
Sta. Rita (Samar)	1-50 MVA, 138/69 kV

6.4.3 Mindanao

6.4.3.1 Butuan-Placer 138 kV Transmission Project

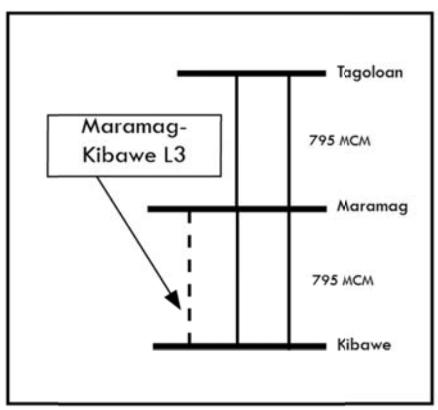


This project is part of the Reliability Compliance Project I- Mindanao. It involves the installation of the second circuit (approximately 100 kilometers) of the existing Butuan-Placer 138 kV corridor. It will provide N-1 to the existing line and reduce transmission loss and further improve the voltage level in Surigao del Norte. The expected completion of this project is 2013.

Table 6.4.3.1Butuan Placer 138 kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Butuan-Placer	138 kV ST-SC, 1-795MCM, 100km
Substation	
Placer (Expansion)	2-138 kV PCB + Accessories
Butuan (Expansion)	2-138 kV PCB + Accessories

6.4.3.2 Maramag-Kibawe 138 kV Transmission Line

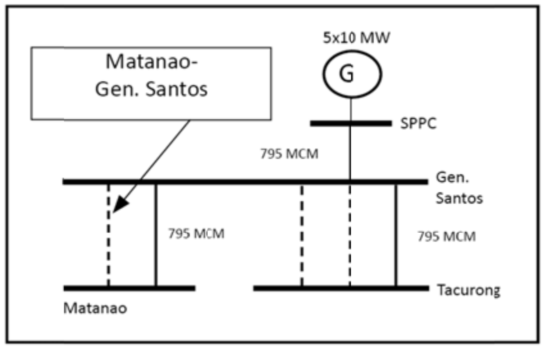


The project involves the installation of additional 138 kV single circuit line to strengthen the 138 kV double circuit Maramag-Kibawe transmission line. This is to relieve Maramag-Kibawe 138 kV line from overloading due to the frequent outage of the Agus 2- Kibawe 138 kV line. The project also involves the expansion of Maramag and Kibawe substations.

Table 6.4.3.2 Maramag-Kibawe 138 kV Transmission Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Maramag-Kibawe	138 kV, ST-SC, 1-795 MCM, 21 km
Maramag	1-138 kV PCB + Accessories
Kibawe	3-138kV PCBs + Accessories

6.4.3.3 Matanao-Gen. Santos 138 kV Transmission Project



This project is part of the Reliability Compliance Project I- Mindanao which involves the provision of N-1 to the existing Matanao- Gen. Santos 138 kV corridor. In case of an outage of the existing Matanao-Gen. Santos line, the Tacurong-Gen. Santos line will not be able to accommodate the load of Gen. Santos Substation starting 2015.

Table 6.4.3.3Matanao-Gen. Santos 138 kV T/L

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Matanao-Gen. Santos	138 kV ST- SC, 1-795 MCM, 70 km
Substation	
Gen. Santos (Expansion)	2-138 kV PCB + Accessories
Matanao (Expansion)	2-138 kV PCB + Accessories

6.4.3.4 Mindanao Substation Reliability I

The project involves the installation of six (6) transformers with a total 325 MVA substation capacity to provide N-1 capability to various substations in Mindanao. The two units of these transformers (for Sultan Kudarat and Nabunturan substations) are proposed as replacements to the Mobile Transformer Project which has been approved by the ERC during the Second Regulatory Period. Other substations that are included in the project are Jasaan, Bunawan, Aurora and Lugait.

Table 6.4.3.4 Mindanao Substation Reliability I

SUBSTATION	PROPOSED ADDITIONAL TRANSFORMER
Sultan Kudarat	1-75 MVA 138/69-13.8 kV /1
Nabunturan	1-100 MVA 138/69-13.8 kV /1
Jasaan	1-100 MVA 138/69-13.8 kV
Bunawan	1-50 MVA 138/69-13.8 kV
Aurora	1-100 MVA 138/69-13.8 kV
Lugait	1-75 MVA 138/69-13.8 kV

/1 Replacement for Mindanao Mobile Transformer

6.4.3.5 Tacurong-Sultan Kudarat 138 kV Transmission Line (Sultan Kudarat Capacitor Project)

The proposed 138 kV single circuit steel tower Tacurong-Sultan Kudarat transmission line project is intended to complete the looping within South Western Mindanao Area (SWMA), i.e. General Santos-Tacurong-Sultan Kudarat-Kibawe link, thus providing a strong transmission backbone that will ensure reliable power delivery. However, due to security concerns on the areas traversed by the proposed line, the project could not be implemented.

As a remedial solution to improve the low voltage that will occur in the area during outage of the Kibawe-Sultan Kudarat 138 kV line, 2 x 7.5 MVAR, 69 kV capacitor banks will be installed at the Sultan Kudarat Substation. The implementation of the 138 kV transmission line project as originally proposed, or other option, will be further studied. Maguindanao Electric Cooperative and Cotabato Light and Power Company Inc., with peak demand of about 19 MW and 23 MW, respectively will benefit from this project.

