Final Report

Transmission Development Plan 2014-2015

Volume I

MAJOR NETWORK DEVELOPMENT

DECEMBER 2016

NGCP

TRANSMISSION DEVELOPMENT PLAN

2014-2015

Final Report

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FOREWORD

The National Grid Corporation of the Philippines (NGCP) is pleased to present its 2014-2015 Transmission Development Plan (TDP) which strategically lays out, over a 10-year period, the expansion of the Philippine power grid. This is part of its continuous efforts to provide reliable, adequate, secure, and stable power transmission to its customers and stakeholders.

Other than the status of the approved projects for the 3rd Regulatory Period, the 2014-2015 TDP contains the list of proposed transmission projects for the next ten years. The list includes the crucial projects scheduled for implementation in the 4th Regulatory Period.

In Luzon, the additional major projects already approved by the ERC, with ongoing implementation already, include the new Calaca-Dasmariñas Transmission Line Project which aims to accommodate the generation capacity additions in Batangas; the Las Piñas Substation Expansion Project which involves the installation of an additional transformer to support load growth in Metro Manila; and the Tuguegarao-Lal-lo 230 kV Transmission Line Project which will extend the 230 kV transmission backbone to the north-eastern part of Luzon. Positively, the San Esteban-Laoag 230 kV T/L project was already energized which allows full dispatch of the wind farms in northernmost part of Luzon.

NGCP is also giving special attention to increase the capacity and improve system reliability of the transmission facilities in the country's load center in Metro Manila. New substations in Navotas/Manila, Pasay, and Taguig and associated transmission lines have been proposed to support the load growth and to strengthen the Metro Manila grid by forming loop configurations.

In the Visayas, where the Cebu-Negros-Panay 230 kV Backbone Project is already being implemented, more projects that will support the entry of generators are also in the pipeline. These projects will ensure the long-term security of power transmission in the Visayas and strengthen NGCP's transmission facilities to accommodate incoming generating plants that will cater to the region's growing power demand.

In Mindanao, NGCP focuses on generation entry-driven transmission projects in consideration of the region's power situation. These projects will ensure that Mindanao's transmission system is stable, efficient and reliable to support new generation facilities that will augment Mindanao's power supply.

Major projects include the Malita-Matanao 230 kV Transmission Line Project and the Balo-i–Kauswagan 230 kV Transmission Line Project which will support the entry of the new coal-fired power plants in Mindanao. Another noteworthy undertaking is the Mindanao 230 kV Transmission Backbone Project which will enable higher transfer capability of the existing transmission lines and support the impending entry of huge capacity power plants. More importantly, this project is expected to play a vital role in the exchange of power between Visayas and Mindanao in consideration of the proposed Visayas-Mindanao Interconnection Project.

The TDP also includes the transmission planning approach for renewable energy (RE) particularly, wind and solar. The challenges for integration are discussed in this TDP as well as corresponding action plan of NGCP to fully support the development of RE.

The TDP is a valuable document for industry stakeholders. As the country's sole power grid operator and transmission service provider, it continues to improve the quality of its transmission planning process through constant collaboration with the Department of Energy, generation facilities, power customers, distribution utilities, local government units, and the general public. Their inputs are carefully considered in each year's comprehensive and responsive TDP update.

The long-term projects contained in the TDP are expected to improve NGCP's transmission services. With the support and engagement of stakeholders in the development of this document, NGCP is ensured of the smooth implementation of its plan towards a "Stronger Transmission for a Stronger Nation."

HENRY T. SY, JR.
President & CEO

Table of Contents

1.1 Introduction

NGCP's transmission system network consists of 500 kV, 350 kV HVDC, 230 kV, 138 kV, 115 kV and 69 kV high voltage lines and cables. As the sole transmission service provider, NGCP plays a vital role in the safe and reliable transmission of electricity in response to system requirements and market demands. It continues to improve the reliability, adequacy, security and stability of the grid in the three major regions of the Philippines, namely: Luzon, the Visayas and Mindanao.

As the System Operator of the Philippine power grid, NGCP balances the supply and demand of electricity to efficiently serve all of its customers – power generators, private distribution utilities, electric cooperatives, government-owned utilities, eco-zones, industries, as well as directly-connected customers. It is responsible in dispatching the power plants and transmitting the generated power to the various distribution utilities which, in turn, deliver the electricity at a lower voltage to households and other end-users. NGCP also operates and maintains metering facilities and provides technical services, particularly system studies, and operation and maintenance of customer facilities.

This Transmission Development Plan (TDP) outlines the planned projects which are required to address the system needs for the period 2016 to 2025.

1.2 NGCP as a Regulated Entity

With the enactment of the EPIRA into a law in June 2001, the Philippine Electricity Industry was subdivided into four sectors: generation, transmission, distribution and supply. Each sector is distinguished as different business activity. The transmission and distribution sectors exhibit natural monopoly characteristic; hence these are regulated. Generation and supply or the aggregators for the sale of electricity, on the other hand, operate under a competitive environment.

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

In its continuing effort to provide quality and efficient service, NGCP received its Integrated Management System (IMS) recertification on May 11, 2015 from TUV Rheinland Philippines, a third-party auditing firm specializing in international standards accreditation. The country's sole transmission service provider and power System Operator was certified in three management systems: Quality Management System – ISO 9001:2008, Occupational Health and Safety Management System – OHSAS 18001:2007 and Environmental Management System – ISO 14001:2004 + Cor.1:2009.

The 2014-2015 TDP consists of three volumes. Volume I contains the proposed grid expansion and upgrades, which generally, are based on the results of system studies. The other volumes outline the capital expenditure programs of Operations and Maintenance (Volume II–Part 1) and System Operations (Volume III). Those for metering services have been integrated into Volume II but in a separate report (Volume II-Part 2). Volume I consists of twelve chapters.

Chapter 1 provides an overview of NGCP organization and operation as transmission service provider and a regulated entity;

Chapter 2 discusses the steps in the TDP Volume 1 Preparation Process;

Chapter 3 discusses the profile of each grid and the features of the existing transmission facilities;

Chapter 4 presents the latest demand projection as inputs to the simulation studies to identify future transmission constraints and transmission expansions in each grid;

Chapter 5 presents the latest generation capacity addition including Renewable Energy (RE), potential resource areas and ideal locations of power plants as inputs to the simulation studies to determine the future transmission reinforcements/expansions in each grid;

Chapter 6 presents the power system reliability/security measures through climate change adaptation for transmission facilities, including discussion on strategies to meet the challenges on right-of-way (ROW) acquisition;

Chapter 7 enumerates the ERC-approved projects in Luzon, the Visayas and Mindanao Grids that are in various stages of implementation;

Chapter 8-10 discusses transmission outlook for 2016-2025 including discussion on project components and drivers for the proposed transmission projects for Luzon, the Visayas and Mindanao Grids; including Major Island/Grid Interconnection projects;

Chapter 11 presents the major island interconnections, such as the Visayas-Mindanao Interconnection Project and transmission backbone projects for the period 2016-2025. Also includes information on small islands for potential interconnections to the main grids; and

Chapter 12 contains different appendices that include discussions on relevant topics such as the Prospective Plants, ASEAN Power Grid (APG), other RE potential, and comparison of transmission projects, i.e., 2013 TDP vs. 2014-2015 TDP.

2.1 TDP Process Flowchart

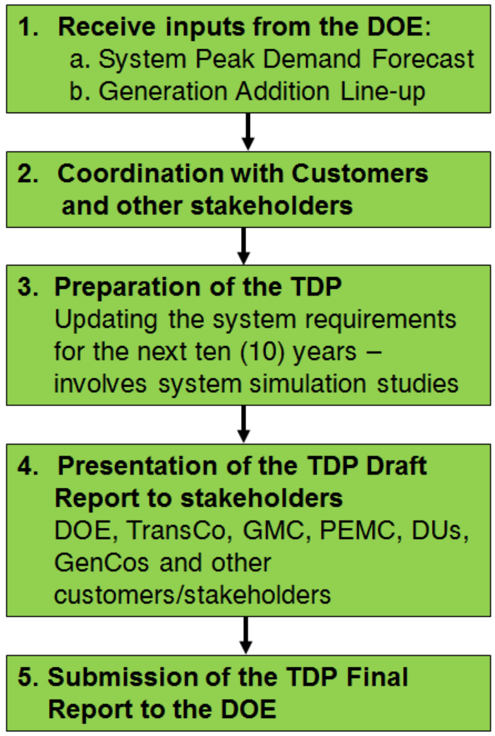


Figure 2.1 - TDP Preparation Process

2.2 Description of Each Steps

Step 1: Receive inputs from the DOE

The System Peak Demand Forecast and the Generation Capacity Addition Line-up are the two major inputs in the TDP which come from the DOE. These inputs are being updated annually by the DOE. For use in the transmission network analysis, the system peak demand forecast shall be broken down and forecasted into individual transformer loads. For determination of load-end substation expansion requirements, on the other hand, NGCP's own non-coincident substation peak loading forecast is being used.

Step 2: Coordination with Customers and other Stakeholders

One of the requirements of EPIRA as regards the preparation of the TDP is the conduct of consultation with the electric power industry participants. NGCP regularly conducts Customers Interface Meetings to gather inputs from the Distribution Development Plans of Distribution Utilities, expansion programs of Generator Companies and other directly connected customers. In addition, coordination meetings with other stakeholders are also being conducted.

Step 3: Preparation of the draft TDP

The identification of system requirements for the next ten years involves the conduct of load flow, short-circuit, and transient stability studies using special software in power system simulation. These assessments are made in reference to the planning criteria and limits prescribed in the Philippine Grid Code (PGC).

The system assessment takes off from the model of the existing transmission network. Then using the updated system peak load forecast, which is disaggregated into per substation transformer level and the recent list of generation capacity additions, the network model for the next ten-year period as covered by the TDP will be developed.

In conducting the simulation studies, different dispatch scenarios are considered. For Luzon Grid, the bulk generations are located in the northern and southern part of the island. Thus, the Maximum North, Maximum South, Typical Generation and Other Generation scenarios are considered. Maximum Leyte and Maximum Panay scenarios for the Visayas, and Maximum North and Dry Season scenarios for Mindanao.

Table 2.1 – Dispatch Scenarios for each Grid

LUZON DISPATCH SCENARIOS	
Maximum North Wet Season	All generation facility outputs in the northern part of the grid are set to their maximum capacities
Maximum South Dry Season	All generation facility outputs in the southern part of the grid are set to their maximum capacities;
Typical Generation Scenario	Power generation are based on the typical output levels of power plants during system peak load;
Other Generation Scenario	Particular study areas, e.g., Bataan, Batangas, etc. where varying dispatch of concentrated power generation could result in additional transmission constraints.
VISAYAS DISPATCH SCENARIOS	
Maximum Leyte Scenario	The geothermal generation facilities in Leyte are maximized, while the generation facilities in Panay serve as regulating plants and the power plants in Cebu, Negros and Bohol are also maximized
Maximum Panay Scenario	The generation facilities in Panay are maximized, while the geothermal generation facilities in Leyte serve as regulating reserve; the generation facilities in Cebu, Negros and Bohol are also maximized.
MINDANAO DISPATCH SCENARIOS	
Maximum North Dispatch Scenario:	Generation from the north, especially those coming from hydro plants are maximized thereby causing the highest load to the transmission lines, which transmit power to the load centers in the south, e.g., Davao and Gen. Santos areas
Dry Season Dispatch Scenario	The significant decrease in power generation from hydro plants from the north is considered, thus all available power plants, particularly peaking

	plants are assumed to be dispatched to augment the power requirement;
Other Future Scenarios	1) Development of thermal generation in Southeastern Mindanao; and 2) Linking of the Visayas and Mindanao Grids, through the implementation of the proposed Visayas-Mindanao Interconnection Project (VMIP).

Resulting transmission line loading, grid transformer loading, fault level at the substations, voltage profile and system response to disturbance can be evaluated. The next step would be the assessment of the various solutions to the identified network problem which may be in the form of a new transmission line, transmission line upgrading, new substation or substation expansion, PCB replacement, installation of reactive power compensation equipment, and/or transmission network reconfiguration project. One important consideration in the identification of projects is the overall long-term transmission backbone development for each grid. Some projects may have to be implemented by stages or may be initially energized at lower voltage level but will remain consistent with the target end-state of the grid. The selected solution from the network analysis will form part of the documentation of the TDP.

In the case of expansion plans for load-end substations, a direct comparison of the existing substation capacity and the load forecast would already result in the determination of capacity addition projects to meet load growth both during normal and single-outage contingency conditions of the transformers. The transformer addition projects, however, would also take into account the sizing and age of the existing units, optimization and the space limitation issues in a substation. Moreover, development of a separate new substation is also an option in lieu of further expanding the transformer capacity at the existing locations. Under this case, system simulation studies will be required to fully assess the need and impact of new substation nodes in the grid.

Step 4: Presentation of the TDP Draft Report to Stakeholders

This step is still part of the consultation process with the stakeholders as required by the EPIRA. Stakeholders are given the opportunity to raise comments and suggestions on the proposed transmission network developments as contained in the TDP.

Step 5: Submission of the TDP Final Report to the DOE

As provided in the EPIRA, the TDP shall be submitted to the DOE for approval and for integration in the Power Development Program (PDP) and the Philippine Energy Plan (PEP).

2.3 Use of the 2014-2015 TDP in the Regulatory Reset Application

The 2014-2015 TDP will serve as the reference plan in the Fourth Regulatory Period (2016-2020) reset application of NGCP. While the TDP already provides the long list of projects needed by the network, project prioritization and project ranking would be another important process and a separate exercise during the capital expenditure (CAPEX) application. This will involve further assessment on the probability of contingency events, assessment of the impact if a project is not implemented yet and economic analyses.

The proposed major transmission projects for the period 2016-2025 under the 2014-2015 TDP Volume 1, with components shown in Chapters 7, 8, 9 and 10, were based on the selected implementation scheme after considering all the technically feasible alternatives. The identification of project components would involve line routes, substation sites evaluation and selection, and other initial field investigations. A least-cost development approach was also applied consistent with various NGCP Planning and Design Standards utilizing the cost estimate database derived from recently completed projects and/or prices of materials and equipment obtained through canvass from suppliers.

Similar to the 2005 and 2009 TDPs which were used as references in the rate applications for 2nd and 3rd Regulatory Periods, respectively, the capital expenditures of NGCP for Major Network Development were included in the documentation of the 2014-2015 TDP Volume 1. However, a more detailed five-year CAPEX Program will be included in the 4th regulatory reset application together with other relevant information necessary for a more extensive review and evaluation by the ERC following the transparency provision for a prudent CAPEX in the RTWR.

Project prioritization is generally based on the ranking of the project drivers as follows:

Load Growth – this pertains to ensuring transmission facility adequacy and given top most priority are projects to address the projected overloading which will occur even during normal condition or no outage condition.

Generation Entry – this pertains to accommodation of new power plant connections to the grid and bulk generation capacity additions would usually drive new transmission backbone development.

Power Quality – this involves the installation of equipment that will aid in operating the grid within the grid code prescribed voltage limit.

System Reliability – this pertains to projects that will provide N-1 contingency and projects that will upgrade aging facilities or replace defective equipment.

Island Interconnection - this refers to new interconnection facilities to link isolated island grid. These are special projects which include the Visayas-Mindanao Interconnection Project and Batangas-Mindoro Interconnection Project.

Project drivers are highly interrelated and that addressing load growth, generation entry and system reliability are same projects that will address system congestions.

2.4 Project Impact to Customers

As the transmission projects are aimed at ensuring the adequacy, reliability and security of the power grid, these will have direct impact to the quality and level of reliability of transmission service to customers. Projects should be able to support load growth and entry of generation capacity additions in the long-term while maintaining the reliability criterion prescribed in the Philippine Grid Code.

The transmission rates increase or decrease is determined by the ERC during the regulatory reset which is based on the building block approach to derive the revenue path of NGCP for the regulatory period. The revenue path to be decided by the ERC may be in the form of increasing or decreasing trend. Thus, the cost of a single transmission project or a group of transmission projects can only provide an indicative rate impact which does not necessarily be the same with that of the ERC regulatory reset determination. NGCP's fourth regulatory period is from 2016 to 2020 and the regulatory reset process to date is yet to be undertaken as of this writing.

3.1 Grid Profile

As of August 2015, a total of 31,038 MVA substation capacities and 20,073 circuit-km are accounted in NGCP's asset. Table 3.1 shows the summary of existing facilities.

Table 3.1: Summary of Existing Facilities

SUBSTATION CAPACITY (IN MVA)					
	2011	**2012**	**2013**	**2014**	**2015**
PHILIPPINES	**26,796**	**27,726**	**27,931**	**30,607**	**31,038**
Luzon	20,589	21,170	21,110	23,395	23,785
Visayas	3,414	3,414	3,504	3,734	3,926
Mindanao	2,793	3,142	3,318	3,478	3,327
TRANSMISSION LINE LENGTH (IN CKT-KM)					
	2011	**2012***	**2013***	**2014***	**2015***
PHILIPPINES	**19,704**	**19,490**	**19,425**	**19,463**	**20,073**
Luzon	9,529	9,374	9,439	9,370	9,428
Visayas	4,918	4,971	4,840	4,821	4,813
Mindanao	5,257	5,145	5,146	5,272	5,832

*There was a decrease in total transmission line length in circuit-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, capacitor banks and shunt reactors have been installed in appropriate locations in different parts of the grid. The summary is shown below:

Table 3.2: Summary of Installed Capacitor Banks and Shunt Reactors

	CAPACITOR BANK (in MVAR)*	SHUNT REACTOR (in MVAR)
PHILIPPINES	**3,324.6**	**1,472.5**
Luzon	2,766	875
Visayas	281.10	575
Mindanao	277.50	22.50

*These exclude the capacitor banks at the Naga and Ormoc Converter Stations

3.2 Dependable Capacity Mix

The dependable capacity indicated in the following sections is based from the DOE List of Existing Plants as of December 30, 2015.

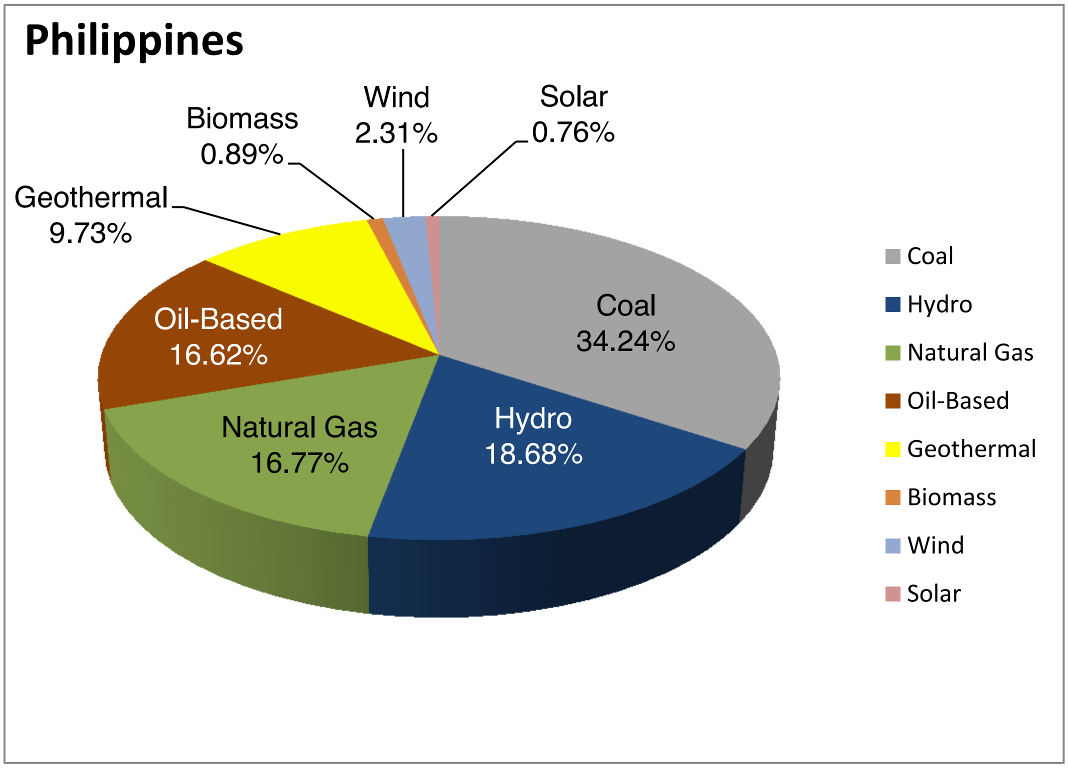


Figure 3.1 – Dependable Capacity Mix

The Philippines has a total dependable capacity of 16,450.5 MW including embedded generation. 5,632 MW of the capacity comes from coal-fired power plants (CFPP) and 3,072.5 MW comes from the hydroelectric power plants (HEPP). Natural gas, oil based and geothermal power plants accounts for 2,759.4 MW, 2,734.2 MW and 1,601.3 MW, respectively. The share from all other RE-based plants, on the other hand, is still relatively small with a total dependable capacity of 651.1 MW only.

Figure 3.2 and Table 3.3 show the distribution of dependable capacity for Luzon, Visayas and Mindanao.