CHAPTER 07. PROJECTS BEYOND 2015 (INDICATIVE PROJECTS)

7.1 Generation-Association Projects

PROJECT NAME	PURPOSE
Tayabas Substation Expansion II	To accommodate the expansion of QPPL and Pagbilao coal plant
Hermosa-Mexico 230 kV Line Upgrading	To maintain the N-1 provision for the line during maximum dispatch of Mariveles Coal, Limay and RP Energy Coal plants
Santiago-Bayombong-Ambuklao Line	To allow unconstrained dispatch to the generation capacity expansion of Magat HEP (additional 180 MW) and other incoming plants in the area
Calaca-Dasmariñas Transmission Line	To cater the expansion of Calaca Plant (additional 600 MW) and the entry of Puting Bato Greenfield (135 MW) Coal Plant
Northern Luzon 230 kV Transmission Loop	To accommodate the entry of incoming wind farms in Northern Luzon

7.2 Load Growth-Driven Projects

PROJECT NAME	PURPOSE
Cut-in to Fort Bonifacio Substation	To accommodate the anticipated new delivery point of Meralco inside Fort Bonifacio
Luzon Substation Expansion I (Biñan Substation)	To provide additional transformer capacity to meet load growth
Luzon Substation Expansion III (Las Piñas Substation)	To provide additional transformer capacity to meet load growth
Luzon Substation Expansion V	To meet the increasing demand at Batangas and Antipolo substations
New Antipolo 500 kV Substation	To increase the supply capability of the 500 kV backbone and to improve the reliability of supply to the load center
New Balara 230 kV Substation	To provide a new drawdown substation to meet the load growth in Metro Manila and address the overloading of Quezon
New CBP 230 kV Substation and Associated Transmission	To relieve the loading of Las Piñas substation to continuously provide reliable supply to the growing demand of Metro Manila
New Rosario 115kV Substation	To serve the growing load of the customers in the area which include the Cavite Ecozone.
Davao-MAA 138 kV Transmission Line	To meet the increasing demand at Davao substation
Mindanao Subsation Expansion II (Tagoloan Substation)	To provide additional transformer capacity to meet load growth

7.3 Reliability and Power Quality Projects

PROJECT NAME	PURPOSE
LUZON	
La Trinidad-Calot Line Upgrading	To provide N-1 contingency for the connected loads and the hydroelectric plants in the area
Luzon Substation Reliability III	To maintain the provision for N-1 at various substations
Luzon Voltage Improvement III	To maintain the voltage profile at various substations within the prescribed limits
Luzon Voltage Improvement IV	To keep the voltage profile within the prescribed limits both during normal and N-1 conditions
Luzon Voltage Improvement V	To keep the voltage profile within the prescribed limits both during normal and N-1 conditions
San Jose 500 kV Reconfiguration	To ensure the reliability of the substation and to increase the substation capacity
San Manuel Substation Expansion	To provide N-1 and maintain the power quality in the area during contingency
Tuguegarao-Magapit 230 kV Line Extension (Northeastern Transmission Development)	To improve the power quality and reliability of supply to the growing load in the area which include the Cagayan Ecozone
VISAYAS	
Amlan-Mabinay Transmission Line	To provide N-1 provision to the Negros transmission backbone during low generation at Panay island
Mabinay-Kabankalan-Bacolod Transmission Line	To provide N-1 provision to the Negros transmission backbone during low generation at Panay island
Visayas Substation Reliability III	To address overloading of various substations during N-1
Visayas Substation Reliability IV	To address overloading of various substations during N-1
Visayas Voltage Improvement I	To maintain the voltage level at various substations within the Grid Code prescribed limits by installing capacitors
MINDANAO	
Agus 6- Aurora 138 kV Transmission Line	To maintain the voltage level at North Western Mindanao during outage of the existing corridor
Mindanao Substation Reliability II	To provide N-1 transformers at various substations
Mindanao Substation Reliability III	To provide N-1 transformers at various substations
Nasipit Substation Bus-in	To improve the power quality and reliability to the growing load in Northeastern Mindanao
Tacurong-Sultan Kudarat 138 kV Line	To provide N-1 and maintain power quality in the area of Maguindanao

7.4 Island Interconnection Projects

7.4.1 Visayas

In the Visayas, the increase in the demand in each of the island grid must be met, as much as possible, with corresponding additional generation capacity within the island, otherwise the additional or uprating of submarine cable may be considered an option. NGCP is anticipating the uprating of existing Negros-Panay, Leyte-Bohol and Leyte-Cebu interconnections in the Fourth Regulatory Period (2016-2020). These upratings are necessary to meet load growth and accommodate increased power transfer between the islands.

7.4.2 Luzon-Mindoro

The proposed Luzon-Mindoro Interconnection Project was approved by the ERC during the Second Regulatory Period. However, the approved capex disbursement for the Second Regulatory Period was about P 2-Million only. Being a "small-capex" project, the said amount was for the pre-construction activities only while the bulk amount for the project will have to be filed for ERC approval for implementation in the Third Regulatory Period.

As a result of NGCP's project prioritization and to balance capex spending with its impact on transmission tariff, the project was not among the projects filed by NGCP with the ERC for the Third Regulatory Period (2011-2015). Based on the latest estimates, the total project cost of the interconnection is roughly P 5-Billion. In the absence of generation projects in Mindoro and due to the limited demand of the island, the project has been deferred.

The project will connect the Mindoro Island to mainland Luzon through the installation of 25-kilometer submarine cable and 51 kilometers of overhead lines, along with the associated cable terminal stations, voltage conditioning devices and additional switching facilities. The interconnection will give Mindoro Island access to a more stable and reliable source of electricity from the main grid. This, in turn, would result in better economic growth in the island and even make the location of generating plant in the island viable. Due to small demand in Mindoro, the excess generating capacity can be exported to Luzon once the interconnection is in place.

7.4.3 Leyte-Mindanao

The interconnection of Leyte and Mindanao was first conceptualized in the early 1980s through the study conducted by JICA. The government of the Philippines asked the government of Japan to carry out the feasibility study of the Luzon-Leyte Power Transmission Project for the DC transmission line. Between 1984 and 1997, a number of studies were commissioned, from conceptualization to the assessment of technical and economic feasibility of the interconnection.

NPC implemented a project in 1997, the Leyte-Mindanao Interconnection Engineering Project, which prepared the plan and the design of the interconnection. Thus, among the studies and relevant activities commissioned with regard to the interconnection, this NPC project financed by the Asian Development Bank (ADB) is the most comprehensive and serious effort to implement the interconnection. Based on this study, the project involves 500 MW submarine cable at ±250 kV HVDC Bipolar configuration, with a total of 544 kilometers transmission line, 23 kilometers of which is for submarine cable.

The economic, financial feasibility and pre-engineering studies for the interconnection will involve substantial budget to complete. No relevant capex was allotted for this project in the Third Regulatory Period but NGCP may initiate regulatory filing. In the conduct of the feasibility study, it has to be established that the interconnection is technically feasible and that its economic and financial benefits are high. The National Government plays a crucial role in the implementation of the interconnection. If the project is feasible, the Government participation is to ensure that its policy and regulations shall allow this economically beneficial capital investment to proceed. Effective regulation will be necessary to ensure that NGCP has financial incentives to proceed with the project.

CHAPTER 08. RESIDUAL SUB-TRANSMISSION ASSETS

ERC Resolution No. 18 Series of 2009 provides that residual sub-transmission assets (RSTA) which have not been sold or disposed by 31 December 2010 shall remain as NGCP's assets. RSTA refers to sub-transmission assets shared by two or more customers. The divestment of connection assets (CA), or those that are used by only one customer, shall continue to be pursued by TRANSCO. Table 8.1 shows the details of these assets.

Table 8.1 Route Length of CA and RSTA

	Route Length of CA[1/] in ckt-km	Route Length of RSTA[2/] in ckt-km		Total Route Length in ckt-km
		To be Reverted to the RAB[3/]	To Remain as RSTA[4/]	
North Luzon	716	529	779	2,023
South Luzon	563	126	484	1,173
Visayas	683	627	771	2,081
Mindanao	948	396	798	2,142
Total	2,909	1,677	2,833	7,419

Notes: 1/ Sub-Transmission Assets with only one (1) connected customer (small number will be reclassified as transmission on January 1, 2011 following the ERC decisions.)
2/ Sub-Transmission Assets with two or more connected customers
3/ (a) RSTAs with two or more connected DISTRIBUTION UTILITIES and are *not* pending sale;
(b) RSTAs with connected generator;
(c) CAs which are reclassified as transmission assets per ERC decisions;
(d) Transferred assets from NCP in 2009 and 2010.
4/ RSTAs with: (a) one DU and Directly-connected Customers; (b) Directly-connected customers; and (c) two or more connected DUs which are pending sale to qualified consortium.

It should be noted that in the Second Regulatory Period, the ERC did not expect the financing anymore of sub-transmission projects in 3 to 4 years time. The ERC further opined that the investments needed to maintain, upgrade and expand these sub-transmission assets shall be solely borne by connected customers, who shall eventually acquire the said assets. ERC expected that projects associated with sub-transmission facilities shall already be undertaken by the concerned customers requiring such installations and upgrading.

As a result, without any approved capex allocated for sub-transmission facilities, new investments on rehabilitation and upgrading activities depended on commercial arrangement with the customers.

Across the different grids, there are defective sub-transmission facilities that are undergoing rehabilitation. These are mostly old structures – rotten poles and cross-arms and corroded insulators – that need to be replaced. Low sag must also be corrected through installation of higher poles.

Additional expenditures will be lined up by NGCP to ensure the reliable operation of RSTA being maintained by its Operation and Maintenance (O&M) Group. The detailed programs and maintenance activities, which are outlined in TDP Volume II, include the rehabilitation, reinforcement and replacement of sub-transmission line structures and hardware and even the provision of spares for use in case of emergency.

As of 31 October 2010, 3,569.89 ckt-km of RTSA remain with NGCP. This represents about 48% of the total 7,419 ckt-km to be divested. The figures of divested assets for each grid indicated in the following sections refer to sub-transmission lines only and are based on the 31 October 2010 report of TRANSCO.