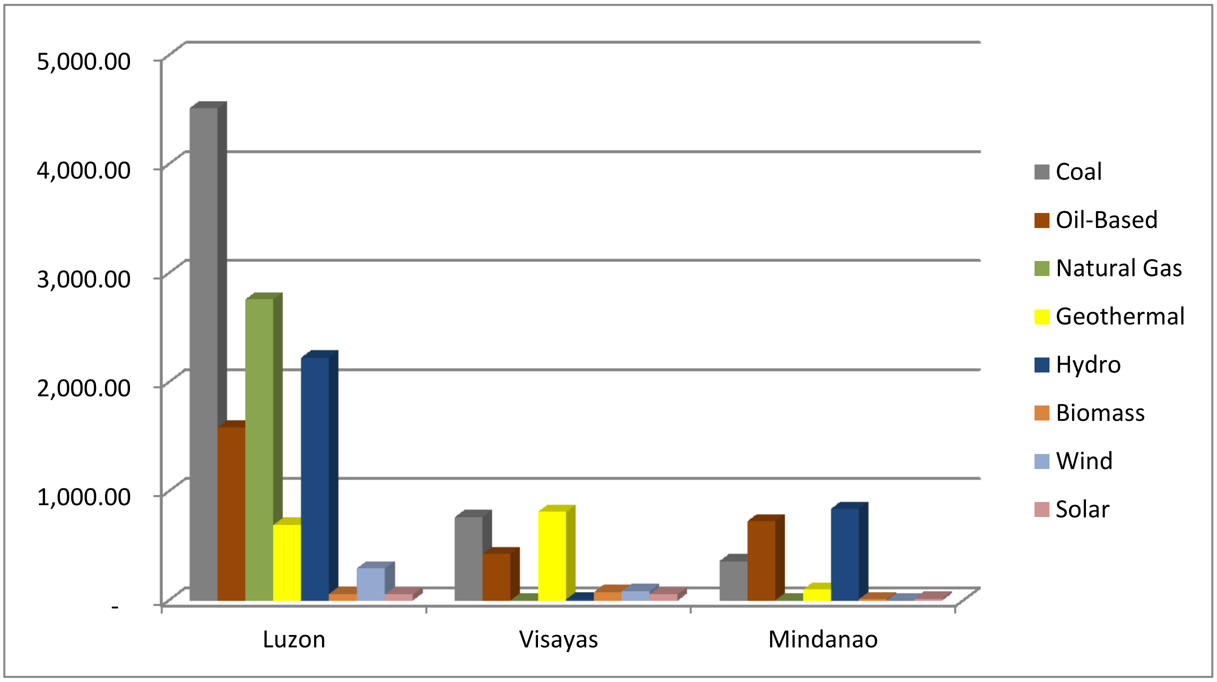


Figure 3.2: Dependable Capacity Mix for Luzon, the Visayas and Mindanao

Table 3.3: Existing Dependable Capacity

Power Plant Type / Fuel Source / RE Source	LUZON		VISAYAS		MINDANAO	
	MW	%	MW	%	MW	%
Conventional Power Plants	**8,856.2**		**1,186.4**		**1,083**	
▪ Coal	4,512	37.05%	761	34.15%	359	17.57%
▪ Oil-based	1,584.8	13.04%	425.4	19.07%	724	35.43%
▪ Natural Gas	2,759.4	22.66%	-	-	-	-
RE-Based Power Plants	**3,322.3**		**1,042**		**960.6**	
▪ Wind	293.3	2.41%	86	3.86%	-	-
▪ Solar PV	54	0.44%	56	2.51%	15.3	0.75%
▪ Biomass	60	0.49%	76.5	3.43%	10	0.49%
▪ Geothermal	690.8	5.67%	812.5	36.46%	98	4.80%
▪ Hydro	2,224.2	18.26%	11	0.49%	837.3	40.97%
TOTAL	**12,178.5**		**2,228.4**		**2,043.6**	

3.3 Luzon Transmission Network

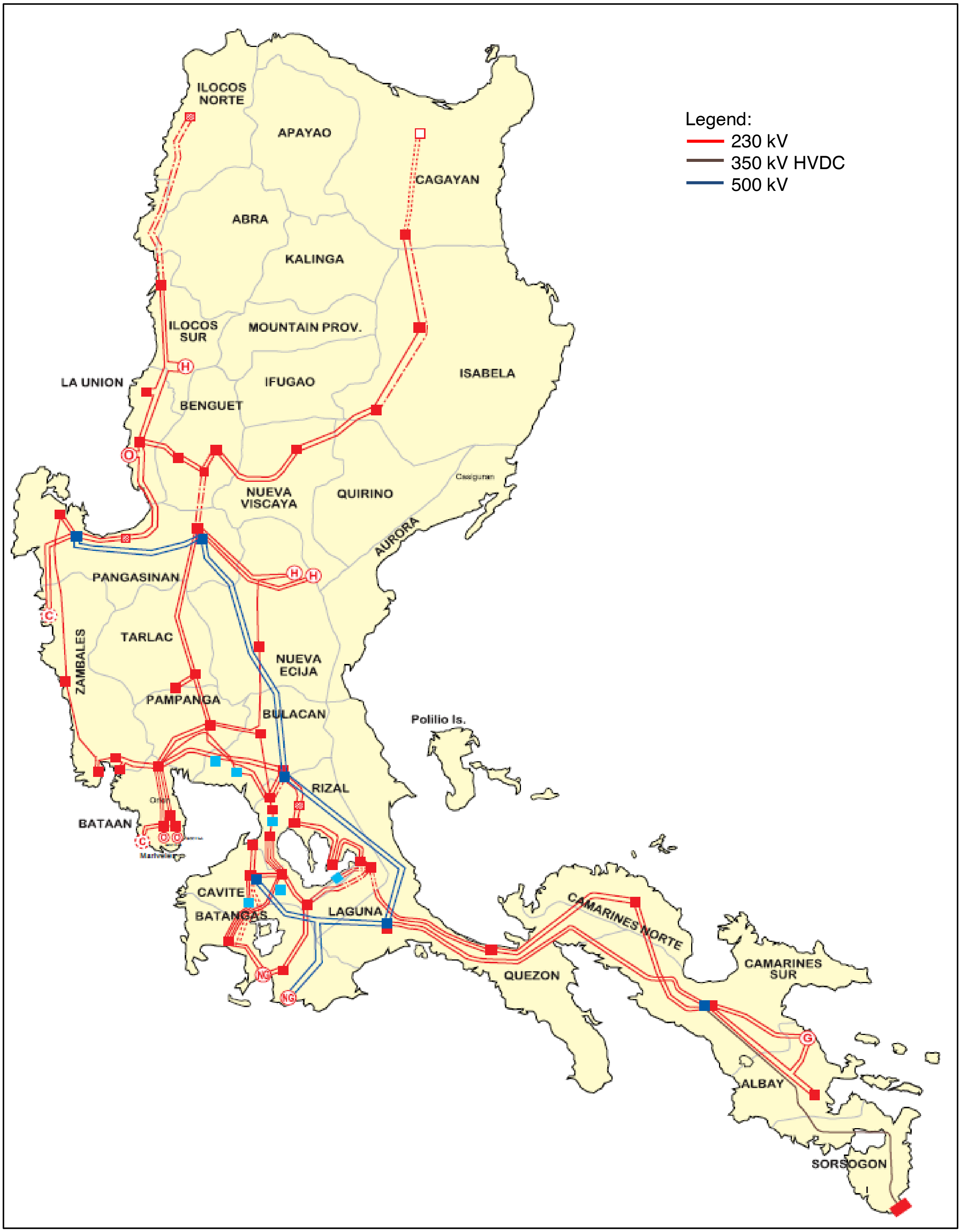


Figure 3.3: Luzon Transmission Network

The bulk generation sources in the Luzon Grid are located in the northern and southern parts of the Luzon Island while the load center is in Metro Manila area. About 53% of the total demand in Luzon is accounted in Metro Manila. Because of this system configuration, NGCP's transmission backbone must have the capability to transfer bulk power from both northern and southern parts of Luzon to the Metro Manila area.

Northern Transmission Corridor

The transmission corridor consists of several flow paths for transferring power from the generation sources located in Northern Luzon to Metro Manila. The 500 kV double-circuit 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 CFPP to Metro Manila. The Bolo and Nagsaag 500 kV Substations are the receiving ends of generation from the north. The power is then delivered to Metro Manila mainly via Mexico and San Jose Substations.

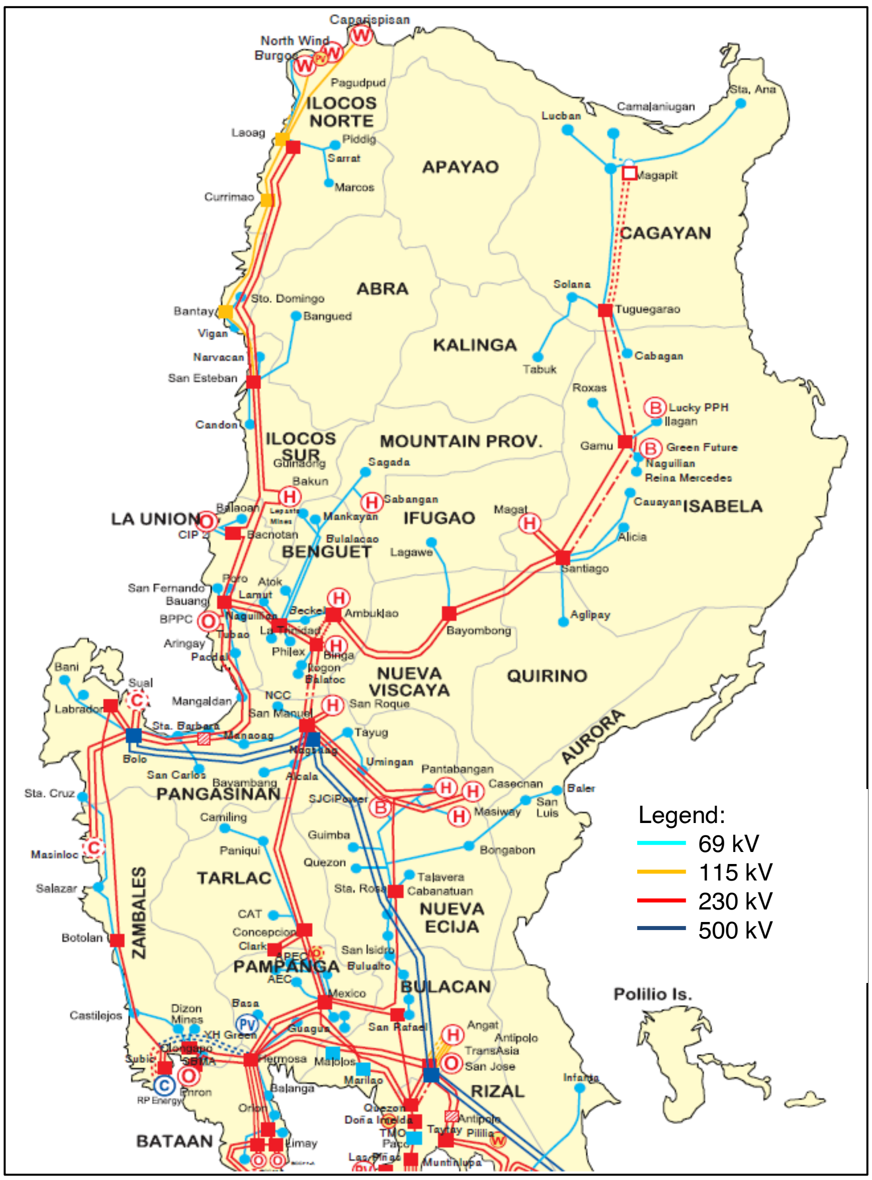


Figure 3.4 – North Luzon Transmission Corridor

Other underlying paths are the 230 kV transmission lines:

a. Labrador to Hermosa single circuit line;
b. San Manuel – Concepcion - Mexico double-circuit line; and
c. San Manuel – Pantabangan – Cabanatuan – Mexico single-circuit line.

The San Manuel-Concepcion-Mexico 230 kV line is an alternate corridor which also caters the generation capacity of the HEPP delivering power to San Manuel 230 kV Substation.

Metro Manila

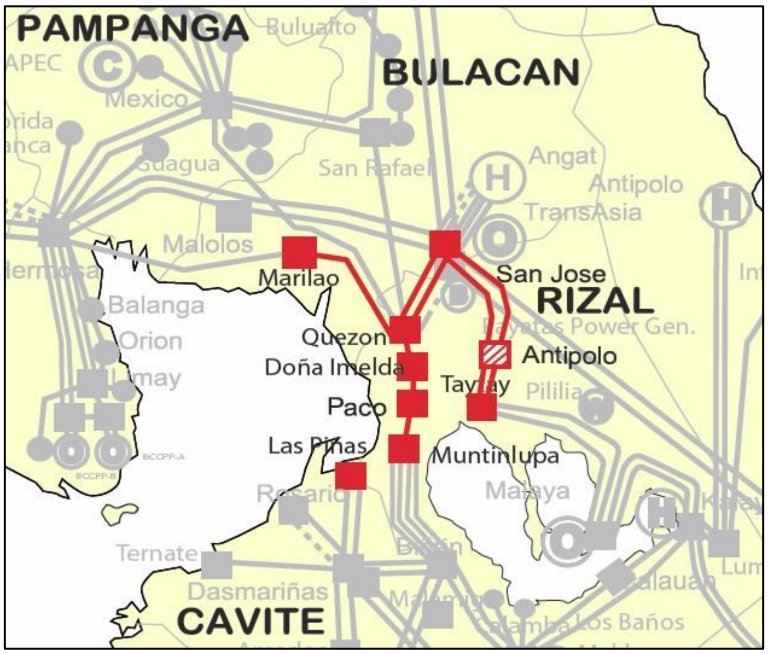


Figure 3.5 – Metro Manila Transmission Network

As the center of commerce and trade, it is inevitable that the demand within Metro Manila will continue to grow, thus requiring the expansion of existing substations and building of new ones. The National Capital Region (NCR) accounts to more than half of the total load in Luzon but only relies on the import of power coming from the north and south Luzon.

One unique geographical feature of Metro Manila is its narrow land area between Manila Bay and Laguna Lake, which is only about 10 km wide.

The New Antipolo 230 kV Substation Project will cater to the demand increase in Metro Manila and reduce the loads at Doña Imelda and Taytay Substations, which have expansion constraints.

Presently, there are three main load sectors within Metro Manila:

a. Sector 1 is served through Quezon, Paco and Marilao (Duhat) Substations. Both Paco and Marilao (Duhat) Substations are MERALCO-owned;
b. Sector 2 is served through Taytay and Doña Imelda 230 kV Substations; and
c. Sector 3 is served through Muntinlupa and Las Piñas 230 kV Substations.

The major supply lines for both Quezon and Taytay are the double-circuit 230 kV line from San Jose as these substations rely heavily on the supply from San Jose 500 kV Substation.

In the south, the power requirements are being drawn from Dasmariñas 500 kV Substation and from power plants directly connected to the 230 kV system. Las Piñas is connected through a double circuit 230 kV radial line from Dasmariñas, while Muntinlupa has four-circuit supply line from Biñan.

Southern Transmission Corridor

The southern portion of the 500 kV transmission backbone stretches from Naga Substation in Bicol Region to Tayabas, Quezon. Tayabas is also connected to San Jose thereby completing the link between the north and south 500 kV transmission corridors.

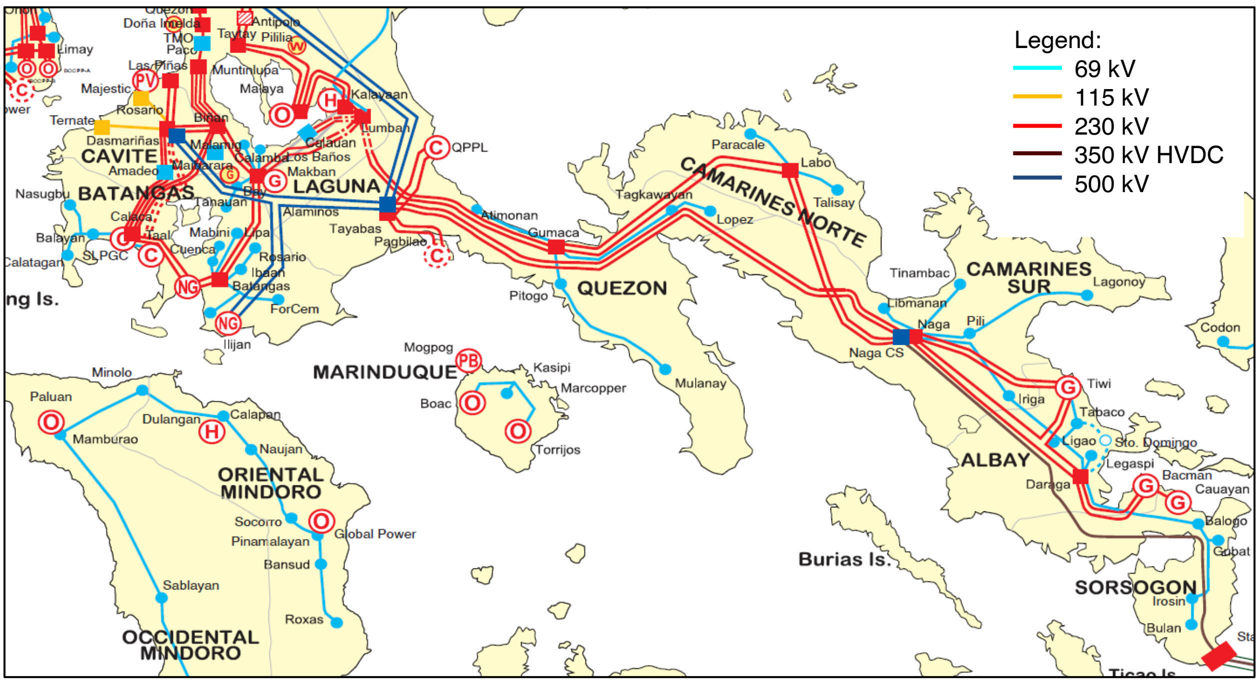


Figure 3.6 – South Luzon Transmission Corridor

The 500 kV backbone segment from Tayabas to Naga Substation is currently energized at 230 kV. The Naga Substation is also the termination point for the HVDC Interconnection System that could allow the exchange of power for up to 440 MW between Luzon and the Visayas Grids.

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

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

3.4 Visayas Transmission Network

The Visayas transmission system is divided into five different sub-system or sub-grids: Panay, Negros, Cebu, Bohol and Leyte-Samar. The sub-grids are interconnected by AC submarine cables as follows with indicated capacity: Leyte-Cebu (2x185 MW), Cebu-Negros (2x90 MW), Negros-Panay (1x85 MW) and Leyte-Bohol (1x90 MW). These submarine cables provide the capability of sharing excess generation between islands to accommodate the Visayas' growing demand.

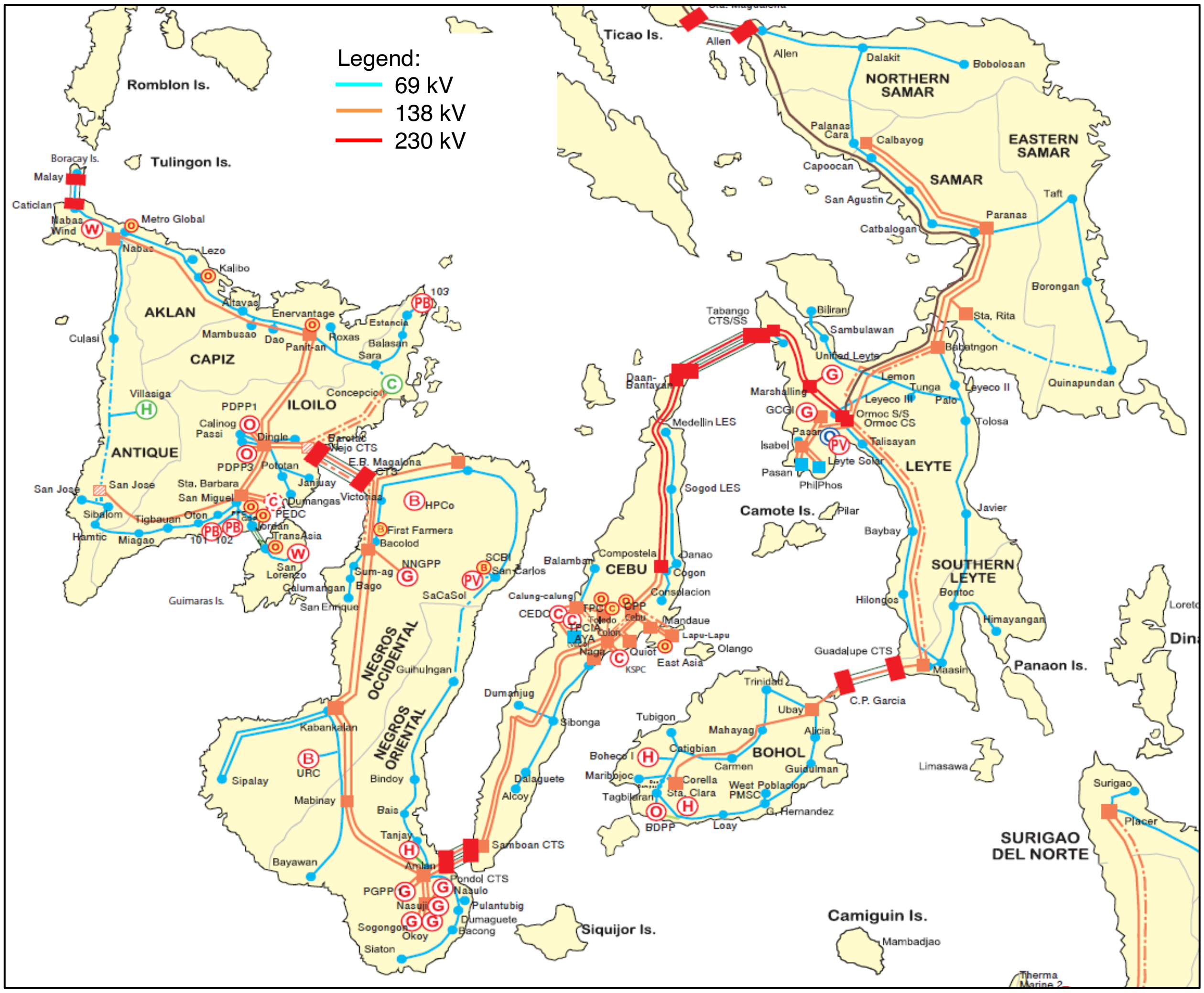


Figure 3.7 – Visayas Transmission Network

The transmission backbone of the Visayas Grid extends from Allen Cable Terminal Station in Samar, all the way to Nabas Substation in Panay. This power delivery system comprises approximately 895 kilometers of transmission lines.

Eastern Visayas (District 1) is composed of Leyte and Samar Islands. Leyte remains the power supplier to Samar and Bohol Islands through the single-circuit Ormoc-Babatngon and Ormoc-Maasin 138 kV lines, respectively. Outage of the said lines will result in power interruption in the affected island. Thus, projects intended to provide single outage contingency or N-1 for the said lines are currently ongoing. Also, it has a 230 kV interconnection to Cebu enabling the other islands to source power from cheaper geothermal resources. Leyte is the site of 547 MW geothermal resources that comprise about 30% of the total dependable capacity in the Visayas.

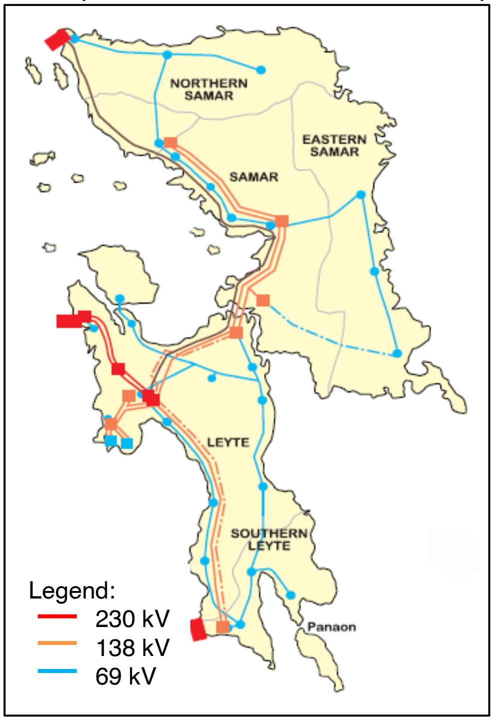


Fig 3.8: Eastern Visayas Transmission Network

Central Visayas (District 2) is composed of Cebu and Bohol. Cebu can be well considered as the major load center of the Visayas Grid. In 2015, it has a coincident peak load of 921 MW which accounted for 52% of the grid's total demand. Bohol has the lowest peak load among sub-grids at 70 MW (3.96%) in 2015.

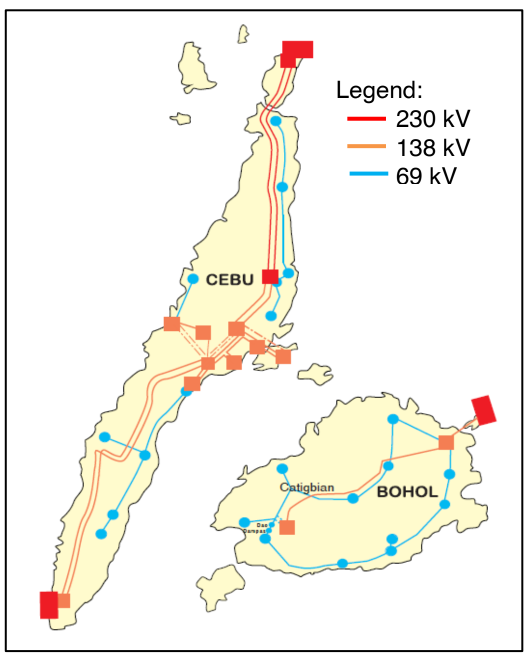


Fig 3.9: Central Visayas Transmission Network

In 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. A total of 95.5 MW, generation capacity was added in the Negros Island with the entry of San Carlos Solar, Nasulo Geothermal, URC Bagasse Cogeneration and HPCo Bagasse Congeneration Plant from January 2014 to August 2015.

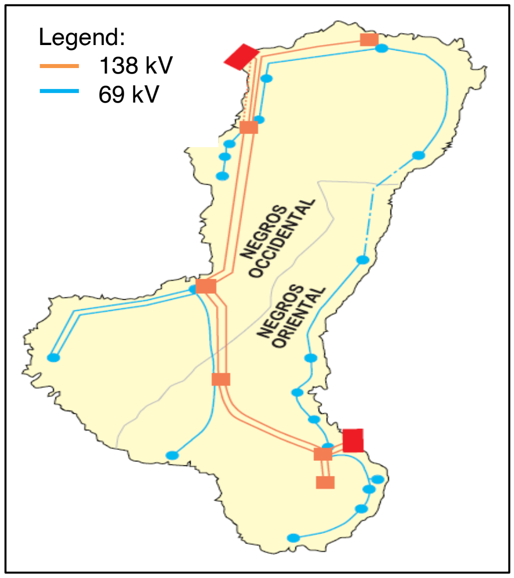


Fig 3.10: Negros Island Transmission Network

Panay Island (District 4) had been reliant to oil-based plants until the entry of Panay Energy Development Corporation (PEDC) 164 MW CFPP. Panay became less reliant on power import from other islands via the 138 kV Negros-Panay Interconnection System and, at certain times, also exports power to Negros. A total of 82.4 MW generation capacity was added in the Panay Island with the entry of San Lorenzo Wind and the PetroWind Nabas last December 2014 and June 2015, respectively.

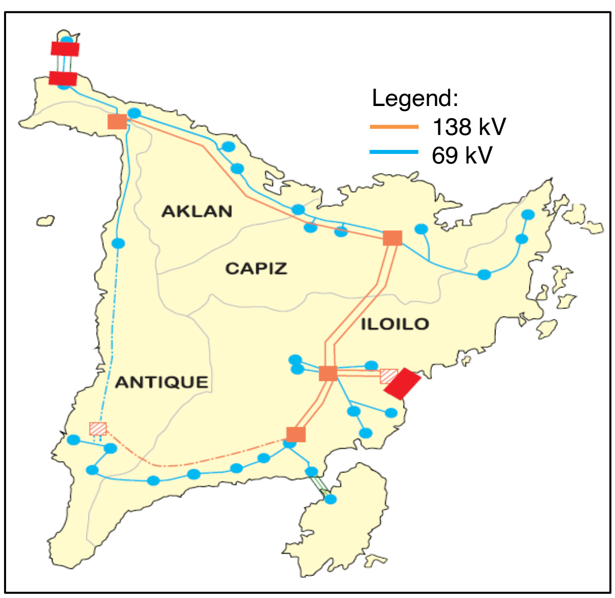


Figure 3.11: Panay Island Transmission Network

3.5 Mindanao Transmission Network

The Mindanao transmission system is composed of six Districts: North Western Mindanao Area (District 1 – NWMA) covers Zamboanga area and Misamis Occidental, Lanao Area (District 2 - LA), North Central Mindanao Area (District 3 - NCMA) includes the provinces of Bukidnon and Misamis Oriental, North Eastern Mindanao Area (District 4 - NEMA) comprised of Agusan and Surigao provinces, South Eastern Mindanao Area (District 5 - SEMA) is the Davao Region, and South Western Mindanao Area (District 6 - SWMA) consists of South Cotabato, Cotabato, Sultan Kudarat, Saranggani and Gen. Santos (SOCCSKSARGEN) and Maguindanao. While the bulk of power generation is situated in the northern part of the island, the load centers are located in southeast (Davao provinces) and southwest (SOCSKSARGEN) regions. Power demand from these areas accounts to approximately half of Mindanao's total demand.

Given this power supply-demand characteristics, much of the power flows from north to south through the Balo-i-Tagoloan-Maramag-Kibawe 138 kV transmission corridor and the Balo-i-Villanueva-Maramag-Bunawan backbone which is designed at 230 kV but initially energized at 138 kV.

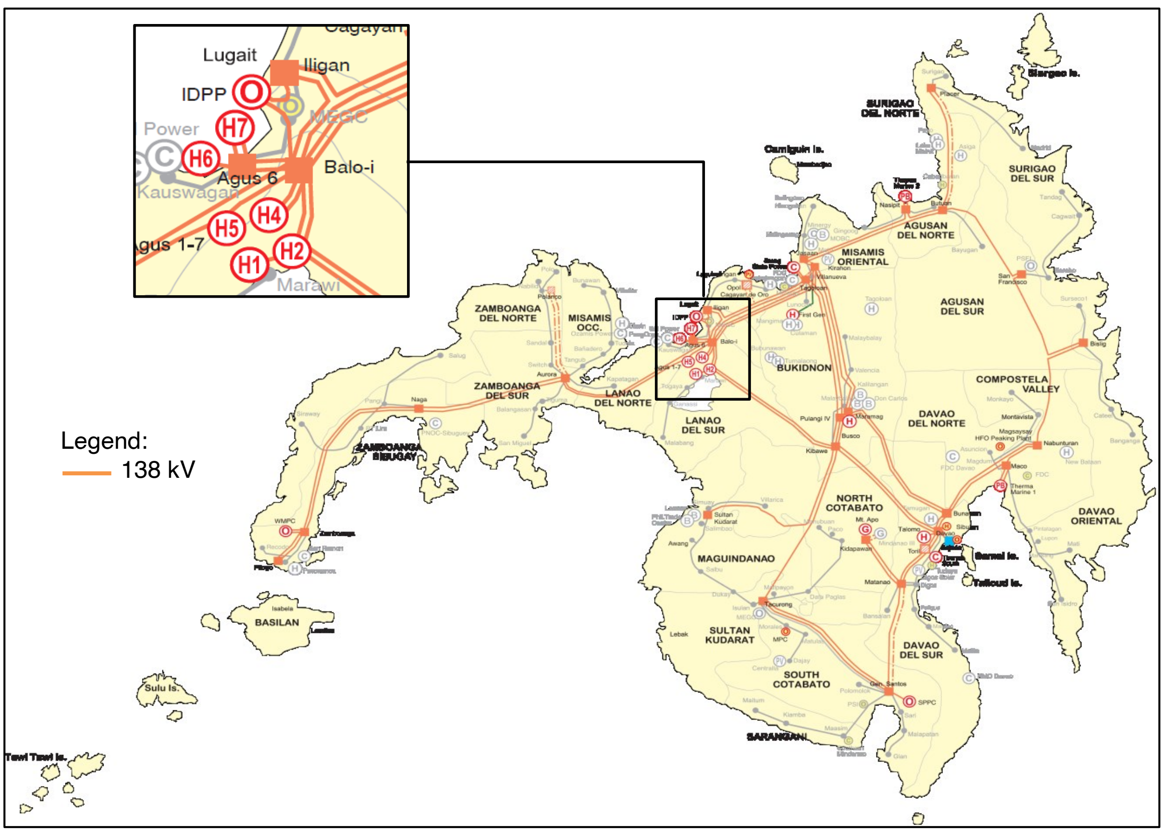


Figure 3.9 – Mindanao Transmission Network

Aside from the new 230 kV-designed transmission backbone, Mindanao Grid comprises mostly of 138 kV transmission corridors, with 69 kV radial lines that traverse from the main substations to load-end substations. Three 138 kV transmission corridors emanate from the Lanao Area, where the biggest chunk of power supply for Mindanao is generated.

The two important input parameters in the preparation of the TDP are the updated annual peak demand forecast and generation capacity addition listed in the DOE List of Private Sector Initiated Power Projects (PSIPP).

4.1 TDP Power Demand Projection

4.1.1 Basis of the Transmission-level Forecast

The demand forecast for the 2014-2015 TDP used the electricity sales and peak demand projections of the Department of Energy (DOE) based on the aggregated forecasts of the Distribution Utilities from the Distribution Development Plans (DDP).

4.1.2 Historical and Projected Demand for Electricity

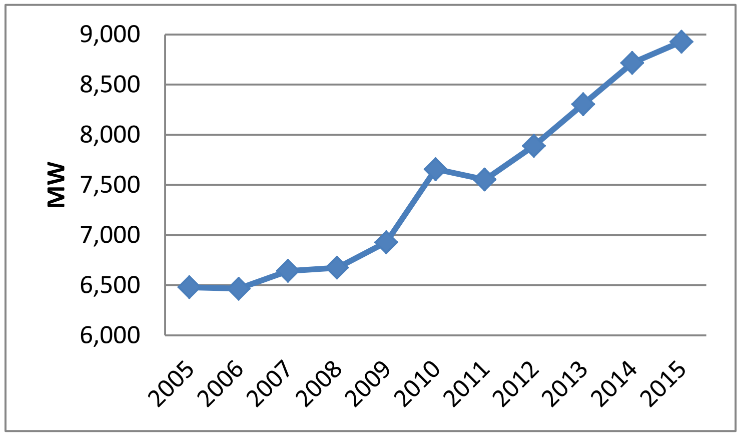
Total peak demand (in MW, non-coincident sum) of the Philippines shows consistent upward trend from 2006 to 2015 with an Average Annual Compounded Growth Rate (AACGR) of 3.58%. Total demand growth was at its highest in 2010 (at 9.53%) while it was at its most sluggish in 2011 (at 0.04%).

Table 4.1: Summary of Historical Demand per Grid (2005-2015), in MW

Actual	Luzon	Visayas	Mindanao	Philippines
2005	6,479	967	1,149	8,595
2006	6,466	997	1,228	8,691
2007	6,643	1,102	1,241	8,987
2008	6,674	1,176	1,204	9,054
2009	6,928	1,241	1,303	9,472
2010	7,656	1,431	1,288	10,375
2011	7,552	1,481	1,346	10,379
2012	7,889	1,551	1,321	10,761
2013	8,305	1,572	1,428	11,305
2014	8,717	1,636	1,469	11,822
2015	8,928	1,768	1,518	12,215
%AACGR (2005-2014)	**3.26%**	**6.22%**	**2.82%**	**3.58%**

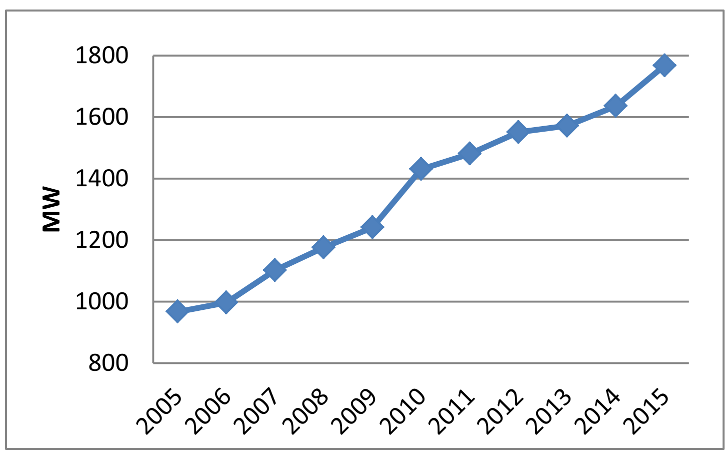
*Includes only the demand monitored by NGCP

4.1.2.1 Luzon



The Luzon Grid has posted an AACGR of 3.26% for the period 2006-2015. Consistent steady growth has been recorded for the Luzon Grid except for the decrease in demand observed in 2006 and 2011. This was due to the reduction in the power consumption of MERALCO for the two periods brought about by the effect of the global financial crisis in 2006 and the effect of La Niña phenomenon experienced in 2011. MERALCO's demand accounts for at least 70% of the total system peak demand (SPD) in Luzon. Further, demand growth in 2010 has been unprecedented (10.51%) – similar double-digit growth was also observed in MERALCO's franchise area. This was attributed to increased economic activity brought about by election spending and the higher-than-average growth in GDP for the year. Also, the prolonged hot temperature experienced during the summer months brought about by El Niño have contributed to the unusual upsurge in the Luzon SPD. Note however that this demand growth has not been sustained in 2011. In fact, SPD has fallen by 1.36%. Demand was quick to recover though, registering a 4.46% growth in 2012, 5.27% in 2013 and 4.96% in 2014.

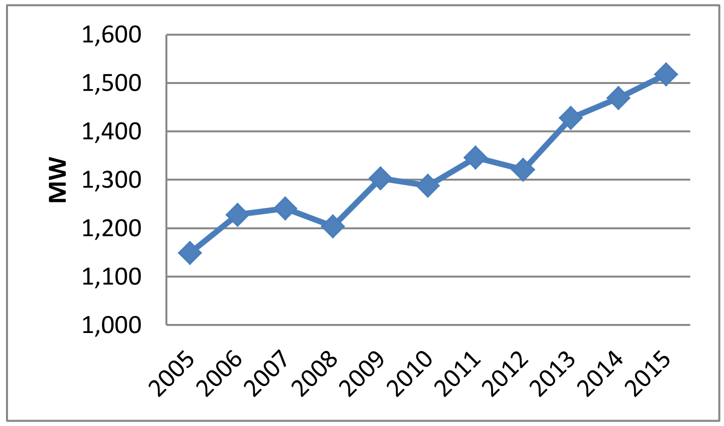
4.1.2.2 Visayas



The Visayas Grid has posted an AACGR of 6.22% for 2006-2015. The year 2010 brought significant increase in the demand for electricity in the Visayas. Compared with the SPD recorded in 2009, Visayas Grid grew by a record high of 15.31%. This was due to the improved economic activities and increased reliance on power supply from the Grid of existing large customers with self-generation. In addition, the realization of 346 MW increase in capacity coming from CEDC, KEPCO and PEDC helped boost the supply-demand situation in 2010. However, this growth was not sustained as the system grew only at an average rate of 4.11% for the next 2 years (2011-2012). In 2013, the total demand in Visayas posted a meager increase of only 1.38%. This is due to the effect of Typhoon Yolanda that hit the region in November and caused significant decrease in power consumption. In 2014, the recorded SPD for Visayas stood at 1,636 MW which occurred in May. This is unusual because the peak demand in Visayas normally occurs during the last quarter of the year specifically between November and December. However, due to the onslaught of typhoons during the second half of the year, majority of the electrical systems was destroyed resulting in reduction in power demand. Typhoons Glenda, Mario, Ruby and Seniang hit Visayas in July, September and December, respectively.

4.1.2.3 Mindanao

The Mindanao Grid has posted an AACGR of 2.82% for the period 2006-2015. After recording high annual growth rates from 2002 to 2004 (an average of 7.36%), demand growth has been sluggish from 2005 to 2010 due to the overall reduced power requirement from large non-utility customers. From 2005 onwards, the historical growth in the Mindanao Grid has been volatile with alternating periods of rise and decline.



Drop in demand occurred in 2005, 2008, 2010 and 2012. 2005 was characterized by reduced demand from distribution utilities while 2008 was characterized by the large decrease in the demand of non-utility customers, possibly a direct effect of the global financial crisis which adversely affected exporting industries. On the other hand, suppressed generation impeded demand growth in 2010 and 2012. This is due to the El Niño phenomenon that hampered hydropower generation, which comprises about half of the Grid's installed capacity. Mindanao power demand recovered in the recent years and grew by 8.1% in 2013 and 2.9% in 2014.

4.2 Forecast for 2014-2015 TDP

Power demand for the country is expected to grow at an AACGR of 4.35% for the period 2016-2020 and 4.05% for 2021-2025. It is projected that Mindanao will have the highest AACGR compared with the other Grids. Mindanao is forecasted to reach an AACGR of 5.9% for 2016-2025 while the Luzon and Visayas Grids at 3.99% and 3.61%, respectively. The peak demand used for Luzon in 2015 is the actual year-to-date peak demand of 8,928 MW which occurred in May. The table below shows the projected demand disaggregated per district based on the transformer peak demand coincident with the System Peak. It was derived from the DOE Forecast as of 11 September 2015 based on the generation level.

Table 4.2: Summary of Projected Demand per District[3] (MW)

District	Area	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Luzon		**9,127**	**9,474**	**9,934**	**10,368**	**10,821**	**11,249**	**11,694**	**12,164**	**12,657**	**13,161**
MERALCO		**6,764**	**7,047**	**7,294**	**7,561**	**7,822**	**8,107**	**8,404**	**8,716**	**9,029**	**9,356**
1	NCR	4,745	4,943	5,117	5,304	5,486	5,686	5,894	6,114	6,333	6,563
2	North	294	307	317	329	340	352	365	378	392	406
3	South	1,725	1,797	1,860	1,928	1,995	2,068	2,144	2,224	2,304	2,387
North Luzon		**1,824**	**1,876**	**2,063**	**2,204**	**2,361**	**2,474**	**2,588**	**2,710**	**2,850**	**2,987**
1	Ilocos	160	162	173	181	191	199	208	217	228	238
2	Mt. Province	151	155	165	172	183	191	200	209	220	231
3	North Central	197	200	237	249	264	276	290	303	319	334
4	Cagayan Valley	206	214	229	240	255	267	281	295	311	327
5	West Central	322	332	359	381	409	431	455	488	524	560
6	South Central	716	739	821	897	971	1,018	1,056	1,094	1,138	1,181
7	North Tagalog	72	74	79	83	88	93	98	103	110	116
South Luzon		**539**	**552**	**577**	**603**	**638**	**667**	**702**	**737**	**778**	**818**
1	Batangas/Cavite	250	254	264	274	288	298	311	325	340	355
2	Laguna /Quezon	86	88	92	96	102	106	112	118	124	131
3	Bicol	204	210	222	234	249	263	279	295	314	332
Visayas		**1,699**	**1,762**	**1,823**	**1,885**	**1,945**	**2,011**	**2,079**	**2,150**	**2,223**	**2,320**
1	Panay	279	290	300	310	320	330	341	353	365	380
2a	Cebu	879	912	943	975	1,006	1,040	1,075	1,112	1,150	1,200
2b	Bohol	68	71	73	76	78	81	83	86	89	93
3	Leyte-Samar	196	203	211	218	225	232	240	249	257	269
4	Negros	276	287	297	307	316	327	338	350	362	378
Mindanao		**1,669**	**1,803**	**1,927**	**2,044**	**2,141**	**2,229**	**2,320**	**2,415**	**2,512**	**2,658**
1	North Western	211	217	235	255	270	282	295	308	324	343
2	Lanao Area	162	176	192	203	212	223	231	239	249	264
3	North Central	278	364	379	394	407	418	430	441	454	473
4	North Eastern	156	161	183	198	209	224	243	262	274	292
5	South Eastern	591	605	643	682	717	744	771	800	833	886
6	South Western	272	278	296	313	326	338	350	363	378	400
Philippines		**12,494**	**13,038**	**13,684**	**14,296**	**14,906**	**15,487**	**16,092**	**16,727**	**17,392**	**18,138**

[3]Based on the transformer peak demand coincident with the System Peak.
Based on NGCP System Peak Forecast as derived from DOE Forecast Levels, excluding applicable losses

4.2.1 Demand Projections for Substation Capacity Addition

The demand projections for substation expansion take off from the per meter forecast undertaken by NGCP. Forecast energy deliveries per metering point are derived from historical trends and/or information as to the potential expansion or contraction of demand of Grid-connected customers. Inputs are sought from customers in this bottom-up process to incorporate their expansion plans.

Projected monthly energy deliveries (in MWh) to metering points connected to a given transformer are then summed up. Accounting adjustments for technical losses and substation use to this sum, the monthly per transformer energy delivery forecast (in MWh) is derived. The forecast transformer peak (in MW) is then calculated by applying the appropriate load factor to these energy delivery projections. This transformer peak becomes the basis for adding transformer capacities at the substations.

4.2.2 Demand Projections for Transmission Expansions

The SPD projections for each Grid are used in determining the necessary transmission expansion projects. However, for these figures to be usable in the power system analysis software, it has to be broken down into individual transformer loads. First, the embedded generation during system peak is subtracted from the SPD to come up with the non-embedded peak. Then the individual transformer maximum demand projections during the month when the system peak usually occurs (as determined in the previous section) are used to establish the percent share to arrive at the non-embedded peak that will be assumed for a specific transformer.