8.1 Luzon

In Luzon, most of the 69 kV sub-transmission lines are radial, i.e., they emanate from 230 kV substations to serve load substations of electric cooperative and direct connect customers without forming any loop. Some of these long 69 kV lines serve remote coastal and isolated mountainous areas, particularly in the eastern side of Luzon. In the northeast, the single circuit feeder originating from the northernmost 230 kV substation (Tuguegarao) extends up to Sta. Ana (122 km) and Abuyong. The coastal town of Ilagan, Isabela is being served by a 73 km line from Santiago Substation. The line serving the Mountain Province is a long 93 km line from the 230 kV La Trinidad Substation to a load-end substation in Bontoc. In the central plain, a 69 kV line from Cabanatuan Substation stretches up 80 km northeast to serve a load-end substation in San Luis, Aurora.

For Luzon, a total of 1,055 ckt-km out of 3,196 ckt-km or 33% have been divested. The biggest NGCP customer MERALCO has acquired 140.52 ckt-km of sub-transmission assets. In Central Luzon, a total of 233.38 ckt-km have been acquired already by various distribution utilities and electric cooperatives such as AEC, CELCOR, PENELCO, SFELAPCO, Subic EnerZone, TARELCO II and TEI. Dagupan Electric (DECORP) in Pangasinan has acquired 45.65 ckt-km lines. In northern Luzon, a total of 365.55 ckt-km have been acquired by INEC, LUELCO, LUECO, ABRECO, ISECO and CAGELCO I and II. In south Luzon, about 270 ckt-km have been divested to CASURECO II, MERALCO, Lima Utilities, BATELEC I, BATELEC II, CANORECO and SORECO I.

8.2 Visayas

Unlike in Luzon where the 69 kV facilities are generally classified as sub-transmission assets, 69 kV lines in the Visayas remain a significant part of the transmission network. In fact, two (2) 69 kV projects have been approved by ERC during the Second Regulatory Period: the Culasi-Sibalom (Panay) and Sta. Rita-Quinapundan (Samar) 69 kV line projects. As these projects will loop the existing 69 kV network, the ERC, in approving the said projects, further reclassified to transmission a number of sub-transmission assets affected by the looping.

In the Visayas, about 30%, or 615.50 ckt-km out of 2,081 ckt-km of sub-transmission lines have been divested.

In Panay, the assets that have been reclassified to transmission are Panitan-Nabas-Culasi and Sta. Barbara-Sibalom corridors. AKELCO and CAPELCO have acquired a total of about 50 ckt-km sub-transmission assets.

In October 2009, the ERC through its order under Case No. 2008-088 MC further reclassified the following 69 kV lines in Samar as transmission assets: Paranas (Wright)-SAMELCO II, SAMELCO II-Catbalogan, Catbalogan-Gadgaran, Gadgaran-Palanas Cara, Palanas Cara-Catarman, Catarman-Catubig and Catarman-Allen.

In Leyte, the 69 kV network forming a big loop is not operated as such. There are portions that are split by disconnection switches so that the 69 kV lines are radially connected to the 138 kV substations. Due to the resulting configuration with the approval of the Sta. Rita-Quinapundan 69 kV line project, the Paranas-Taft-Borongan-Buenavista loop has been classified as transmission asset. To date, a total of 118.24 ckt-km have been acquired by LEYECO II, LEYECO IV, LEYECO V and DORELCO.

In Negros, the eastern side of the grid is being served by 69 kV lines. Once the Negros V Transmission Line Project which will connect San Carlos to Guihulngan is completed, it will form a 69 kV backbone from Cadiz (south) to Amlan (north). About 210 ckt-km of 69 kV lines have been acquired already by NOCECO, CENECO and VRESCO.

In Cebu, VECO and MECO sub-transmission facilities serve much of the load located in the business districts of Cebu, Mandaue and Mactan. MECO and VECO have also acquired a number of 69 kV facilities. To date, VECO has acquired 24.56 ckt-km excluding those assets it jointly acquired with CEBECO I. The 69 kV lines that stretch to north (up to Medellin) and south (Alcoy and Dumanjug) serve CEBECO II and CEBECO I, respectively.

In Bohol, pending the completion of the Bohol Backbone 138 kV Transmission Backbone, the island relies on 69 kV woodpole backbone. Given the transmission functions of these lines, they are not to be divested. The assets being divested are the 13.8 kV lines, about 16 ckt-km of which have been acquired by BOHECO I, BOHECO II and BLCI.

8.3 Mindanao

Similar to Luzon, the 69 kV lines in Mindanao are radial in nature. Among the long radial lines are the 83 km from Placer 138 kV Substation to Madrid Load-end Substation, Bislig-Cateel-Baganga (86 km), Gen. Santos-Maasim-Kiamba (95 km), Balo-i-Malabang (61 km), Matanao-Malita (70 km) and the 69 kV lines from Naga and Aurora 138 kV substations.