4.3 Identified Sites for Bulk Load Growth

Load growth is generally considered as an indication of economic development in an area. The development of economic zones and entry of industrial loads are among the key drivers to significant load increase over a short period of time. Aside from the economic benefits to the provinces, the power grid can also benefit if bulk load growth will take place in areas with huge excess generation capacity since grid reinforcements can be avoided or can be delayed. A significant increase in the local load absorption can help stabilize the grid as it can reduce the loading in the existing transmission line due to excess power that needs to be exported to the other parts of the grid. Bulk load growth can help maintain a supply-demand balance in an area. The identified areas are:

Table 4.3: Identified Area for Bulk Load Growth

Grid	Areas where bulk load growth is recommended to absorb excess generation
Luzon	Ilocos Norte (250 MW), Ilocos Sur (30 MW), La Union (100 MW), Benguet (70 MW), Cagayan Valley (100 MW), Isabela (150 MW), Nueva Vizcaya (50 MW), Quirino (20 MW), Pangasinan (100 MW), Bataan (100 MW), Zambales (40 MW), SBMA (50 MW), Tarlac (100 MW), Nueva Ecija (50 MW), Batangas (150 MW), Laguna (200 MW), Quezon Province (250 MW) and Bicol Region (Camarines Norte to Sorsogon) (170 MW)
Visayas	Panay Island (130 MW), Negros Island (225 MW), Cebu Island (85 MW), Leyte (150 MW)
Mindanao	Zamboanga del Sur (170 MW), Zamboanga del Norte (25 MW), Lanao del Norte (8 MW), Misamis Oriental (60 MW), Bukidnon (8 MW), Surigao del Norte (60MW), Surigao del Sur (2 MW), Agusan del Sur (30 MW), Agusan del Norte (55 MW), Davao del Sur (20 MW), Compostela Valley (50 MW), Cotabato (40 MW), South Cotabato (65 MW), Sultan Kudarat (75 MW)

5.1 Generation Capacity Addition

This section shows the additional capacities and proposed generating plants in Luzon, the Visayas and Mindanao Grids based on DOE Power Outlook 2015-2020 as of August 2015.

The DOE has also provided the list of generating plants that already have clearance to undertake System Impact Study (SIS) but are not included yet in the said DOE Power Outlook since the reports on the status of their development are not yet submitted. This list will fall under the new classification named as the Prospective Projects. Thus, there will be three generation project classifications, as follows:

a. Committed – These are projects that have service contracts in place, are in the development/commercial stage and have reached financial closure already and have been declared as “committed” by the DOE.
b. Indicative – Projects with service contracts, in the development/ commercial stage but with no financing yet.
c. Prospective – Projects with DOE clearance to undertake SIS and service contracts and on the predevelopment stage. These projects are not included in the official list of DOE’s Private Sector Initiated Power Projects. (Refer to Appendix 1 for the generation list).

It is worth noting that the proponents should regularly update the DOE on their plans and updates regarding the status of their projects for monitoring and inclusion in the official list of DOE’s PDP Generation Projects. Proponents are advised to regularly coordinate with the DOE’s Electric Power Industry Management Bureau (EPIMB).

Table 5.1 shows the additional capacities from 01 January 2014 to 15 August 2015.

Table 5.1: List of Additional Capacities from 01 Jan 2014 to 15 Aug 2015

Power Plant	Location	Installed Capacity (MW)	Dependable Capacity (MW)	Commercial Operation
LUZON				
Maibarara Geothermal Power	Sto. Tomas, Batangas	20	18.6	Feb 2014
Lafarge DPP	Taysan, Batangas	12.7	12	July 2014
Bangui Bay Wind Phase 3	Bangui, Ilocos Norte	18.9	12.6	Oct 2014
Burgos Wind	Burgos, Ilocos Norte	150	45	Nov 2014
SJCiPower Biomass	San Jose, Nueva Ecija	12	10	Oct 2014
Caparispisan Wind	Pagudpud, Ilocos Norte	81	28	Nov 2014
Raslag Solar^	Pampanga	10	8.5	Feb 2015
Majestic CEZ Solar	Cavite	41.3	20	Mar 2015
Burgos Solar^	Burgos, Ilocos Norte	4.1	4	Mar 2015
SLTEC Puting Bato Coal Unit 1	Calaca, Batangas	135	123	Apr 2015
Sinoma Waste Heat Recovery Facility*	San Jose, Antipolo	6	5.7	Apr 2015
SPCRPI SM North*	Quezon City	1.5	1.5	Apr 2015
Millennium Gas**	Navotas, Metro Manila	100	80	May 2015
Sabangan HEPP	Sabangan, Mt. Province	14	4	Jun 2015
Pililia Wind^	Pililia, Rizal	54	48.6	Jul 2015
	Sub-total (Luzon)	**660.5**	**421.5**	
VISAYAS				
San Carlos Solar Phase 1	San Carlos City, Negros Occidental	13	9	May 2014
San Carlos Solar Phase 2	San Carlos City, Negros Occidental	9	7.5	Aug 2014
Nasulo Geothermal	Valencia, Negros Oriental	49.37	40	Sep 2014
San Lorenzo Wind	San Lorenzo, Guimaras	54	50	Dec 2014
URC Bagasse Cogeneration Facility Phase 1	Kabankalan, Negros Occidental	40	36	Jan 2015
HPCo Bagasse Cogeneration	Silay City, Negros Occidental	12	3	Feb 2015
PSFLI (SOLEQ) Solar	Ormoc, Leyte	30	24	Apr 2015
PetroWind Nabas Wind	Nabas, Aklan	36	32.4	Jun 2015
TPC – 1A Coal	Toledo City, Cebu	82	75.9	
	Sub-total (Visayas)	**325.37**	**277.8**	
MINDANAO				
SoEnergy DPP^	Brgy. Apopong, Gen. Santos City, South Cotabato	19	18.05	Mar 2014
MPC-Digos DPP^	Digos, Davao del Sur	15	14.25	Mar 2014
KEGI-Panaon DPP^	Panaon, Ozamis City, Misamis Occ.	15	13.6	May 2014
Tudaya 1 Hydro^	Sta. Cruz, Davao del Sur	6.6	6.53	May 2014
Tudaya 2 Hydro^	Sta. Cruz, Davao del Sur	7	6.93	May 2014
KEGI Tandag^	Tandag, Surigao	7.5	6	Oct 2014
Mapalad Energy DPP^	Iligan City	15	14.25	Dec 2014
Peak Power (PSI) DPP^	Brgy. Apopong, Gen. Santos City	20.9	19.6	Jan 2015
Peak Power (PSFI) DPP^	San Francisco, Agusan del Sur	5.9	5	Feb 2015
	Sub-Total (Mindanao)	**111.9**	**104.21**	
	TOTAL	**1,097.77**	**803.51**	

Based on the DOE Power Outlook 2015-2020 as of August 2015
^Embedded
*Own-use
**Recommissioned

The following tables shows the DOE List of Private Sector Initiated Power Projects as of March 15, 2016 for Luzon, Visayas and Mindanao.

Table 5.2: Summary of Generation Capacity Addition

	Total Committed Capacity (MW)	Total Indicative Capacity (MW)
Luzon	4,340.24	7,514.2
Visayas	826.95	1,441.43
Mindanao	1,834.81	2,255.69
PHILIPPINES	**7,002**	**11,211.32**

It can be noted that the list includes small capacity plants which may not actually connect directly to NGCP. For relatively small capacity power plants connecting to the distribution system, the main impact is a slight reduction in the power being drawn by the Distribution Utility from NGCP substations and would not generally require reinforcement in the transmission network.

Also, there are power plant projects in the DOE list with no connection application yet to NGCP or with no System Impact Study (SIS) yet.

Table 5.3(a): List of Luzon Generation Capacity Addition

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
COMMITTED POWER PLANTS			
COAL			
SLPGC Coal Phase 1*	300	Brgy. San Rafael, Calaca, Batangas	2016
Anda Power Coal*	82	Brgy. Bundagul, Mabalacat, Pampanga	2016
Limay Coal Phase 1 Unit 1*	150	Brgy. Lamao, Limay, Bataan	2016
Limay Coal Phase 1 Unit 2*	150	Brgy. Lamao, Limay, Bataan	2017
Pagbilao 3 Coal*	420	Pagbilao Power Station, Brgy. Ibabang Polo, Pagbilao, Quezon	2017
GN Power Dinginin Expansion Unit 1*	600	Mariveles, Bataan	2018
San Buenaventura (SBPL) Coal*	460	Mauban, Quezon	2019
GN Power Dinginin Expansion Unit 2*	600	Mariveles, Bataan	2020
Sub-Total Coal	**2,762**		
BIOMASS			
ACNPC WTE Biomass	1.5	Tarlac City, Tarlac	2016
GIFTC Biomass*	10.8	Muñoz, Nueva Ecija	2016
Bicol Biomass Energy Corp*	4.5	Pili, Camarines Sur	2016
Biogas Power Plant	6.1	Batangas	2016
SJCiPower Rice Husk-Fired Phase 2	10.8	Brgy. Tulat, San Jose, Nueva Ecija	2017
Sub-Total Biomass	**33.7**		
NATURAL GAS			
Pagbilao Combined Cycle	600	Brgy. Ibabang Polo, Pagbilao, Quezon	2016
San Gabriel Avion Project*	100	Brgy. Bolbok, Batangas	2016
San Gabriel Project*	450	San Gabriel, Batangas	2016
Sub-Total Natural Gas	**1,150**		
HYDRO			
Kapangan HEPP*	60	Kapangan and Kibungan, Benguet	2019
Bulanao HEPP	1	Tabuk, Kalinga	2019
Prismc HEPP	1	Rizal, Nueva Ecija	2019
Magat A	1.4	Ramon, Isabela	2020
Magat B	1	Ramon, Isabela	2020
Tubao Mini Hydro	1.5	Tubao, La Union	2020
Sub-Total Hydro	**65.9**		
SOLAR			

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
Currimao Solar*	20	Currimao, Ilocos Norte	2016
Macabud Solar*	30	Brgy. Macabud, Rodriguez, Rizal	2016
San Rafael Solar	3.82	San Rafael, Bulacan	2016
Morong Solar	5.02	Morong, Bataan	2016
Cabanatuan Solar	10.06	Cabanatuan City, Nueva Ecija	2016
Palauig Solar	5.02	Morong, Bataan	2016
Sta. Rita Solar	100.44	Morong and Hermosa, Bataan	2016
YH Green	14.5	Hermosa, Bataan	2016
Tarlac Solar	50	Tarlac City, Tarlac	2016
Calatagan Solar	46.78	Calatagan and Balayan, Batangas	2016
Sub-Total Solar	**285.64**		
GEOTHERMAL			
Bacman 3 (Tanawon)	31	Guinlajon, Sorsogon	2017
Maibarara 2 Geothermal	12	Batangas	2017
Sub-Total Geothermal	**43**		
TOTAL COMMITTED	**4,340.24**		
INDICATIVE POWER PLANTS			
COAL			
SMC Limay Coal Phase 3 Unit 1*	300	Brgy. Lamao, Limay, Bataan	2016
SMC Limay Coal Phase 2 Unit 1*	150	Brgy. Lamao, Limay, Bataan	2017
SMC Limay Coal Phase 2 Unit 2	150	Brgy. Lamao, Limay, Bataan	2017
SMC Limay Coal Phase 3 Unit 2	300	Brgy. Lamao, Limay, Bataan	2017
Lucidum Energy Coal	300	Silanguin Bay, Zambales	2017
SLPGC Coal Phase 2*	300	Brgy. San Rafael, Calaca, Batangas	2017
JGS Coal Unit 1 and 2*	300	Brgy. Pinamukan Ibaba, Batangas City	2018
Redondo Peninsula Coal*	600	Sitio Naglatore, Cawag, Subic Bay Freeport Zone	2019
JGS Coal Unit 3 and 4*	300	Brgy. Pinamukan Ibaba, Batangas City	2019
AES Masinloc Expansion*	600	Zambales	2019
AOE Coal Unit 1*	600	Atimonan, Quezon	2020
AOE Coal Unit 2*	600	Atimonan, Quezon	2021
H&WB Supercritical Coal Unit 1	350	Camarines Norte	2020
H&WB Supercritical Coal Unit 2	350	Camarines Norte	2025
Sub-Total Coal	**5,200**		
OIL-BASED			
Aero Derivative Combined Cycle	150	Calamba, Laguna	TBD
DMCI Power Gas Turbine	23	San Rafael, Calaca, Batangas	TBD
DMCI Masbate Gas Turbine	23	San Rafael, Calaca, Batangas	TBD
Sub-Total Oil-Based	**196**		
NATURAL GAS			
Sta. Maria Project (San Gabriel Phase 2) Unit 1	450	Sta. Maria, Batangas	2017
Sta. Maria Project (San Gabriel Phase 2) Unit 2	450	Sta. Maria, Batangas	2019
Sub-Total Natural Gas	**900**		
GEOTHERMAL			
Bacman 4 Botong-Rangas Geothermal*	40	Bacon District, Sorsogon	2019
Kayabon Geothermal*	40	Manito, Albay	2020
Sub-Total Geothermal	**80**		
SOLAR			
Clark Freeport Zone Solar	24.55	Clark Freeport Zone, Pampanga	2016
Concepcion Solar*	50.55	Brgy. Sta. Rosa, Concepcion, Tarlac	2016
Cavite Solar	3	Cavite Economic Zone, Rosario Cavite	2016

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
V-mars Solar	10	San Jose/Lupao, Nueva Ecija	TBD
SJC Solar	10	San Jose City, Nueva Ecija	TBD
RGEC Solar	30	Nasugbu and Tuy, batangas	TBD
Calabanga Solar	50	Calabanga, Camarines Sur	TBD
Sub-Total Solar	**178.1**		
HYDRO			
Ibulao Hydro*	4.5	Lagawe, Ifugao	2018
Dupinga Hydro	3	Gabaldon, Nueva Ecija	2018
Pinacanauan	6	Peñablanca, Cagayan	2018
Tinoc 2*	11	Tinoc, Ifugao	2019
Tinoc 3*	5	Tinoc, Ifugao	2019
Colasi	1	Mercedes, Camarines Norte	2019
Majayjay	2.2	Majayjay, Laguna	2019
Ranggas	1.5	Goa & Tigaon, Camarines Sur	2019
Biyao	0.8	Balbalan, Kalinga	2019
Tinoc 1*	4.1	Tinoc, Ifugao	2018
Tinoc 4*	5	Tinoc, Ifugao	2018
Abdao HEP	1	Tabaan Sur, Tuba, Benguet	2019
Barit Hydro	0.4	Buhi, Camarines Sur	2019
Tignoan HEP	20	Real, Quezon	2019
Tumauini (Lower Cascade)	7.8	Tumauini, Isabela	2019
Tumauini (Upper Cascade)	14	Tumauini, Isabela	2019
Tinoc 5	6.9	Tinoc, Ifugao	2019
Tinoc 6	8	Tinoc, Ifugao	2019
Alilem	16.2	Alilem, Ilocos Sur	2019
Man-Asok	3	Buguias, Benguet	2020
Quirino	11.5	Quirino, Ilocos Sur	2020
Laguio Malaki 1	1.6	Mauban, Quezon	2020
Laguio Malaki 2	3.1	Mauban, Quezon	2020
Davidavilan	1	Mauban, Quezon	2020
Bansud	1	Mauban, Quezon	2020
Matuno 1	7.9	Ambaguio, Nueva Vizcaya	2020
Matuno 2	7.9	Bambang, Nueva Ecija	2020
Lalawinan Mini-Hydro	3	Real, Quezon	2020
Ilaguen*	19	San Mariano & San Guillermo, Isabela	2020
Cawayan 2	1	Sorsogon, Sorsogon	2020
Ilaguen 2*	14	Dinapique, Isabela	2020
Danac	13.2	Sugpon, Ilocos Sur	2020
Matuno	8	Bambang, Nueva Vizcaya	2020
Dibuluan	5	San Agustin, Isabela	2020
100 MW Alimit*	100	Lagawe, Ifugao	2021
240 MW Alimit*	240	Ifugao	2021
Olilicon HEPP*	10	Ifugao	2021
Maris Main Canal 1 HEP*	6	Ramon, Isabela	2021
Maapon River Mini-Hydro	2.6	Brgy. Piis, Lucban, Quezon	2020
Maris Main Canal 2 HEP*	1.8	Alfonso Lista, Ifugao	TBD
Kabayan 1	20	Benguet	TBD
Talubin	5.4	Bontoc, Mountain Province	TBD
Ibulao I	6	Kiangan, Ifugao	TBD
Sub-Total Hydro	**610.3**		
WIND			
Pasuquin East Wind*	48	Pasuquin, Ilocos Norte	2016
Sembrano Wind*	72	Mt. Sembrano, Mabitac, Laguna	2017
Balaoi Wind	45	Brgy. Balaoi, Pagudpud, Ilocos Norte	2017

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
Pagudpud Wind	84	Brgy. Balaoi and Caunayan, Pagudpud, Ilocos Norte	2018
Sub-Total Wind	**249**		
BIOMASS			
GGREC Rice Husk-Fired Biomass	10.8	Nueva Ecija	2018
Sub-Total Biomass	**10.8**		
BATTERY			
AES Battery	10	Masinloc, Zambales	2016
AES Battery	40	Laoag, Ilocos Norte	TBD
AES Battery	40	Bantay, Ilocos Norte	TBD
Sub-Total Battery	**90**		
TOTAL INDICATIVE	**7,514.2**		

*with SIS

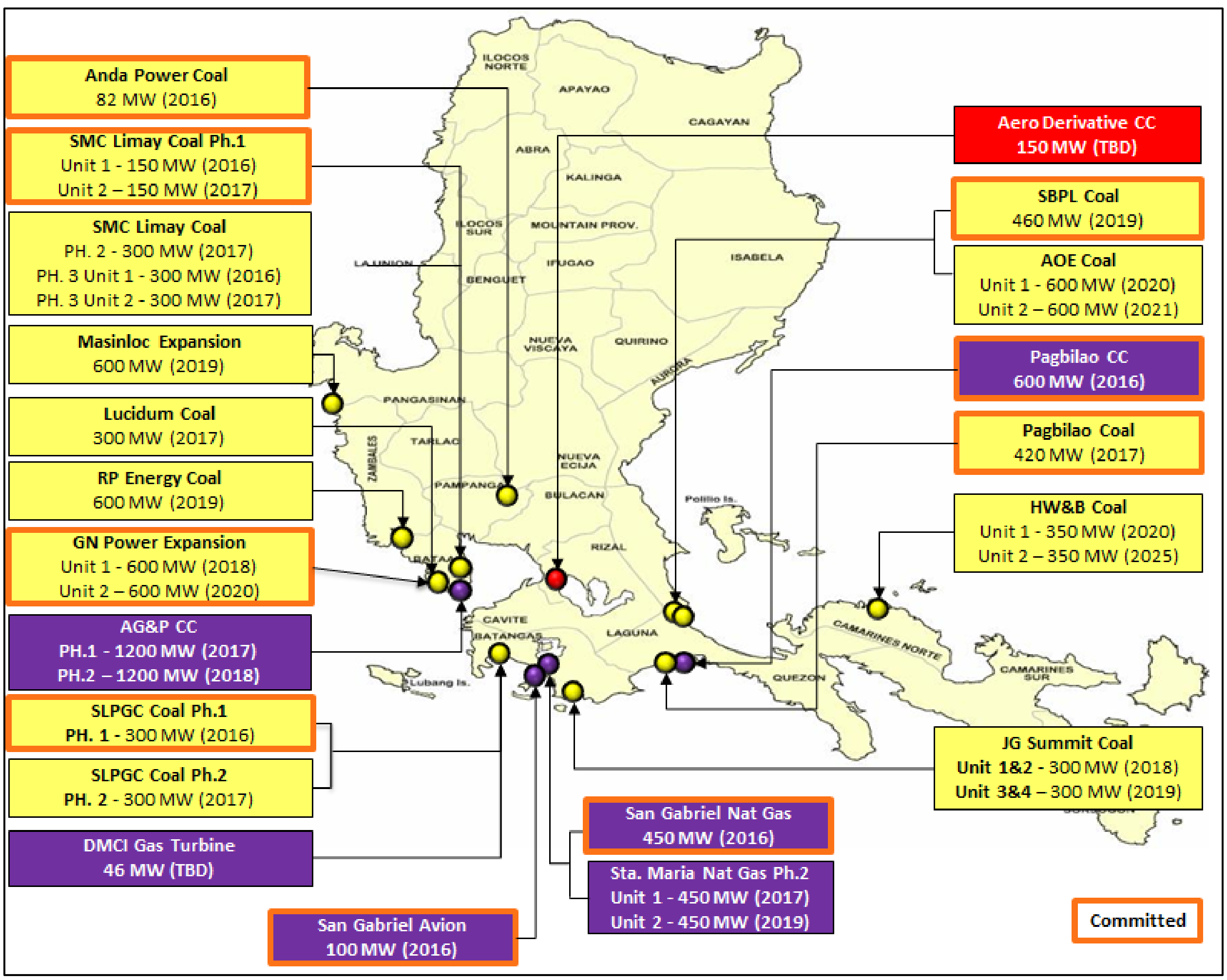


Figure 5.1(a): Luzon Generation Capacity Addition (Conventional Power Plants)