A total of about 1,191.4 ckt-km of sub-transmission lines (about 56%) have been divested. Among those that have acquired the assets are SOCOTECO II (215.18 ckt-km), DANECO (193.28 ckt-km), COTELCO (81.44 ckt-km), MORESCO I (62.82 ckt-km) and ANECO (62.62 ckt-km). COTELCO acquired long lines such as Tacurong-Kidapawan 69 kV (43.55 ckt-km) and Kidapawan-Mt Apo (23.69 ckt-km). Other electric cooperatives that have acquired long 69 kV lines are MORELCO II (Nasipit-Gingoog, 41.04 ckt-km) and SOCOTECO I (Tacurong-Koronadal, 28.63 ckt-km).

Chapter 09. Appendices

Appendix 1 - List of Official Site Names of Substations based on the Standard System of Site & Equipment Identification and Labeling (SEIL) - Rev. 2

A1.1 Luzon

NEW NAME	OLD NAME	TYPE
Bay	New Makban	230 kV Substation
Bolo	Kadampat EHV	500 kV Substation
Cawag	Hanjin	230 kV Substation
Doña Imelda	Araneta	230 kV Substation
Las Piñas	Zapote	230 kV Substation
Lumban	Kalayaan EHV	500 kV Substation
Malamig	Sta. Rosa	230 kV Substation
Marilao	Duhat	230 kV Substation
Muntinlupa	Sucat SS (Old/New)	230 kV Substation
Naga CS	HVDC	350 kV Converter Station
Nagsaag	San Manuel EHV	500 kV Substation
Quezon	Balintawak	230 kV Substation
San Rafael	Cruz Na Daan	230 kV Substation
Taytay	Dolores	230 kV Substation

A1.2 Visayas

NEW NAME	OLD NAME	
Allen	Cabacungan	350 kV Cable Terminal Station
Barotac Viejo	San Juan	138 kV Substation/ CTS
Borongan	Cabong	69 kV Switching Station
C.P. Garcia	Tugas	138 kV Substation
Calung-calung	Talavera	138 kV Substation
Cebu	Banilad (VECO)	138 kV Substation
Colon	New Naga	138 kV Substation
Daan-Bantayan	Talisay Visayas	230 kV Substation
E.B. Magalona	Tomonton CTS/Sarabia CTS	138 kV Substation
Lapu-lapu	Mactan GIS	138 kV Substation
Naga	Old Naga	138 kV Substation
Ormoc Converter Station	HVDC-OCS	350 kV Converter Station
Paranas	Wright	138 kV Substation
Samboan	Suba CTS	138 kV Substation
San Fernando	Taiheiyo	69 kV Substation
Sipalay	Maricalum	69 kV Substation
Sta. Rita	Bagolibas	138 kV Substation
Tagbilaran	Dampas	69 kV Substation
Toledo	Sigpit	138 kV Substation

A1.3 Mindanao

NEW NAME	OLD NAME	TYPE
Balo-i	Abaga	138 kV Substation
Cagayan de Oro	Carmen Mindanao	69 kV Substation
Gen. Santos	Klinan	138 kV Substation
Iligan	Overton	69 kV Substation
Ipil	Pangi	69 kV Line Breaker
Jasaan	Aplaya	138 kV Substation
Malaybalay	Aglayan	69 kV Capacitor Bank Station
Nabunturan	Tindalo	138 kV Substation
Naga	Sta. Clara	138 kV Substation
Oroquieta	Villaflor	69 kV Capacitor Bank Station
Placer	Anislagan	138 kV Substation
Sultan Kudarat	Nuling	138 kV Substation
Tumaga	Lunzuran	69 kV Capacitor Bank Station
Villanueva	Kirahon	138 kV Substation
Zamboanga	Sangali	138 kV Substation

Appendix 2 – Grid Code Performance Standard

Majority of the projects in the TDP are intended to meet load growth and accommodate generation capacity addition. Assumptions are simplified on the type of loads due to uncertainty of the nature of loads that will be connected in the future. For this reason, all performance standard requirements could not all be addressed by the projects in the TDP but are hopefully addressed in the Grid Impact Study (while the customer is applying for a connection), by the System Operator (in real-time), or by the local operation and maintenance personnel. If no project is proposed for the improvement of some of the performance standards, it is not due to oversight, but more on the relevance of a project in the majority of the situations. Table A2 summarizes the Grid Code requirements on power quality and how NGCP intends to satisfy them.

Table A2 Grid Code PQ Standards and the TDP

GRID CODE SECTION	REQUIREMENTS ADDRESSED BY TDP?	REMARKS
3.2.2 Frequency Variations	Partly	The ability of the TDP to address the constraints provides the adequate corridor for spinning reserves to be made available where it is needed, resulting in the balance of generation and load. This is also addressed in real-time by the System Operator by securing sufficient load following, frequency regulation and spinning reserves.
3.2.3 Voltage Variations	Yes	Please refer to Section A1.1 Voltage Variation
3.2.4 Harmonics	No	The compensation requirements for loads that generate harmonics are determined in the Grid Impact Study that is conducted during the application of the customer for a connection. The provision for the compensators then becomes a pre-requisite for allowing the connection.
3.2.5 Voltage Unbalance	No	For planning purposes, all loads and transmission lines are assumed to be balanced. Voltage unbalance will be dealt in real-time.
3.2.6 Voltage Fluctuation and Flicker Severity	No	The compensation requirements for loads that cause voltage fluctuation and flicker are determined in the Grid Impact Study that is conducted during the application of the customer for a connection. The provision for the compensators then becomes a pre-requisite for allowing the connection.
3.2.7 Transient Voltage Variations	No	Problems related to transient voltage variations are addressed in the design stage (for expansion projects).
3.3 Reliability Standards	Partly (projects for N-1 provision)	Reliability Standards, as described in the Grid Code, are based on the total number and duration of sustained power interruption. Improvements in this aspect may be achieved not only through infrastructure projects but by some other means such as proper vegetation management, more systematic and coordinated line restoration and strategic partnership with local citizenry in the maintenance and monitoring of the lines. All of these approaches have been tried to a certain degree on various areas with promising success.
3.4 System Loss Standards	Partly	This is partly addressed through voltage improvement projects. When economically viable, higher transmission voltage is used to transfer bulk power from generators to loads.
3.5 Safety Standards	No	Safety standards requirements are factored-in in the design of the equipment/structure that eventually become part of the specification for the respective projects.