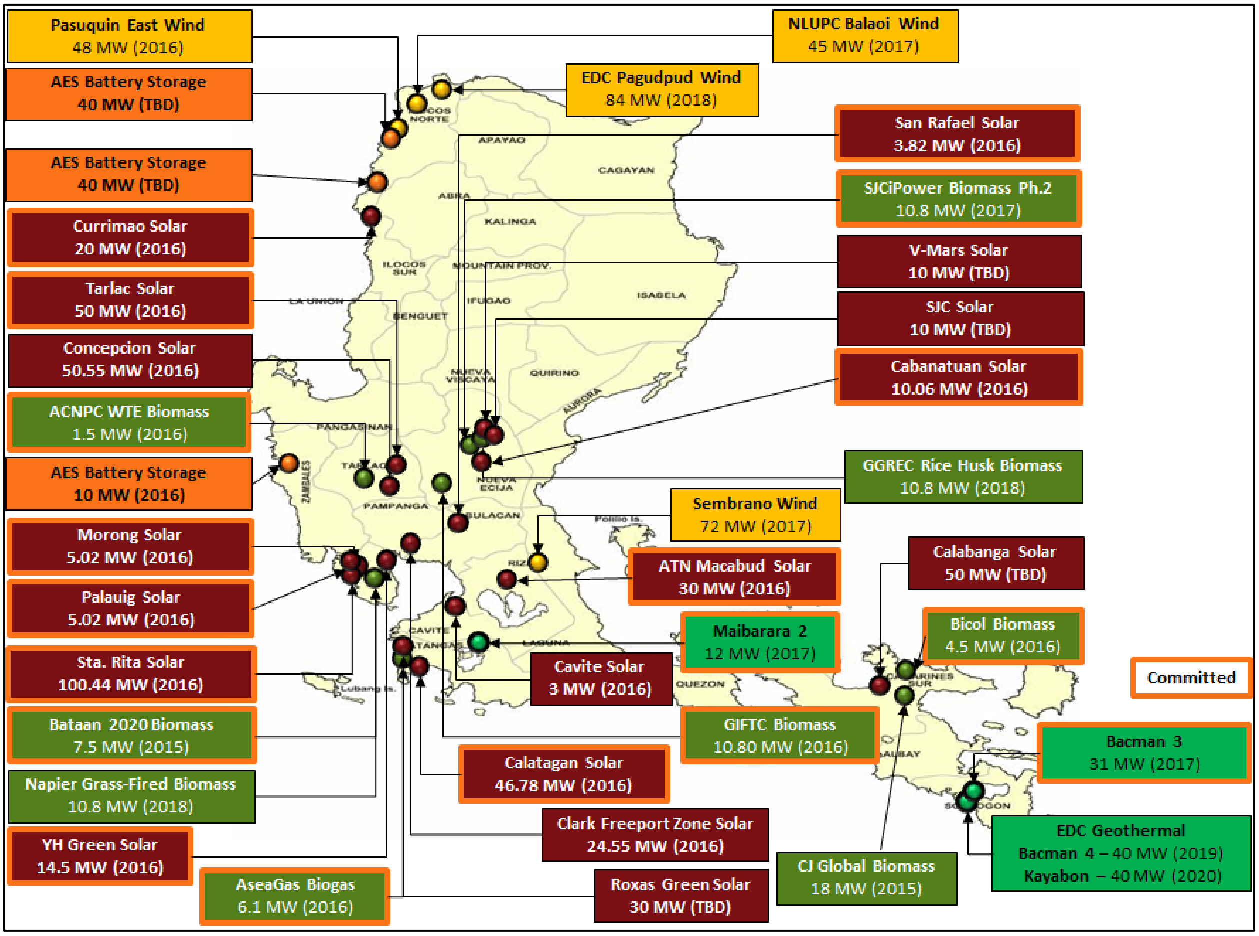


Figure 5.1(b): Luzon Generation Capacity Addition (Renewable Energy Plants)

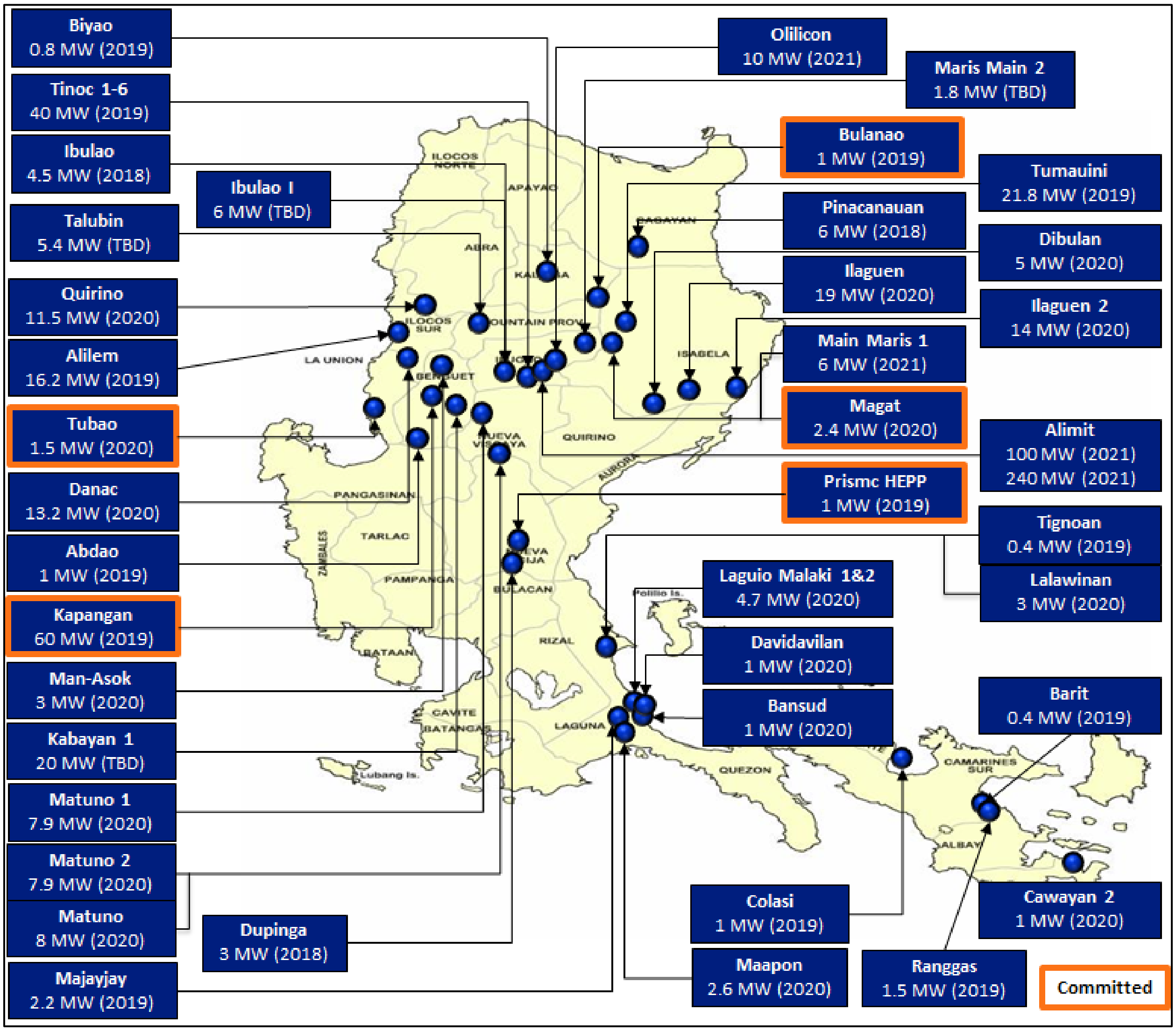


Figure 5.1(c): Luzon Generation Capacity Addition (Hydroelectric Power Plants)

Table 5.3(b): List of Visayas Generation Capacity Addition

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
COMMITTED POWER PLANTS			
COAL			
PEDC Expansion	150	Brgy. Ingore, La Paz, Iloilo	2016
Concepcion Coal Unit 1*	135	Brgy. Nipa, Concepcion, Iloilo	2016
Concepcion Coal Unit 2*	135	Brgy. Nipa, Concepcion, Iloilo	2018
Sub-Total Coal	**420**		
OIL-BASED			
Calumangan Diesel*	18.9	Brgy. Calumangan,Bago City, Negros Occidental	2016
Sub-Total Oil-Based	**18.9**		
HYDRO			
Villasiga HEPP*	8	Brgy. Igsoro, Bugasong, Antique	2016
Igbulo (Bais) Hydro*	5.1	Igbaras, Iloilo	2018
Cantakoy HEP*	8	Danao, Bohol	2018
Amlan	0.8	Amlan, Negros Oriental	2019
Sub-Total Hydro	**21.9**		
WIND			
Nabas Wind*	14	Brgy. Pawa, Nabas Aklan	2017
Sub-Total Wind	**14**		
GEOTHERMAL			
Biliran Geothermal*	50	Biliran, Biliran	2016 2017
Sub-Total Geothermal	**50**		
SOLAR			
La Carlota Solar Phase A* (SACASOL II-A)	18	La Carlota City, Negros Occidental	2016
Cadiz Solar*	132.5	Brgy. Tinampa-an, Cadiz City, Negros Occidental	2016
Miag-ao Solar*	5.67	Miag-ao, Iloilo	2016
Manapla Solar (SACASOL III)	48	Manapla, Negros Occidental	2016
Bais Solar (SACASOL IV)	25	Bais City, Negros Occidental	2016
La Carlota Solar Phase A (SACASOL II-B)	14	La Carlota City, Negros Occidental	2016
SACASUN Solar	58.98	San Carlos City, Negros Occidental	2016
Sub-Total Solar	**302.15**		
TOTAL COMMITTED	**826.95**		
INDICATIVE POWER PLANTS			
COAL			
Therma Visayas Energy Unit 1*	150	Brgy. Bato, Toledo City, Cebu	2017
Therma Visayas Energy Unit 2*	150	Brgy. Bato, Toledo City, Cebu	2018
SPC Expansion	300	Brgy. Colon, Naga City, Cebu	TBD
Ludo Coal	300	Cebu City	TBD
Sub-Total Coal	**900**		
OIL			
Datem Energy Diesel	10	Northern Samar	TBD
Sub-Total Oil	**10**		
GEOTHERMAL			
Dauin Geothermal	40	Dauin, Negros Oriental	2021
Sub-Total Geothermal	**40**		

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
SOLAR			
Tigbauan Solar	30.2	Tigbauan, Iloilo	2016
Biliran Solar	48	Biliran, Biliran	2016
E&P Green Energy Solar	25	Biliran, Biliran	2016
Ceko Solar	100	Brgy. Tominjao, Daan Bantayan, Cebu	TBD
First Toledo Solar	60	Toledo City, Cebu	TBD
Sub-Total Solar	**263.2**		
WIND			
Pulupandan Wind	50	Pulupandan, Negros Occidental	2016
Sub-Total Wind	**50**		
HYDRO			
Timbaban Hydro*	18	Madalag, Aklan	2018
Loboc Hydro	1.2	Loboc, Bohol	2018
Hilabangan (Upper Cascade)	4.8	Kabankalan, Negros Occidental	2018
Hilabangan (Lower Cascade)	3	Kabankalan, Negros Occidental	2018
Main Aklan River Hydro	15	Libacao, Aklan	2018
Maninila (Lower Cascade)	4.5	San Remigio, Antique	2018
Maninila (Upper Cascade)	3.1	San Remigio, Antique	2018
Sibalom (Upper Cascade)	4.2	San Remigio, Antique	2018
Sibalom (Middle Cascade)	4	San Remigio, Antique	2018
Sibalom (Lower Cascade)	4	San Remigio, Antique	2018
Basak II	0.5	Badian, Cebu	2019
Amlan*	5.5	Amlan, Negros Oriental	2019
Malugo	6	Silay City. Negros	2019
Lower Himogaan	4	Sagay, Negros Occidental	2020
Caroan	0.84	Sebaste, Antique	2020
Ipayo	0.84	Sebaste, Antique	2020
Ilaguen 4	10	Echague	2020
Bansud	1.5	Bansud & Gloria, Oriental Mindoro	2020
Sub-Total Hydro	**90.98**		
BIOMASS			
Mina Multi-Fuel Biomass Phase 1*	16.5	Iloilo	2017
Mina Multi-Fuel Biomass Phase 2*	16.5	Iloilo	2018
MCEI Multi-Feedstock Biomass	12	Negros Occidental	2018
MCEI Risk Husk-Fired Biomass	2.25	Leyte	2018
Sub-total Biomass	**47.25**		
BATTERY			
AES Battery Storage*	40	Kabankalan, Negros Occidental	2016
Sub-Total Battery	**40**		
TOTAL INDICATIVE	**1,441.43**		

*with SIS

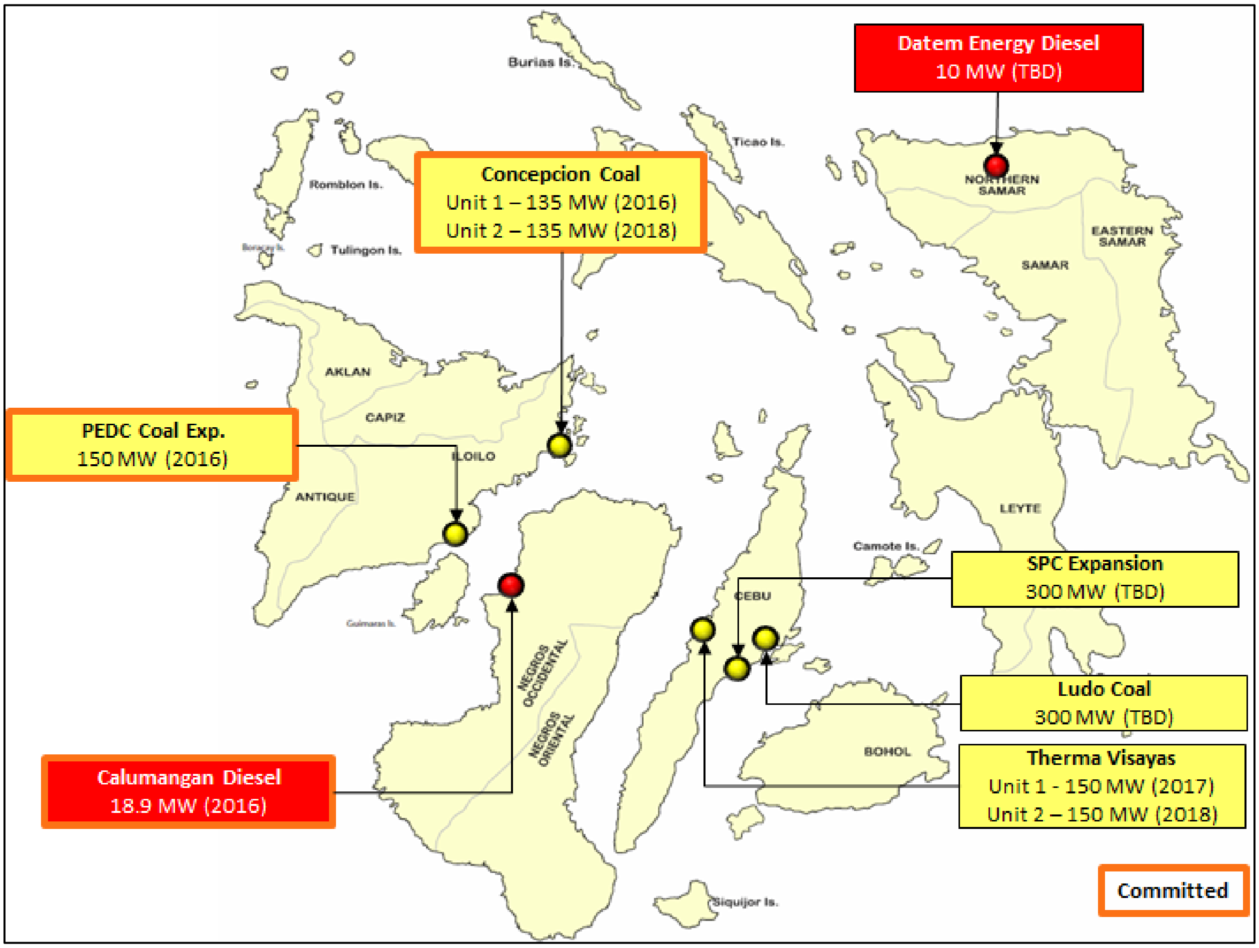


Figure 5.2(a): Visayas Generation Capacity Addition (Conventional Power Plants)

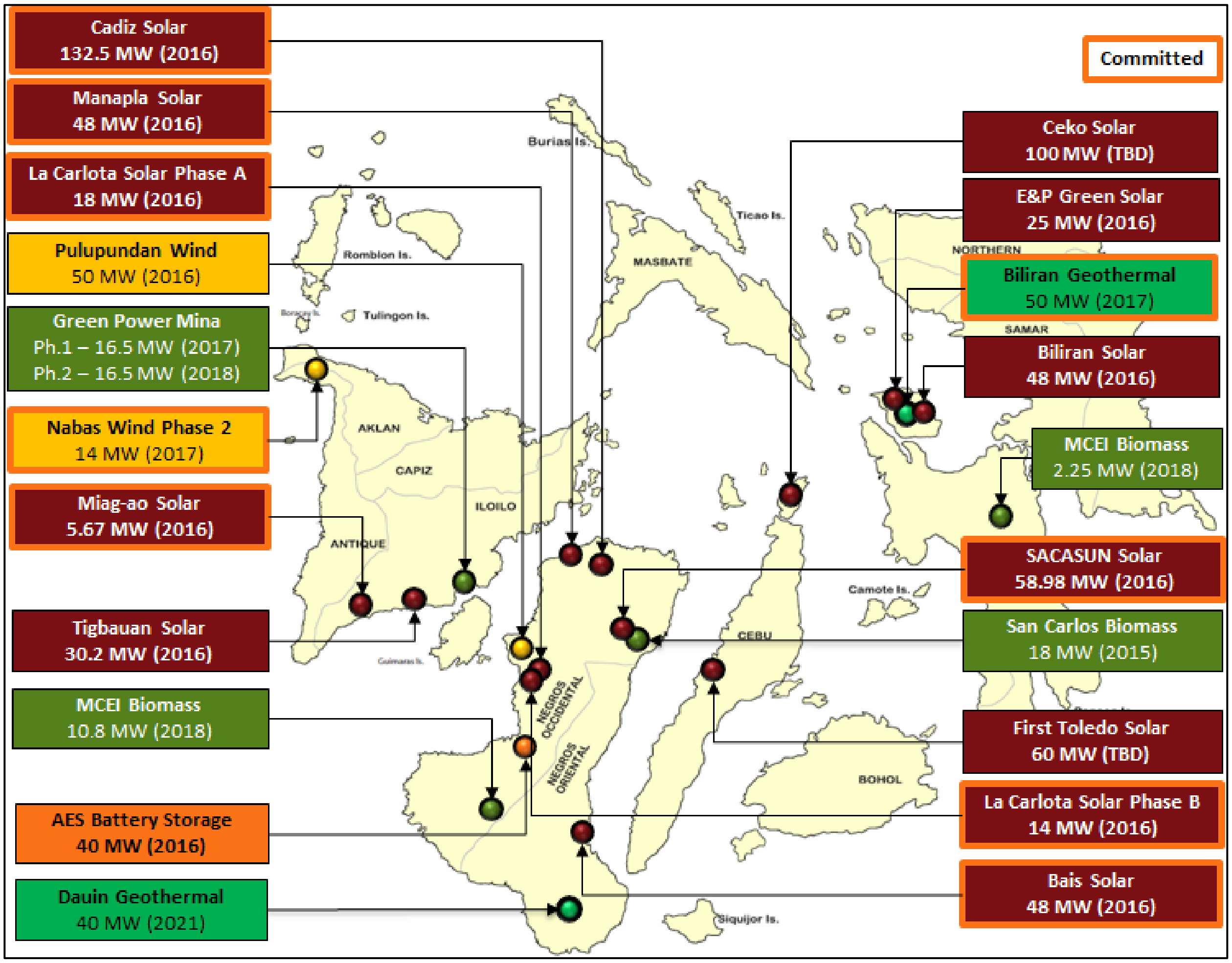


Figure 5.2(b): Visayas Generation Capacity Addition (Renewable Energy Plants)

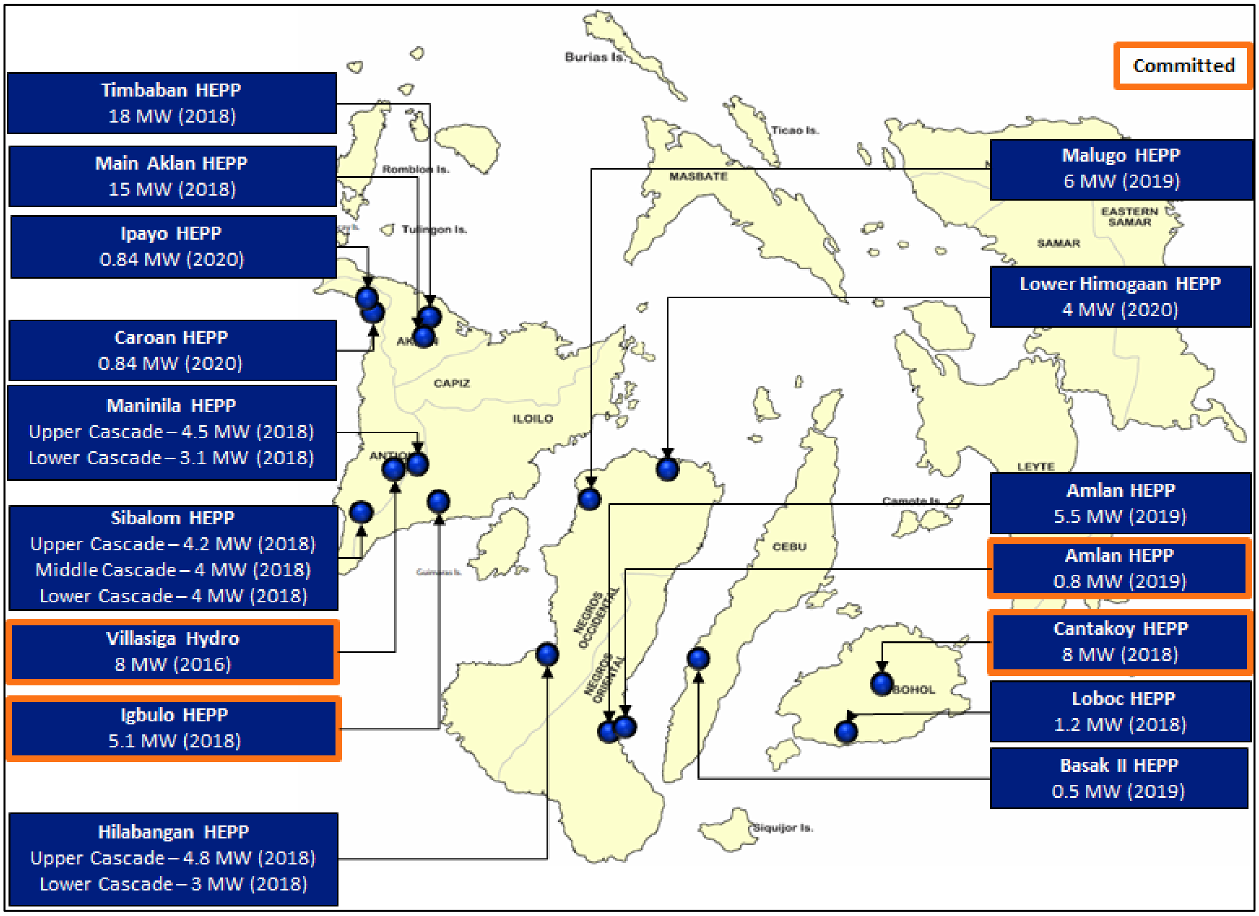


Figure 5.2(c): Visayas Generation Capacity Addition (Hydroelectric Power Plants)