A2.1 Voltage Variation

The Grid Code requires that the long duration voltage variations be greater than 95 percent but less than 105 percent of the nominal voltage at any connection point during normal conditions (Section 3.2.3.4). The approach used to satisfy this requirement is to improve the voltage at the substations using capacitors and reactors (for inclusion in the TDP) so that it falls within this range, after the transformer taps have been adjusted and reached its limit. Generator terminal voltages are set at 1 per unit (p.u.) and MVAR output is allowed to vary according to the requirements of the Grid Code.

A2.2 System Loss Standard

The system loss of the transmission system is highly dependent on the generation dispatch. If generating plants output farthest from the load centers are maximized, higher system loss is expected. Without any transmission constraints, the dispatch pattern is not within NGCP's control but is dictated by the transactions between the generators and the load customers. It follows, therefore, that system loss is not within NGCP's full control.

The following are the possible solutions to reduce system loss and some issues in implementing them:

- Uprating of the existing transmission line. This can be done through the use of conductors with larger diameter (and therefore higher capacity) or similar weight conductors but with higher capacity (such as TACSR). Larger but more expensive conductors translate to smaller resistance. Larger diameter conductors, although have larger capacity, would require stronger and hence, more expensive towers. The more expensive Thermal ACSR, on the other hand, are similar in weight but with higher capacity. However, the higher capacity runs the risk of being optimized down in accordance with ERC's TWRG resulting in under-recovery of investment.
- Use of higher voltages in power transmission. This is an expensive solution, and would take much time to implement. NGCP may implement this strategy whenever the entry of very large generators makes it feasible.
- Improvement of voltage profile. There are projects lined-up to improve the voltages at various substations through installation of capacitor banks. The intention for these projects is not so much to reduce the system loss but to bring the bus voltages to acceptable level. To some extent, this would also result to reduction in system loss.

For benchmarking purposes, system loss cannot be compared to that from other countries because the dispatch pattern, system configuration, generation and load locations and voltage transmission levels are not the same.

A2.3 Performance Indices

There are currently five (5) performance indices under the Performance Incentive Scheme (PIS), one of the main features in the Performance-Based Ratemaking (PBR).

(a) System Interruption Severity Index (SISI);
(b) Frequency Limit Compliance (FLC);
(c) Voltage Limit Compliance (VLC);
(d) Frequency of Trippings per 100 ckt-km (FOT/100 ckt-km); and
(e) System Availability (SA).

Generally, two different approaches are being used for improved performance. The first approach is through infrastructure additions to attain adequacy and ideally, N-1 security. The second approach would be through improved maintenance strategy and quick restoration during failures.

At the transmission level, there are still locations with no provision for N-1 (i.e., there is only a single line supplying the area). There are projects in the TDP which will specifically address this problem.

In the Final Determination for Third Regulatory Period, ERC has proposed three (3) additional PIS metrics to enhance the Systems Interruption Reporting (SIR) arrangements.

(a) System Planned Outage (SPO);
(b) Pre-Arranged Outages (PAO); and
(c) Unplanned Supply Interruption (USI) and/or Forced Outage (FO).

In addition, ERC proposed a more direct measure relating to general customer satisfaction issues through a publication of an annual NGCP Customer Survey Report (CSR) performance. Also, ERC has explored approaches to an initial PIS metrics relating to ancillary services implementation performance by the SO of NGCP under the Ancillary Services Procurement Plan (ASPP).

Appendix 3–ERC Final Determination on NGCP's Reset Application for the Third Regulatory Period

Under Section 7.1.11 of the Rules for Setting Transmission Wheeling Rates for 2003 to around 2027 (RTWR), ERC published the Final Determination (FD) on November 22, 2010. The FD contains, among others, the primary outcomes of the analysis undertaken by the ERC after consideration of the information provided by NGCP for its proposed capital expenditures.

A3.1 Final Determination on the 2010 TDP Projects

Table A3.1 shows the summary of the decision of ERC on capital expenditure projects filed by NGCP for the Third Regulatory Period as listed in the Final Determination.