Table 5.3(c): List of Mindanao Generation Capacity Addition

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
COMMITTED POWER PLANTS			
COAL			
Southern Mindanao Phase 1*	100	Brgy. Kamanga, Maasim, Sarangani	2016
SMC Davao Phase 1*	300	Brgy. Culaman, Malita, Davao del Sur	2016
FDC-Misamis Coal*	405	Phividec Industrial Estate, Villanueva, Misamis Oriental	2016
Balingasag Thermal Power Plant*	165	Brgy. Mandangoa, Balingasag, Misamis Oriental	2017
GNPower Kauswagan Ltd.*	540	Kauswagan, Lanao del Norte	2018
Southerm Mindanao Phase 2*	100	Brgy. Kamanga, Maasim, Sarangani	TBD
Sub-Total Coal	**1,610**		
DIESEL / OIL			
SPC Koronadal Diesel*	11.9	Purok Garfin, Brgy. Paraiso, Koronadal, South Cotabato	2016
PSFI Bunker Fired	2.5	San Francisco, Agusan del Sur	2016
PSI Bunker Fired	13.94	General Santos City, South Cotabato	2016
PBI Bunker Fired	10.4	Manolo Fortich, Bukidnon	2017
Sub-Total Diesel / Oil	**38.74**		
BIOMASS			
PTCI Rice Husk-Fired Biomass	1.6	Maguindanao	2016
GEEC Biomass Cogeneration System	2.6	Maguindanao	2016
LPC Rice Husk-Fired Biomass*	10	Maguindanao	2016
Sub-Total Biomass	**14.2**		
HYDRO			
Lake Mainit*	25	Jabonga, Agusan del Norte	2016
Puyo Hydro	30	Jabonga, Agusan del Norte	2018
Asiga HEPP	8	Santiago, Agusan del Norte	2019
Manolo Fortich 1*	43.4	Santiago, Bukidnon	2019
Manolo Fortich 2*	25.4	Santiago, Bukidnon	2019
Sub-Total Hydro	**131.8**		
SOLAR			
Kibawe Solar	10.49	Brgy. Labuagon, Kibawe, Bukidnon	2016
Digos Solar Phase I	10	Brgy. San Roque, Digos City, Davao del Sur	2016
Digos Solar Phase II	19.58	Brgy. San Roque, Digos City, Davao del Sur	2016
Sub-Total Solar	**40.07**		
TOTAL COMMITTED	**1,834.81**		
INDICATIVE POWER PLANTS			
COAL			
SMC Davao Phase 3	600	Brgy. Culaman, Malita, Davao del Sur	2016
Sibuguey Power	100	Subugay, Zamboanga	2016
SMC Davao Phase 2*	300	Brgy. Culaman, Malita, Davao del Sur	2018
Ozamiz Power*	300	Brgy. Pulot, Ozamiz City, Misamis Occidental	2019
SRPI Circulating Fluidized Bed Coal*	100	Sitio, San Ramon, Brgy. Talisayan, Zamboanga City	TBD
Sub-Total Coal	**1,400**		
GEOTHERMAL			
Mindanao 3 Geothermal*	40	Kidapawan, North Cotabato	2018
Sub-Total Geothermal	**40**		
SOLAR			
GenSan Solar Phase 1	48	General Santos City, South Cotabato	2016
GenSan Solar Phase 2	48	General Santos City, South Cotabato	2016
San Francisco Solar	10	San Francisco, Agusan del Sur	2016
General Santos City Solar	60	General Santos City, South Cotabato	TBD

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
Sub-Total Solar	**166**		
HYDRO			
Bubunawan Hydro	23	Baungon and Libona, Bukidnon	2016
Limbatangon Hydro	9	Cagayan de Oro, Misamis Oriental	2018
Tagoloan	39	Impasugong & Sumilao, Bukidnon	2018
Culaman Hydro*	10	Manolo Fortich, Bukidnon	2018
Cabadbaran Hydro*	9.8	Cabadbaran, Agusan del Norte	2018
Tumalaong Hydro	9	Baungon, Bukidnon	2018
Cabulig-2 Hydro	10	Jasaan, Misamis Oriental	2019
Pasonanca	0.5	Zamboanga City	2019
Clarin*	5	Clarin, Misamis Occidental	2019
Mat-i-1*	2	Claveria, Cagayan de Oro	2019
Mat-i-2*	1.6	Cagayan de Oro, Misamis Oriental	2019
Mat-i-3*	3.25	Cagayan de Oro, Misamis Oriental	2019
New Bataan	2.4	New Bataan, Compostela Valley	2019
Mangima Hydro	10	Manolo Fortich, Bukidnon	2019
Maladugao River (Upper Cascade)	5.5	Wao, Bukidnon	2020
Maladugao River (Lower Cascade)	10	Kalilangan & Wao, Bukidnon	2020
Lanon (Lam-alu)	9.5	Lake Sebu, South Cotabato	2020
Silo-o*	3.29	Malitbog, Bukidnon	2020
Agus III	225	Pantar & Balo-I, Lanao del Sur & Lanao del Norte	2020
Malitbog	17.85	Malitbog, Bukidnon	2020
Maramag	1.4	Maramag, Bukidnon	2020
Manupali	9	Valencia, Bukidnon	2020
Pulanai	9	Valencia, Bukidnon	2020
Kitaotao1	150	Bukidnon	2021
Sub-Total Hydro	**575.09**		
BIOMASS			
Kalilangan Bio-Energy	9	Bukidnon	2016
Don Carlos Bio-Energy	9	Bukidnon	2016
EPC Woody Biomass*	21	Agusan del Norte	2017
Malay-balay Bio-Energy	9	Bukidnon	2017
Biomass Power Plant	10.8	Misamis Oriental	2017
Napier Grass-Fired Biomass	10.8	Bukidnon	2018
Sub-Total Biomass	**69.6**		
OXYFUEL GAS			
Bislig 1 Oxyfuel-Gas	1	Brgy. Kahayag, Bislig City, Surigao del Sur	2016
Bislig 2 Oxyfuel-Gas	4	Brgy. Kahayag, Bislig City, Surigao del Sur	2016
Sub-Total Oxyfuel	**5**		
TOTAL INDICATIVE	**2,255.69**		

*with SIS

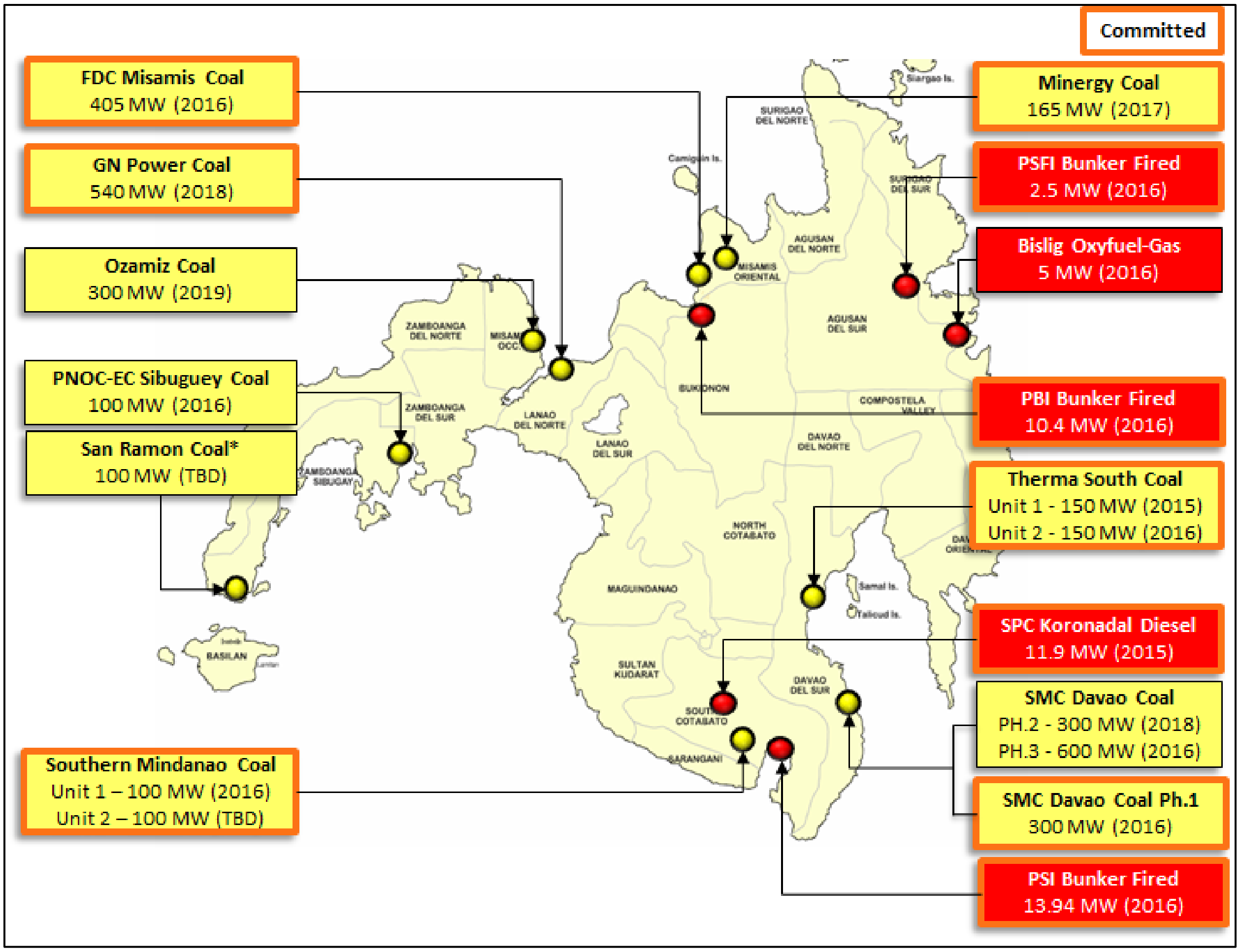


Figure 5.3(a): Mindanao Generation Capacity Addition (Conventional Power Plants)

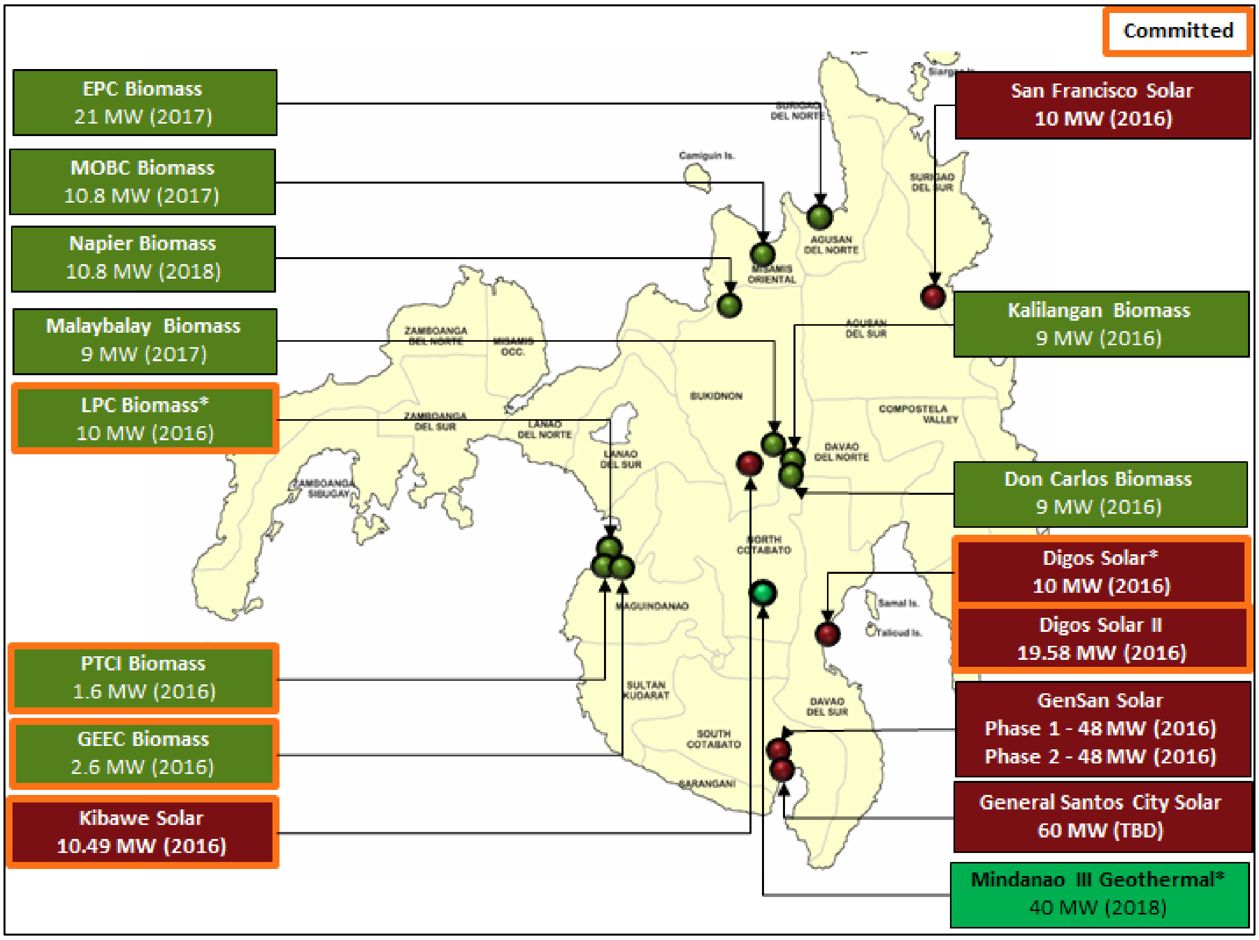


Figure 5.3(b): Mindanao Generation Capacity Addition (Renewable Energy Plants)

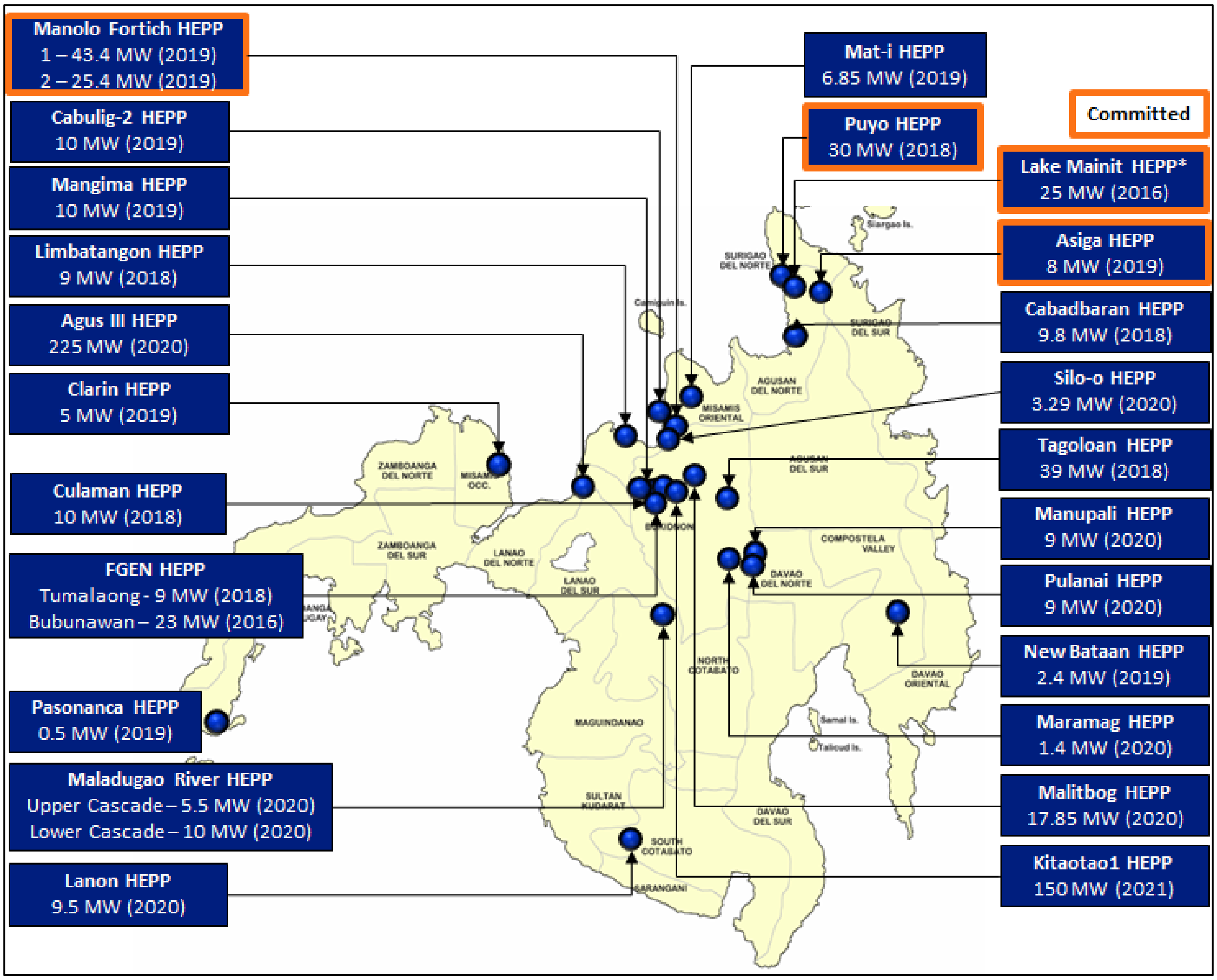


Figure 5.3(c): Mindanao Generation Capacity Addition (Hydroelectric Power Plants)

5.2 Renewable Energy

NGCP allocates this section for the development and plans associated with the entry of Renewable Energy (RE). Discussed here are the transmission planning approach with RE, present concerns and the activities of NGCP in support to RE.

5.2.1 Transmission Planning for RE: Philippine Scenario

In developing transmission expansion plans for the grid, every project included in the TDP is evaluated to meet the following objectives:

a. Ensure the reliability and stability of the grid
b. Grid demand requirements are met by available supply
c. Minimize the cost of transmission investments passed-through to end-consumers
d. Minimize the cost of energy by providing more opportunities for competition and mitigating market congestions

The same objectives are given with the addition of RE. The RE Act of 2008 mandates NGCP to include the required connection facilities for RE-based power facilities in the TDP. The Feed-in Tariff (FIT) rules strengthens this mandate by giving eligible RE plants priority connection to the transmission or distribution system, subject to their compliance to the pertinent standards and ERC rules governing such connection. This, however, provides further challenges in transmission planning faced by NGCP.

First challenge is the proximity of transmission facilities and its available transfer capacity to Variable Renewable Energy (VRE) potential areas. These are applicable to site-specific VREs located far from load centers. Although there are some areas that are near transmission facilities, these are not designed to accommodate the potential capacity of VRE. As a result, long transmission lines were needed to be built.

Second is the shorter timeline of VRE projects compared to transmission expansion projects. Actual construction timeline of VRE projects has proven that it can be completed faster compared to transmission projects. Aggravated by the "first come first serve" policy of the FIT scheme, VRE proponents are somewhat in a race to secure an allocation to the installation targets. Consequently, the transmission expansion projects need to catch-up with the completion VRE projects.

Though recognized, NGCP cannot simply advance the implementation of transmission facilities without the confirmation of VRE proponent. Transmission investments shall still conform to the Rules for Setting Transmission Wheeling Rates (RTWR) and the principles contained therein, the optimization principle among one of them. At this regulation, NGCP transmission facility could be exposed to the risk of being optimized down if the VRE proponent decided not to pursue with their project. As a result in some cases, the VRE proponent had to advance the transmission investment and later to be transferred to NGCP subject to reimbursement upon ERC approval.

Third challenge is the grid connection and operational requirements for VRE. The latest Philippine Grid Code after the approval of the RE Act of 2008 only covers the rules and requirements for conventional generators. With the limited experience on VRE, creating and setting the proper requirements for VRE was a big challenge. The goal was to set the necessary requirements to make VRE behave like a conventional power plant. Positively, the Addendum to the Amendment no.1 of the Grid Code was approved in 2013, containing the requirements for VRE, particularly wind and solar.

In the RE Act of 2008, NGCP is required to determine a maximum penetration limit to the grid of intermittent or variable RE. NGCP and PEMC are also tasked to implement technical mitigation and improvements in the system in order to ensure safety and reliability of electricity transmission.

Starting with the limited knowledge on grid integration of VRE, NGCP was in an interesting position. With continuous research and workshops, NGCP has determined how to analyze the effect of VRE to the grid in its study called the Renewable Energy Integration Study. Here, the variability of the net load or residual load (load minus VRE) was analyzed and compared to the availability of regulating reserves.

However, the availability of accurate data to come up with a credible study gave further challenge to NGCP. NGCP initially requested the resource assessment data of VRE proponents and used it as substitute to actual data. NGCP had reservations on whether the results of the study would actually provide the safe level of VRE penetration. With this uncertainty, NGCP will update the study using actual VRE data.

5.2.2 Present Concerns

With the given challenges in transmission planning, there are already present concerns experienced by NGCP with the fast phase development of VRE.

The present situation in the Visayas Grid provides a good example. As of April 2016, a total of 455 MW capacity of VREs is already installed where 90 MW capacity is from wind and 370 MW capacity is from solar PVs. At certain periods, VREs supply about 13% of the load which leads to the increase of net-load variability. With no providers of frequency regulation, only the HVDC link to Luzon delivers the needed flexibility but also has operating limitations particularly the minimum stable loading and the standby time to reverse the direction of power flow. In some instances, the scheduled HVDC power flow from the market is already near its minimum stable loading that further response due to the variability could not anymore be accommodated, i.e., HVDC cannot further be used as frequency control. The next option of the System Operator is to adjust the scheduled generation from the merit order dispatch. But there are also instances that the HVDC is needed to reverse the direction of power flow. Given the 10-minute standby time, the Visayas Grid is left without any flexible support, which makes the task of the System Operator even more challenging.

Further in the Visayas Grid, most of the solar PVs are located in Negros Island. The concentration of Solar PV in Negros Island led to transmission congestion at certain dispatch schedules due to the limited capacities of existing submarine cable interconnections. This signifies the need to properly integrate generation and transmission planning to avoid or at least mitigate the likelihood of such situations.