Table A3.1 2010 TDP Projects in the Final Determination

PROJECT NAME	DECISION	Section in the TDP
LUZON		
Ambuklao-Binga 230 kV T/L Upgrading	Approved	6.3.1
Binga-San Manuel 230 kV T/L	Approved	5.5.1.1
Dasmariñas EHV Substation Expansion	Approved	5.3.1.1
*Dasmarinas-Rosario 115 kV T/L	New Rosario Substation not recommended to proceed with construction. Proposed line classified as sub-transmission asset.	5.3.1.2
Hermosa-Mexico 230 kV Line Upgrading	Deferred to 4th Regulatory Period.	
Lumban EHV-Bay 230 kV Line Upgrading	Approved	6.1.1
Luzon PCB Replacement	Approved. Optimized down	5.5.1.2
*Luzon Substation Expansion I	Transformer for Biñan deferred to next regulatory period	5.3.1.3
Luzon Substation Expansion II	Approved	6.2.1.1
*Luzon Substation Expansion III	Transformer for Las Pinas (Zapote) deferred to next regulatory period	6.2.1.2
Luzon Substation Expansion IV	Approved	6.2.1.3
Luzon Substation Reliability I	Approved	6.4.1.3
Luzon Voltage Improvement I	Approved	6.4.1.4
Luzon Voltage Improvement II	Approved	6.4.1.5
Magapit Capacitor	Approved	6.4.1.6
Mariveles Coal Transmission Reinforcement	Approved	5.2.1
New Antipolo 230 kV Substation	2-300 MVA transformers and the 115 kV switchyard classified as sub-transmsission assets	6.2.1.4
New Rosario Substation	Disapproved	
RP Energy Coal Plant-Associated Project	Approved	6.1.2
San Esteban-Laoag 230 kV T/L	Approved	6.4.1.7

PROJECT NAME	DECISION	Section in the TDP
San Jose-Angat 115 kV Line Upgrading	Approved	6.4.1.8
San Jose-Quezon Line 3	Approved	6.3.2
Santiago-Tuguegarao 230 kV Line 2	Approved	6.4.1.9
Tayabas S/S Expansion I	Approved	6.1.3
Tayabas S/S Expansion II	Deferred to next regulatory period	
VISAYAS		
Bohol Backbone Transmission	Approved	5.3.2.1
Calung-calung-Toledo-Colon T/L	Approved	6.1.4
Cebu-Mandaue-Lapu-lapu T/L	Approved	6.4.2.1
Culasi-Sibalom 69 kV Transmission Line	Approved	6.4.2.2
Negros V Transmission Line	Approved	5.3.2.2
Negros-Panay Interconnection (Phase I)	Approved	5.3.2.3
Colon Substation	Approved	5.2.1
Colon-Cebu Transmission Line	Approved	6.2.2.1
Ormoc-Babatngon Transmission Line	Approved	6.4.2.3
Ormoc-Maasin Transmission Line	Approved	6.4.2.4
Southern Panay Interconnection	Approved	5.3.2.6
Sta. Rita-Quinapundan 69 kV T/L	Approved	6.4.2.5
Visayas PCB Replacement	Approved	5.5.2.1
Visayas Substation Expansion I	Approved	6.2.2.2
Visayas Substation Reliability I (Stage 1)	Approved	6.4.2.6
Visayas Substation Reliability II (Stage 1)	Approved	6.4.2.7
MINDANAO		
Balo-i-Villanueva 230 kV Transmission Line	Approved	5.3.3.2
*Agus 6-Aurora 138 kV Transmission Line	Deferred to next regulatory period	6.4.3.1
Aurora-Polanco 138 kV Transmission Line	Approved	5.3.3.1
Butuan-Placer 138 kV Transmission Project	Approved	6.4.3.2
Gen. Santos-Tacurong 138 kV T/L	Approved	5.5.3.1
Maramag-Kibawe 138 kV T/L (Line 3)	Approved	6.4.3.2
Matanao-Gen. Santos 138 kV T/L	Approved	6.4.3.3
Mindanao PCB Replacement	Approved	5.5.3.2
Mindanao Shunt Reactors and Capacitors	Approved	5.5.3.3
Mindanao Substation Expansion II	Transformer for Tagoloan deferred to next regulatory period	6.2.3.1
Mindanao Substation Reliability I	Approved. Only the 50 MVA for Bunawan disapproved.	6.4.3.4
Sultan Kudarat and Nabunturan S/S Exp.	Approved	5.5.3.4
Tacurong-Sultan Kudarat 138 kV T/L (Sultan Kudarat Capacitor Project)	Approved	6.4.3.5
Villanueva-Maramag 230 kV T/L	Approved	5.5.3.5

*subject of Motion for Clarification/Reconsideration filed with the ERC

Appendix 4 - Other Projects

The projects listed in Table A4 are requested by some sectors with the hope that they would be classified and approved by the ERC as Transmission Assets. NGCP will seek ERC's approval of the projects prior to its actual implementation. It should be noted that NGCP will decide on whether to pursue the project or not depending on regulatory approval.

Table A4 New Projects for ERC Approval

PROJECT NAME	PURPOSE
Aglipay-Casiguran 69 kV Line	To provide more reliable power delivery system and meet the projected load growth of Aurora province through NGCP's Santiago Substation
Tacurong-Kalamansig 69 kV Line	To provide a more reliable power delivery service to the far-flung areas in the province of Sultan Kudarat

A4.1 Aglipay-Casiguran 69 kV Line

In support of the government's thrust to develop the Aurora Province, NGCP is planning to implement a sturdier and more reliable power delivery system which will enable Aurora to source its power from NGCP's Santiago Substation. The existing Santiago– Aglipay 69 kV line needs to be extended by about 115 km up to Casiguran, Aurora. With the recent infrastructure developments in the province of Aurora including the new roads, NGCP is also evaluating other option for the route to be considered for the new transmission line.