There are also some issues with VRE in Luzon Grid but are only local issues. Voltage fluctuations are experienced at the wind farm side in North Luzon when there are prolonged outages of one circuit of adjacent parallel lines. This is caused by the reduction of the short-circuit level or the strength of the grid at the connection point which makes the voltage sensitive to generation variability. To mitigate the issue, the System Operator had developed an operational guideline to limit the total output of the wind farms during prolonged outages of one circuit of adjacent parallel lines.

5.2.3 Action Plan by NGCP

Based on other jurisdictions, there are no studies involving the determination of such maximum penetration limit but rather on the optimistic side; what are the needed changes to the grid to integrate a certain target of VRE. With this, NGCP will conduct a new integration study based on the experience and challenges. NGCP has conceptualized an approach that will not only analyze the variability of VRE but also geographic grid adequacy involving these potential areas of VRE and the system inertia and frequency response. These three areas will provide a clearer integration study to the grid.

The geographic grid adequacy study intends to determine the maximum amount of VRE in potential areas that can be connected without violating static thermal, voltage limits and stability limits. The study will also include the required transmission expansion projects to increase the capacity. The results of this study are intended to be part of the next TDP update. Furthermore, the results of this study will provide a guide to the most plausible areas to connect to the grid.

The inertia and frequency response study intends to determine a limit on the penetration of "inertia-less" generation in each of the regional grid. This study will assess the frequency response of the grid on a certain amount of VRE penetration. The result of the study will provide a basis on when to require operating restrictions on VRE, particularly on the amount and delivery of power sourced from VREs during contingencies.

Lastly, the reserve adequacy study that is previously known as the Renewable Energy Integration Study intends to analyze of VRE variability and review the existing reserve requirements under the Ancillary Services Procurement Plan (ASPP). It is needed to revisit ASPP given that the conventional generator would not follow only the load but rather the residual or net load (load minus VRE). As previously mentioned on the availability of accurate data, NGCP is closely monitoring and recording all the data from the recently installed VRE generators for this study. The result of the study would provide how much VRE capacity can be accommodated using the existing requirements for reserves and how much additional reserves should be scheduled to accomodate more VREs.

Coincidently, a new initiative called "Greening the Grid Project" by the United States Agency for International Development (USAID) and National Renewable Energy Laboratory (NREL) have been conducting an RE Integration Study for the DOE. The project involves the concerned agencies, i.e., DOE, NGCP, GMC and PEMC to work together for a collaborative study. The study will develop a production cost model which is needed to conduct a system-wide economic analysis. The investments needed for flexible generation and transmission infrastructure are among the outputs of the study, which is targeted to be completed in 2017.

NGCP sees that this initiative will complement its proposed studies, particularly the geographic grid adequacy and reserve study with the help of the experts from NREL. After the completion of the project, NGCP can use the results of this study to know what aspects it can focus on in its planned studies discussed above.

5.2.4 Renewable Energy Developments with Certificate of Confirmation of Commerciality

Among the concerns for the renewable energy development, especially the large capacity plants, is the adequacy of the transmission line capacity especially for cases where several renewable energy plant projects are concentrated in one area only. While transmission projects are already being proposed, the completion of transmission projects would take longer time, about 3 to 5 years, compared with the duration of power plant construction.

In the table below, the major RE projects with Certificate of Confirmation of Commerciality[1] are summarized together with the required grid reinforcement and its timing.

Table 5.4a Major RE projects with Certificate of Confirmation of Commerciality in Luzon

<table>
<tr><th>Region</th><th>Location</th><th>Project Name</th><th>Target Date Of Commercial Operation</th><th>Declared Capacity (MW)</th><th>Required Grid Reinforcement</th><th>ETC</th></tr>
<tr><td colspan="4">Solar Projects</td><td>215.68</td><td></td><td></td></tr>
<tr><td>III</td><td>Botolan, Zambales</td><td>Botolan Solar Power Project</td><td>2018</td><td>39.27</td><td>None</td><td></td></tr>
<tr><td>III</td><td>Botolan, Zambales</td><td>Sta. Rita Solar Power Project</td><td>2018</td><td>92.86</td><td>None</td><td></td></tr>
<tr><td>III</td><td>Concepcion, Tarlac</td><td>Concepcion Solar Power Project</td><td>2018</td><td>50.55</td><td>None</td><td></td></tr>
<tr><td>IV-A</td><td>Rodriguez, Rizal</td><td>Macabud Solar Power Project</td><td>2018</td><td>30</td><td>None</td><td></td></tr>
<tr><td colspan="4">Wind Projects</td><td>209.40</td><td></td><td></td></tr>
<tr><td>I</td><td>Pasuquin, Ilocos Norte</td><td>Pasuquin East Wind Power Project</td><td>2018</td><td>48
132</td><td rowspan="3">San Manuel-Nagsaag 500 kV Transmission Line (initially energized at 230 kV)
and
Northern Luzon 230 kV Loop</td><td rowspan="3">Dec 2021

Jun 2024</td></tr>
<tr><td>I</td><td>Pagudpud, Ilocos Norte</td><td>Pagudpud Wind Power Project</td><td>2018</td><td>84</td></tr>
<tr><td>I</td><td>Pagudpud, Ilocos Norte</td><td>Balaoi Wind Power Project</td><td>2018</td><td>45</td></tr>
<tr><td>IV-A</td><td>Pililia, Rizal</td><td>Mt. Sembrano Wind Power Project</td><td>2018</td><td>80.4</td><td>North Luzon Substation Upgrading Project Stage 1 - Malaya 300 MVA Transformer</td><td>Dec 2018</td></tr>
</table>

[1]From DOE: List of Major RE Projects with Certificate of Confirmation of Commerciality

Region	Location	Project Name	Target Date Of Commercial Operation	Declared Capacity (MW)	Required Grid Reinforcement	ETC
Hydro Projects				**209.40**		
CAR	Kabayan, Benguet	Natalang B Hydroelectric Power Project	June 2020	38	Ambuklao - Binga & Binga - San Manuel	Dec 2019
CAR	Kapangan, Benguet	Kapangan Hydroelectric Power Project	February 2019	60	None	
I	Alilem, Ilocos Sur	Alilem Hydroelectric Power Project	December 2019	16.2	None	
I	Sugpon, Ilocos Sur	Danac Hydroelectric Power Project	June 2020	13.2	None	
II	San Mariano, Isabela	Ilaguen	February 2020	19.00	North Luzon Substation Upgrading Project Stage 1 - Gamu 100 MVA Transformer	Dec 2018

Table 5.4b Major RE projects with Certificate of Confirmation of Commerciality in the Visayas

Region	Location	Project Name	Target Date Of Commercial Operation	Declared Capacity (MW)	Required Grid Reinforcement	ETC
Solar Projects				**89.93**		
VI	Victorias City, Negros Occidental	Victorias Solar Power Project	2018	30.63	CNP Stage 3	2020
VI	Tigbauan , Iloilo	Tigbauan Solar Power Project	2018	34.3	CNP Stage 3	2020
VIII	Biliran, Biliran	Biliran Solar Power Project	2018	25	None	
Wind Projects				**74.75**		
VI	Pulupandan, Negros Occidental	Pulupandan Wind Power Project	2018	50	CNP Stage 3	2020
VI	Nabas, Malay, Aklan	Aklan I Wind Power Project Phase I	2018	24.75	CNP Stage 3 / Panitan-Nabas Line 2	2020/ 2018
Hydro Projects				**99.88**		

Region	Location	Project Name	Target Date Of Commercial Operation	Declared Capacity (MW)	Required Grid Reinforcement	ETC
VI	Libacao , Aklan	Main Aklan River Hydroelectric Power Project	September 2018	15	CNP Stage 3	2020
VI	Madalag , Aklan	Timbaban Hydroelectric Power Project	May 2018	18	CNP Stage 3	2020
Geothermal Projects				**50.00**		
VIII	Biliran	Biliran Geothermal Project	4th Qtr. 2018	50	None	

Table 5.4c Major RE projects with Certificate of Confirmation of Commerciality in Mindanao

Region	Location	Project Name	Target Date Of Commercial Operation	Declared Capacity (MW)	Required Grid Reinforcement	ETC
Biomass Projects				**38.55**		
CARAGA	Buenavista, Agusan del Norte	23.5 MW EPC Woody Biomass Power Plant Project	2019	20.68	None	
ARMM	Sultan Kudarat, Maguindanao	15 MW LPC Rice Husk-Fired Biomass Power Plant Project	2017	13.5	None	
Solar Projects				**96.00**		
XII	General Santos City, South Cotabato	GenSan Solar Power Project Phase I	2018	48	None	
XII	General Santos City, South Cotabato	GenSan Solar Power Project Phase II	2018	48	None	
Hydro Projects				**375.79**		
X	Baungon and Libona, Bukidnon	Bubunawan Hydroelectric Power Project	2021	23	None	
X	Impasugong and Sumilao, Bukidnon	Tagoloan Hydroelectric Power Project	June 2018	39	None	
X	Kalilangan & Wao, Bukidnon	Maladugao River (Lower Cascade) Hydroelectric Power Project	April 2020	15.7	None	
X	Santiago, Bukidnon	Manolo Fortich 1 Hydroelectric Power Project	October 2019	43.4	Manolo Fortich S/Y	2017

Region	Location	Project Name	Target Date Of Commercial Operation	Declared Capacity (MW)	Required Grid Reinforcement	ETC
X	Santiago, Bukidnon	Manolo Fortich 2 Hydroelectric Power Project	October 2019	25.4	Manolo Fortich S/Y	2017
X	Iligan City, Lanao del Norte	Bayug Hydroelectric Power Project	2022	17.81	None	
XIII	Jabonga, Agusan del Norte	Lake Mainit	March 2016	25	None	
XIII	Jabonga , Agusan del Norte	Puyo Hydroelectric Power Project	July 2018	30	None	

The other renewable energy potentials are shown in Appendix 3.

5.3 Potential Resource Areas

5.3.1 Coal

The Philippines is largely a coal consuming country with coal having the highest contribution to the power generation mix at 44.5% in 2015. The Philippines has a vast potential for coal resources just awaiting full exploration and development to contribute to the attainment of the country's energy self-sufficiency program. As of 31 December 2015, our in-situ coal reserves amount to 470 million metric tons or 19.7% of the country's total coal resource potential of 2.39 billion metric tons[2].

Table 5.5 Potential Coal Resource Areas in the Philippines

	AREA	MUNICIPALITIES		
1	Cagayan Valley	Benito Soliven	Cauyan	Gattaran
		Iguig		
2	Cebu	Asturias	Catmon	Naga
		Balamban	Compostela	Oslob
		Boljoon	Dalaguete	Pinamungahan
		Carmen	Danao	Toledo City
3	Davao	Manay	Tarragona	
4	Masbate	Cataingan	Palanas	
5	Mindoro	Bulalacao	San Jose	
6	Negros	Bayawan City	Calatrava	
7	Bicol	Bacon	Gubat	Rapu-Rapu
8	Catanduanes	Bagamanoc	Caramoran	Panganiban

[2] As discussed in the DOE website. Data in Tables 5.5 and 5.6 are provided by DOE.

	AREA	MUNICIPALITIES		
9	Quezon	Bordeos	Polillo	
10	Antique	Caluya		
11	Surigao	Alegria	Guigaquit	San Miguel
		Bacuag	Kicharao	Tago
		Bislig City	Lingig	Tandag
		Cagwait	Marihatag	
12	Zamboanga	Buug	Ipil	Payao
		Diplahan	Kabasalan	Siay
		Godod	Malangas	
		Imelda	Naga	
13	Sarangani	Maitum		
14	South Cotabato	Lake Sebu		
15	Sultan Kudarat	Bagumabayan	Palimbang	Senator Ninoy Aquino
16	Agusan	Bunawan	Butuan City	Trento

5.3.2 Oil

Oil-based power generation contributed to 7.1% of the power generation mix in 2015. The Philippines has 2.8 to 3.9 trillion cubic feet of proven natural gas reserves. The largest natural gas development project in the country, Malampaya, fires three power plants with a combined 2,700 megawatts (MW) capacity with remaining reserves for an additional 300MW of power. Other than the Malampaya gas discovery, there are still no new significant discoveries that have been found in the country.

Table 5.6 Potential Coal Resource Areas in the Philippines

BASIN	AREA (sq km)	TOTAL RESOURCES		
		OIL (million bbl)	CONDENSATE (million bbl)	GAS (billion cubic ft)
North West Palawan	36,000	547.5	156.1	14,285
South West Palawan	44,000	549	9.7	4,529
Central Luzon	16,500	0	0	5,063
Visayan	46,500	903	0	1,998
Mindoro-Cuyo	58,000	771	0	342
Cagayan	24,000	30.5	0	2,063
East Palawan	92,000	317	0	703
SE Luzon	66,000	258	7	242
Reed Bank	71,000	34	0.05	2,228

BASIN	AREA (sq km)	TOTAL RESOURCES		
		OIL (million bbl)	CONDENSATE (million bbl)	GAS (billion cubic ft)
Cotabato	14,000	84	0	418
Agusan-Davao	33,000	59	1	768
Sulu Sea	115,000	130	0	405
West Luzon	16,000	0	0	129
Ilocos	19,500	0	0	106
Bicol Shelf	32,500	0	0	247
Iloilo-West Masbate	25,000	1	0	21
TOTAL		**3684**	**173.85**	**33,547**

Out of the total resources, 93.96% of oil resources remain undiscovered. 31.72% of condensate and 73.61% of gas resources have yet to be discovered as well.

5.4 Ideal Locations of Power Plants

To serve as a guide for generation investors, this section identifies the substations where new power plants may connect without the need for any significant transmission reinforcement. These recommended connection points, however, should be viewed from a transmission planning perspective and are based on the capability of the existing grid and already considering the completion of ERC-approved projects for the 3rd Regulatory Period and without consideration on the following other requirements in generation location siting, particularly for the non-site specific plants: (a) fuel supply/transport; (b) topology/geology of site; (c) accessibility; (d) availability of area; (e) availability of cooling water; (f) fresh water supply; (g) security; and (h) environmental/social concerns.

It can be noted, however, that the existing transmission facilities in some generation potential areas have no much room particularly in accommodating bulk generation addition. Thus, new transmission backbone developments are usually required first for the entry of new large capacity plants.

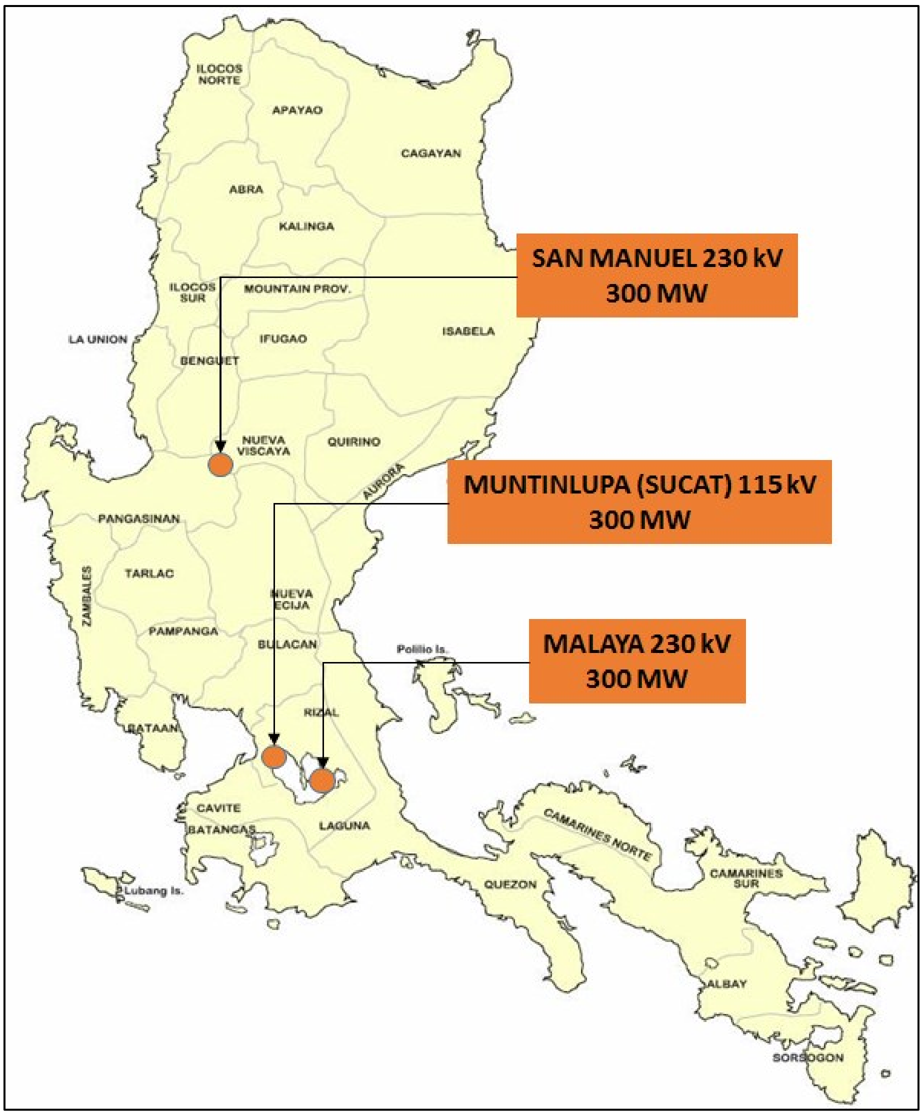


Figure 5.4: Ideal Location of Power Plants (Luzon)

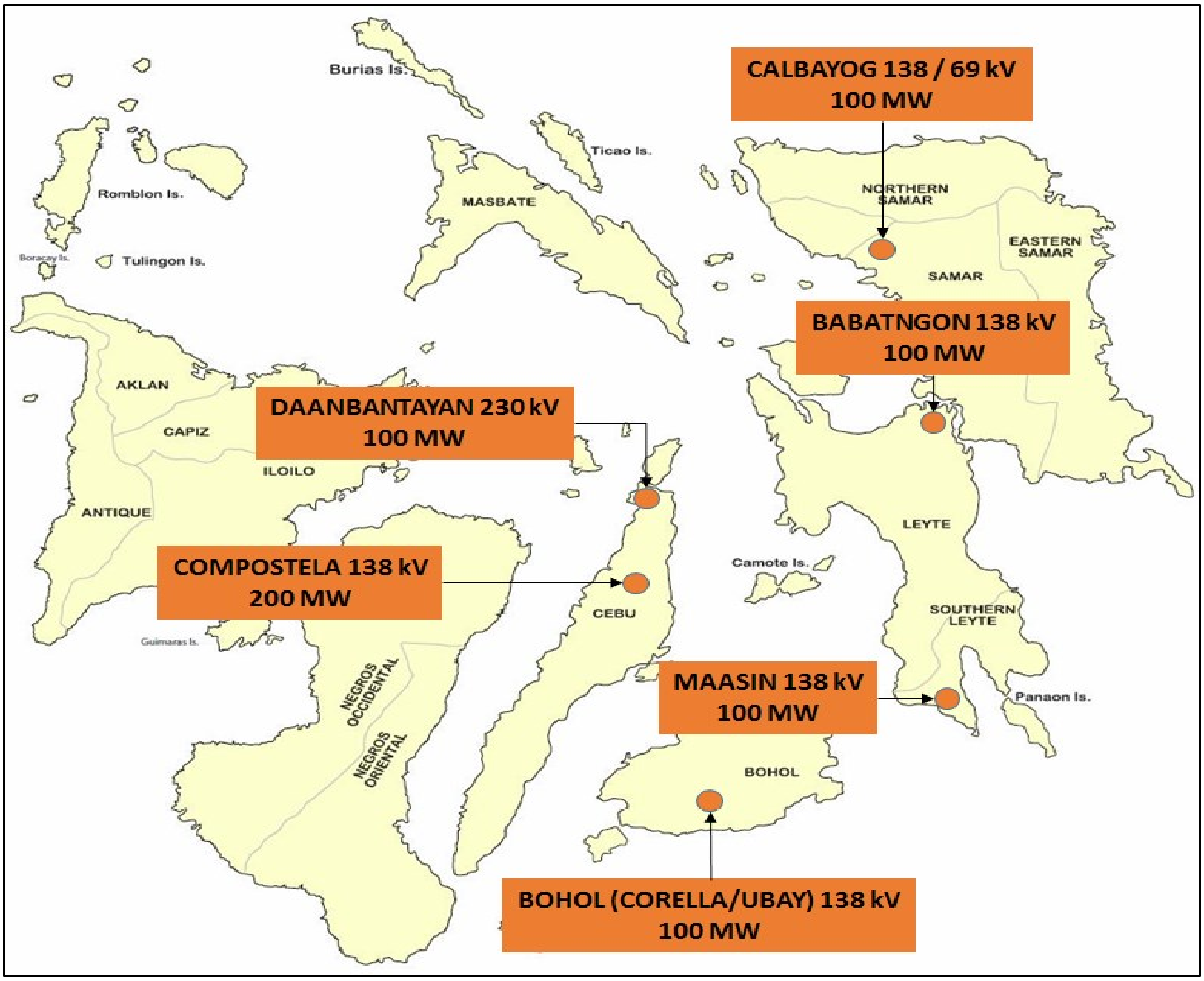
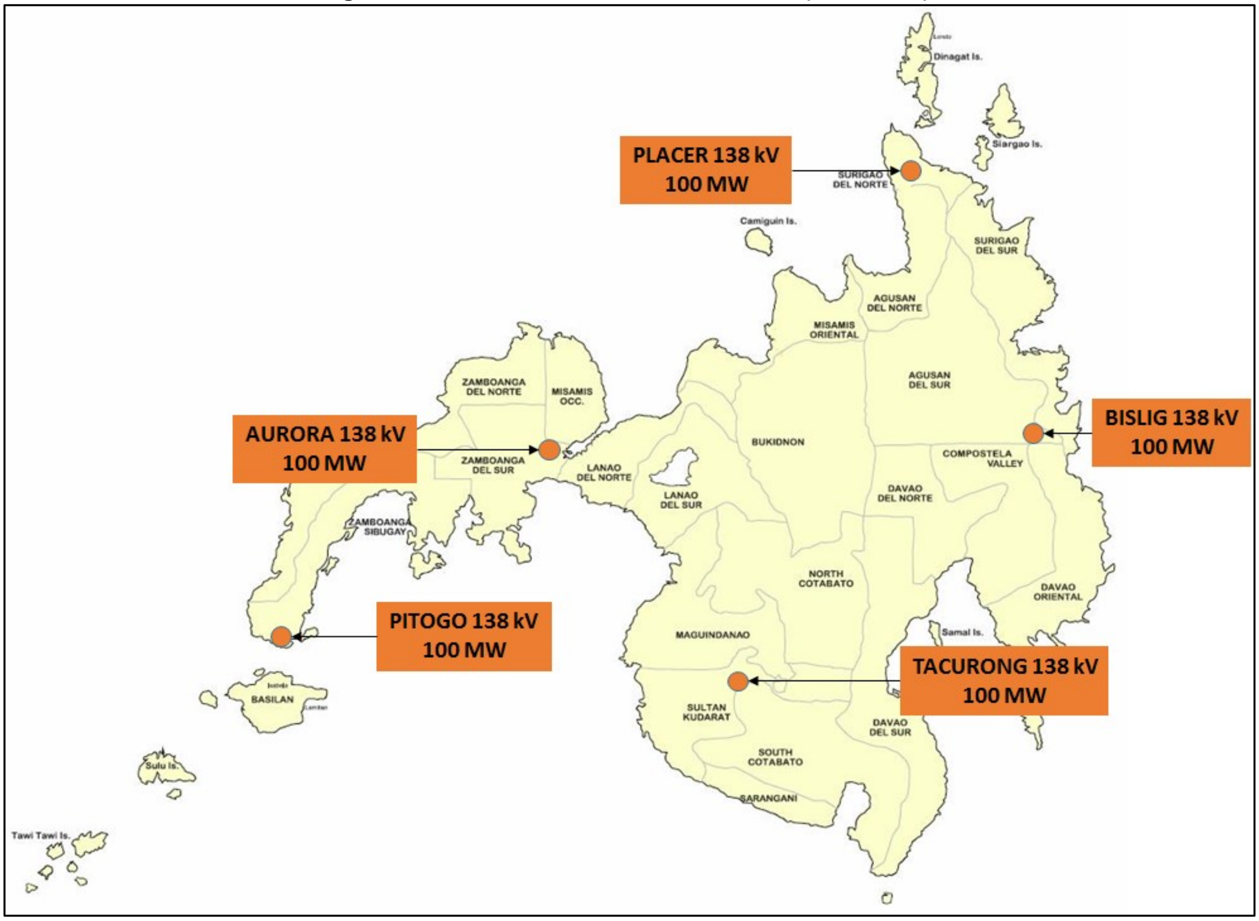


Figure 5.5: Ideal Location of Power Plants (Visayas)

Figure 5.6: Ideal Location of Power Plants (Mindanao)



In order to improve the ability of the power system to withstand the effects of adverse environmental conditions, natural or man-made power interruptions and other disturbances, there is a need to further reduce the technical and human risks to minimize disruption of power delivery service to the electricity end users. A high degree of system reliability is equivalent to a high availability of the electricity supply service, while system security refers to the robustness of a power system to withstand unexpected events having severe consequences[3].