Table A4.1 Aglipay-Casiguran 69 kV Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Tap Aglipay - Casiguran	69 kV, ST-SC, 1-336.4 MCM ACSR, 115 km
Tap Dinadiawan - Baler	69 kV, ST-SC, 1-336.4 MCM ACSR, 45 km
Substation	
Aglipay LE S/S (Expansion)	1-69 kV Air Break Switch
Dinadiawan Tapping Pt.	3-69 kV Air Break Switch
San Luis LE S/S (Expansion)	1-69 kV PCB + Accessories 2-69 kV Air Break Switch 1 X 5 MVAR, 69 kV Capacitor Bank*
Casiguran LE S/S (New)	2-69 kV PCB + Accessories 1 X 10 MVA, 69/13.8 kV Power Transformer 1 X 5 MVAR, 69 kV Capacitor Bank*

A4.2 Tacurong-Kalamansig 69 kV Line

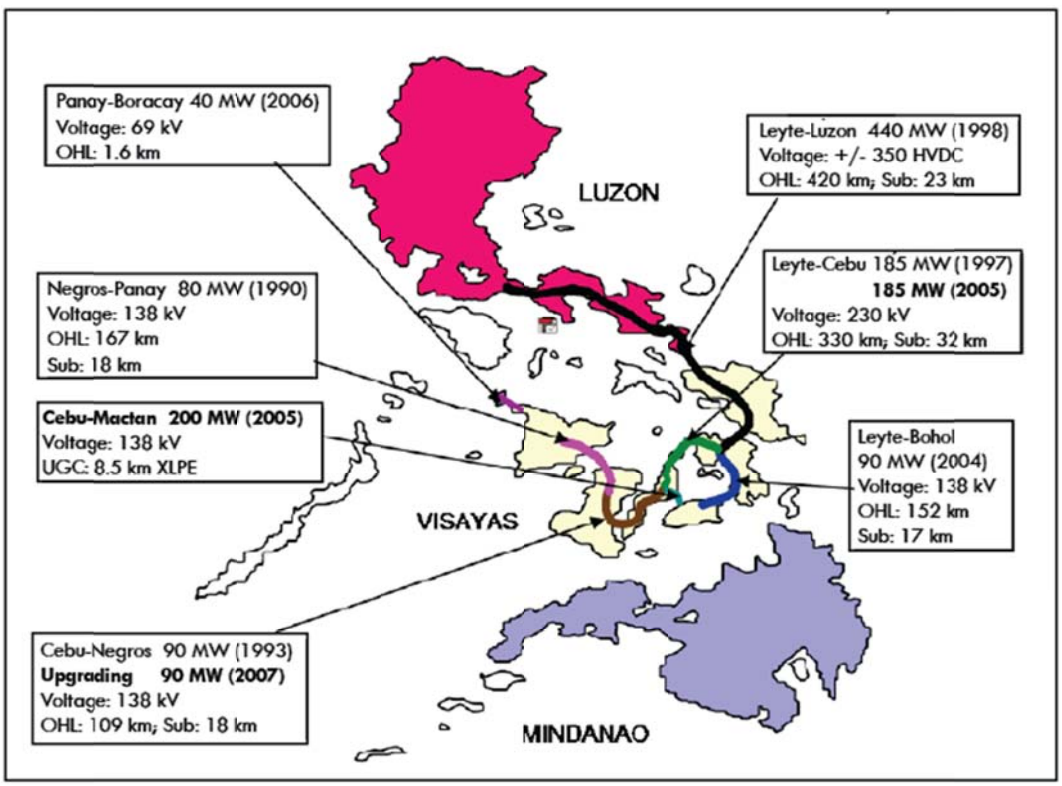
The project is envisioned to provide a more reliable power delivery service to the far-flung areas in the province of Sultan Kudarat. Four municipalities, namely Bagumbayan, Ninoy Aquino, Kalamansig and Lebak will benefit from the project since the power supply to these municipalities are presently being provided by small land based and barge mounted power generating sets of the National Power Corporations's Small Power Utilities Group (NPC-SPUG). To be considered as part of the grid expansion that intends to increase NGCP's service area coverage, the project would result to the removal of government subsidy to the present power rate as an off-grid area under NPC-SPUG.

Table A4.2 Tacurong-Kalamansing 69 kV Line

PROJECT COMPONENT	DESCRIPTION
Transmission Line	
Tacurong–Kalamansig	69 kV, ST-SC, 1-336.4 MCM ACSR, 85 km
Substation	
Tacurong S/S (Expansion)	1 x 69 kV PCB + Accessories

Appendix 5 - Existing Island Interconnections

In 2005, two (2) major interconnection projects were completed: the Leyte-Cebu Upgrading (additional 185 MW) and the Cebu-Mactan Interconnection (200 MW). In February 2007, the Cebu-Negros Interconnection Uprating was completed, providing an additional 180 MW capacity between the island.



Appendix 6 - Contact Details

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2010 Transmission Development Plan

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