6.1 Climate Change Adaptation Measures

NGCP supports the seven Strategic Action Plans under the National Climate Change Action Plan (NCCAP) formulated by the Climate Change Commission (CCC). Specifically, NCCAP "Strategic Actions on Sustainable Energy for 2011 to 2028", highlights the following facts:

a) The Philippines is facing formidable challenge of developing sustainable clean energy options to support the requirements of economic and social development with minimal adverse effects on the environment;

b) The country continues to rely on importation to meet energy demand. Based on the 2010 DOE data, the country imports an average of 300,000 barrels per day of crude oil and petroleum products and more than three quarters of its coal consumption;

c) The country's total energy sufficiency, however, has been increasing from 48 % in 2001 to 59% in 2009 due to the increase in renewable energy production; and

d) Environmental sustainability and energy security are the twin energy challenges caused by the country's economic growth and rapid urbanization. The energy sector is a major source of greenhouse gas emissions, whereas the transport and electricity generation are the biggest Green House Gas (GHG) emitters.

The NCCAP further emphasized that "the energy sector has to respond to significant changes in demand due to fluctuation in temperature and weather condition to ensure that energy systems are able to adapt to the impacts of climate change". **Climate-proofing and rehabilitation of energy systems infrastructures** is one of the four priorities identified to address the climate change issues of the energy sector.

In the Transmission Sector, considering the economic lives[4] of transmission infrastructures being implemented by NGCP, the following are the details of climate change adaptation initiatives in support to the NCCAP:

a) The maximum wind velocity design of overhead transmission lines' (OHTL) support structures is based on three wind zones: Zone 1 (270 kph), Zone 2 (240 kph) and Zone 3

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[3] CIGREE-IEEE joint task force on stability terms and definitions

[4] Under the Performance-Based Regulation (PBR), the economic lives of transmission assets ranges from 15 to 50 years (depending on the type of assets, e.g., transmission lines, substations, protection and communication facilities, etc.)

(160 kph). In view of the increasing frequency of super typhoons that hit various areas in the country in the past decade, NGCP will be increasing the maximum velocity design of support structures for all OHTL including substation take-off towers and other support structures;

b) In the transmission line route selection process, careful evaluation are undertaken to avoid areas prone to flood, with steep slopes prone to soil erosions, and with sufficient distance from fishponds, rivers, lakes, swamps and seashores;

c) For substation sites, the risk of flood or flash flood are carefully assessed, while avoiding areas that are considered possible sources of pollutions, e.g., industrial plant/buildings that generate polluted gases, storage areas for explosive or inflammable materials, bulk oil storage tanks and oil/gas pipelines. If necessary, close proximity to seashores are also avoided to prevent or minimize corrosions and depletion or failure of insulations of substation equipment; and

d) For existing overhead transmission lines critical function to the grid and are located in areas vulnerable to typhoon, the use of HV underground cables will be thoroughly considered.

Furthermore, NGCP selects overhead transmission line routes and substation sites that have minimal effect on human settlement or as much as possible, minimize the removal of vegetation or cutting of trees.

6.2 Challenges on the Right-Of-Way (ROW)

6.2.1 Right-of-Way of Existing Transmission Lines

Among the challenges is to keep the transmission lines free from any obstruction from vegetation and structures that may breach safety clearance and may damage towers and lines. Damaged towers and downed lines pose danger and can result in service interruption. Vegetation, i.e., trees that grow too close to the electric lines can cause power outage. Effective vegetation management has become a very essential part not only of constructing new transmission facilities, but also of operating and maintaining a safe and reliable transmission system.

NGCP undertakes a program on pruning/trimming, or cutting as may be allowed, of trees/vegetation that pose threat to transmission lines, whether growing inside or outside the right-of-way. NGCP is faced with various problems in implementing right-of-way clearing activities, particularly in Mindanao. Critical lines are being affected by vegetation as uncooperative landowners refused to allow maintenance staff to conduct clearing operations. To complicate matters, there are landowners that have intentionally planted fast growing trees under the conductors and even within the tower sites, and unreasonably demand payments for the pruning/cutting of the trees as will be regularly required.

6.2.2 Right-of-Way of New Transmission Projects

In some cases, the aggressive timeline of new power plants that are not part of previous generator list as committed or indicative project resulted in shorter lead time for NGCP to secure regulatory approval and to put up the necessary facilities to support their connection to the grid. Having the adequate lead time is particularly crucial for right-of-way acquisition for new transmission line developments. The deployment of more right-of-way teams may not necessarily work unless adequate lead time is observed, specifically for the resolution of expropriation cases. The locations of generating facilities are also determined by the proponents, in many cases in critical parts of the network resulting in more congested transmission corridors.

The incoming large capacity coal-fired power plants as well as natural gas-fired power plants in Luzon are mainly concentrated in four (4) provinces namely: Batangas, Quezon, Bataan and Zambales. The existing capacity of transmission corridors in those areas will not be adequate to reliably integrate these new capacities into the Luzon Grid. Thus, the network expansion will be geared towards 500 kV transmission facilities which will require building new transmission lines with broader right-of-way requirements.

Acquiring lands for future substation sites and transmission lines in urban center has become inevitable as the available lot size diminishes and land prices go up with the rapid urbanization growth. Land banking would be more economical compared to acquiring land on a per project approach or as the need arises. Strategic locations of these future substations and transmission lines can be readily identified in the Transmission Master Plan.

6.2.3 National Interest Electric Transmission Corridors

The Energy Policy Act of 2005 (2005 EPACT) in the United States gave the US Department of Energy (DOE) the power to identify areas of the national electric grid with problematic reliability and designate such areas as National Interest Electric Transmission Corridors ("NIETCs" or "National Corridors"). This allows the DOE to consider the long-term requirements for transmission corridors.

In the Philippines, the DOE is advocating for energy projects to be declared as Projects of National Significance. This will be particularly helpful given the conflicting interests of stakeholders in provinces and regions being traversed by NGCP's transmission line. As building transmission lines is imbued with national interest, a law that ensures that these infrastructures are considered in the medium- to long-term development plan of the country may also be necessary. More importantly, the assistance from the national government and its agencies would be very important in ensuring that the common good takes precedence over parochial interests.

6.2.4 Need for Integrated Infrastructure Corridor

The ideal approach in right-of-way acquisition and management is an integrated infrastructure corridor. In an integrated infrastructure corridor, transmission and distribution power lines, telecommunication lines, railways, highways, water supply and drainage share a common corridor but each allocated with a designated area. This approach is already being practiced in some jurisdictions abroad through a well thought legislation. NGCP will support this initiative if this will be the approach that the government will implement in the future. In the meantime, NGCP is already considering in the transmission line route selection the sharing of right-of-way with national highways or expressways. This approach though may result in a longer transmission line length.

For the associated transmission line of the proposed Taguig 500 kV Substation, NGCP has coordinated with designer of the Southeast Metro Manila Expressway (SEMME) Project for possible alignment of the line with the C-6 highway. Aligning the transmission line route with the highway will avoid populated areas and will minimize right-of-way cost.

6.2.5 Engineering Surveys and Identification of Landowners

Parcellary survey poses a number of problems, chief of which is the unavailability of cadastral survey – an indication that the government has not yet undertaken survey of the affected lots. Without such records, there will be no technical descriptions as basis to draw the plans of the affected lots. In some cases, the available records are only for the individual surveys initiated by the landowners.

Records from concerned government agencies (DENR, LMB, RoD and Assessors Office) are most often incomplete or inconsistent from one another and therefore not always reliable. In addition, most lot records are not updated particularly those sold to new owners and the sale not registered. The absence of records of affected lots would entail the conduct of NGCP's own survey, verification and data gathering from concerned landowners. There is also limited number of dependable service providers to conduct the survey works.

Upon completion of engineering surveys, NGCP's main source of information to establish the ownership of affected lands will be the LRA. In some areas, it is not uncommon to encounter LRA personnel who refuse to release copy of Original Certificate of Title (OCT) or Transfer Certificate of Title (TCT). It usually takes 15 to 30 days to secure from the concerned Register of Deeds certified true copy of land titles. Proof of ownership of properties covered by the Comprehensive Agrarian Reform Program is usually not available as these properties are not subdivided individually to the beneficiaries and the corresponding TCT are not available. The mother TCT is usually in the possession of a government bank pending full payment of the beneficiaries.

Identification and verification of land ownership also pose problem to researchers due to the following reasons: (a) owner is residing abroad and contact cannot be established; (b) living heirs cannot be located and difficulty in establishing extrajudicial partition of estate; (c) property is mortgaged; and, in some cases (d) subdivided lots are not registered.

6.2.6 Socio-environmental Concerns of the Stakeholders

Aesthetics and potential impact on environment, human health and safety are the common concerns raised by communities where the transmission facilities will be installed. Among the usual questions in consultation meetings are: (a) whether or not the transmission line could be relocated somewhere else; (b) if it would be possible to re-route the line; (c) the safety of people living near the power lines; and (d) environmental impact during and after construction.

The final approved route for a new transmission line would be based on the result of thorough investigation of alternative routes, with due consideration to environmental, cultural, social, engineering, construction, maintenance factors and economic factors. Among the important considerations is to select, as much as possible, a route or location with the least affected communities.

Generally, it is safe to live near a transmission line as long as precautionary measures are taken, primarily the observance of safe distance from the power conductors. NGCP's facilities and operation are in accordance with the Philippine Electrical Code (PEC) and International Commission on Non-Ionizing Radiation Protection **(ICNIRP)** guidelines. **ICNIRP** is an independent scientific organization responsible for providing guidance and advice on the health hazards of non-ionizing radiation exposure. The PEC prescribes the required clearances for transmission lines while ICNIRP guidelines sets the EMF exposure limits. NGCP is addressing this issue by ensuring it has the most up-to-date and relevant information on EMF. It has been following reviews and developments on EMF studies. It likewise conducts information campaigns on EMF for its employees and the general public.

Construction activities at the tower and substation sites would have potential effects on the environment such as temporary soil disturbance, cutting of affected trees, generation of solid wastes and in few cases, temporary disturbance of nearby bodies of water. The mitigating measures are contained in the Terms of Reference (TOR) for the contractor who will implement the project as provided under the Initial Environmental Examination (IEE), a pre-requisite for the issuance of Environmental Compliance Certificate (ECC). In addition, NGCP also secures the following permits from DENR: Special Tree Cutting permit and Special Land Use Permit or Special use Agreement of Protected Area. Zoning/locational clearance is also secured from the concerned local government unit.

6.2.7 Challenges with Landowners

For the affected landowners, the compensation package for the affected properties, including the payment of taxes, is of utmost concern. Voluntary grant of land rights does not come easy even with the appropriateness of market value being offered. In the end, it would depend on the landowners – if they would be reasonable to accept the market value of their properties or aim for a financial windfall by demanding for higher amount.

It should be pointed out that anything less than 100% availability of workable sites might cause delays in the completion of the project. Partial availability of land rights does not mean that partial capacity of the line would be available and that electricity would already be transmitted over the line. For this reason, every landowner matters, regardless of the size of the affected lot.

There would be situations when voluntary agreement from the affected landowners would not come easy, in particular to those who refuse to accept the project without citing any reason at all. When faced with this situation, there is no recourse for NGCP but to exercise its right to eminent domain in order to deliver its obligations and serve the common good.

The expropriation cases will be filed in the local courts and challenges will be faced particularly if the landowners are known to be influential in the community. It takes time for the courts to resolve the cases and issue the Writ of Possession for the affected lots. One factor is the limited number of courts to handle the cases and the multiple cases they handle.

Abaga-Kirahon Transmission Project (Mindanao) has the longest expropriation case which took 49 months to resolve, followed by Santiago-Alicia line (Luzon) at 40 months, Colon-Cebu Transmission Project and Lumban-Bay, both at 25 months. Completing the top 5 is Bauang-San Esteban (21 months) transmission project.

6.2.8 Challenges with Other Stakeholders

The implementation of community development project is a partnership strategy of NGCP to communities hosting its transmission projects, particularly new substation and cable terminal station projects. The objective is to help secure project acceptance by bringing positive impact to host communities through the implementation of beneficial development projects.

This development initiative comes in the form of financial assistance provided by NGCP to fund the barangays' priority projects. Usually supported by a Barangay Council Resolution and implemented through a Memorandum of Agreement, these small projects include logistical support to the needs of the affected villages such as two-way radio and uniform for barangay tanod (village guards), improvement of barangay hall, repair of water distribution system and construction of solar dryer (a small concreted pavement where farmers could dry their palay harvest). The projects go a long way in building a good relationship between NGCP and host communities.

For *Ancestral Domain and Indigenous People,* NGCP has to go through the processes provided under the law[5] to secure necessary clearance for proposed transmission facilities that will traverse ancestral domain. Firstly, the prior certification from the National Commission on Indigenous Peoples (NCIP) must be secured certifying that the areas affected do not overlap with or affect any ancestral domain. The certification will only be issued after a field–based investigation (FBI) is conducted by the concerned ancestral Domains Office. The conduct of FBI and the issuance of Free and Prior Informed Consent (FPIC) from the concerned indigenous cultural communities and indigenous people (ICC/IP) are required prior to issuance of Certificate Precondition (CP). After a favorable decision from the concerned ICC/IPs has been secured, the negotiation process on the benefits for the ICC/IP will begin. The negotiation takes time as ICC/IP would usually demand for more benefits. The results of the negotiation will be contained in a Memorandum of Agreement among ICCs/IPs, NGCP and NCIP. The report on the whole process of FBI and FPIC including the MOA shall be subject to the deliberation and approval of the NCIP Commissioners meeting En Banc. Upon the approval of the MOA, the CP will be issued.

The law empowered the ICC/IP on their rights to benefit from the utilization, extraction, use and development of lands and natural resources within their ancestral lands/domains and to be compensated for any social and/or environmental costs of such activities. It must be emphasized that transmission line projects, which involve only the use of land to build the pylons or towers, should be differentiated from other projects, e.g., mining and hydro power, which entail utilization and even extraction of natural resources. NGCP, in building the

[5] Republic Act No. 8371, the Indigenous Peoples' Rights Act of 1997

structures within the ancestral lands, does not extract mineral from the land or make use of resources such as water or geothermal to generate electricity.

Aside from the actual landowners, cases of informal settlers are also among the major concerns during project implementation. This can result in delays in projects as well as operational issues during the conduct of transmission line maintenance activities for existing transmission lines. To address this, NGCP needs the coordination and support of the local government units.

6.2.9 Security of Transmission Assets

In areas with security issues, each proposed transmission project is subjected to security assessment as part of transmission line route or substation site selection process. All security threats are thoroughly identified to determine the necessary mitigation measures that will be implemented during construction and its eventual operation.

The major network developments are triggered by the entry of new power plants to the grid. For major power outages previously experienced, like the incident in Calaca 230 kV Substation in May 2013, the major system requirements to address the criticality of the configuration of the transmission network in Batangas area have been already identified prior to the incident. These include the recently completed Lumban-Bay 230 kV Line Project and the implementation of the new Calaca-Dasmarinas Transmission Line Project which is actually driven by the new power plants in Batangas.

The projects already approved by the ERC are in various stages of implementation. The approval, as contained in the Final Determination (FD), was obtained in 2010 during the regulatory reset process for the Third Regulatory Period. In addition, there are other projects provisionally approved by the ERC as of December 31, 2015 which will form part of the application for the Fourth Regulatory Period to obtain the final approval.

7.1 Projects Completed in 2014 and 2015

Summarized below are the projects completed or energized from 01 January 2014 to 31 December 2015. In this period, NGCP completed a total of 1,175 circuit-km of overhead transmission lines and installed 4,325 MVA additional substation capacities and 707.5 MVAR of reactive power support.

Table 7.1: Completed Projects in 2014-2015

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
LUZON					
Binga-San Manuel 230 kV T/L, Stage 1 -Binga S/S Upgrade	To address the old age condition of the line and provide N-1 contingency during maximum dispatch of the generating power plants in North Luzon.	50			Dec 2015
Dasmariñas EHV S/S Expansion Project	To maintain the provision for N-1 contingency for the transformers at Dasmariñas drawdown substation.	900			Oct 2014
Mariveles Coal Transmission Reinforcement Project -BCCPP S/S Expansion	To maintain the N-1 contingency provision of the line during maximum dispatch of both Mariveles CFPP and Limay B-CCPP units.				Dec 2014
Lumban-Bay 230 kV T/L Project -Lumban-Kalayaan Line 1 -Lumban-Bay Line 2 -Lumban-Calauan Line 2 -Lumban-Bay Line 1 -Lumban-Malaya Line 1	To increase the capacity of this corridor in order to accommodate any generation dispatch scenarios			80	 Jan 2015 Mar 2015 Mar 2015 Mar 2015 May 2015

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
Luzon Voltage Improvement Project 1 -Araneta S/S	To improve the voltage profile during normal conditions and address the potential undervoltages during N-1 contingency conditions.		100		Feb 2016
Luzon Voltage Improvement Project 2 -Biñan S/S -Dasmariñas S/S -Mexico S/S	To improve voltage regulation and keep the voltages in the area within the Grid Code prescribed limits both during normal and N-1 contingency conditions.		200 200 200		Jul 2015 Oct 2015 Sep 2015
Luzon S/S Expansion Project 2 -Ambuklao S/S -Concepcion S/S -La Trinidad S/S -Mexico S/S -Santiago S/S	To meet load growth and to provide N-1 contingency to various substations in North Luzon.	50 100 600 400			Dec 2014 Aug 2014 Oct 2014 Jun 2015 Jul 2014
Luzon S/S Expansion Project 3 -Batangas S/S	To maintain the provision for N-1 contingency due to increasing load.	600			Nov 2014
Luzon S/S Expansion Project 4 -Bayombong S/S -Limay S/S -Muntinlupa S/S	To add substation capacity to accommodate load growth.	75 100 300			Aug 2015 Dec 2014 Mar 2015
San Esteban-Laoag 230 kV T/L Project Stage 2 -Line 2 -Line 1 -Laoag S/S -San Esteban S/S	To strengthen the existing corridor to provide N-1 contingency and to support the wind farm connections.	600	7.5	240	Sep 2015 Dec 2015 June 2014 Dec 2015
VISAYAS					
Bohol Backbone 138 kV T/L	The Ubay-Corella 138 kV line is necessary to prevent the overloading of Ubay-Trinidad 69 kV line during outage of Ubay-Alicia 69 kV line segment, and vice versa. The new substation in Corella will provide a new bulk power delivery point in Bohol and help reduce the load of Ubay S/S.	100		191	June 2014
Visayas S/S Expansion Project 1 -Calong calong S/S -Kabankalan S/S	To accommodate the projected load growth in the area.	50 50			Sep 2014 Mar 2014
Visayas S/S Reliability Project 1 -Babatngon S/S	To provide N-1 contingency transformers at various substations	50			Jul 2015
Visayas S/S Reliability Project 2 -Babatngon S/S	To provide N-1 contingency transformers at various substations	50			Nov 2015

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
Southern Panay 138 kV Backbone -Sta. Barbara-San Jose T/L -Sta. Barbara S/S	To accommodate load growth in Southern Panay	 50		 194	 Dec 2015 Dec 2015
MINDANAO					
Mindanao S/S Reliability Project 1 -Aurora S/S -Jasaan S/S	To provide N-1 contingency transformers at various substations	100 100			Feb 2014 Dec 2015
Villanueva-Maramag 230 kV T/L Project	To complete the transmission corridor from northern to southern Mindanao.			216	Aug 2014
Balo-i-Villanueva 230 kV T/L Project	To provide new transmission corridor to Agus Hydro for higher reliability.			240	Jan 2015
Opol S/S Project -Transmission Line	To address the increase in demand and improve power quality in the area			14	Nov 2015
	TOTAL	**4,325**	**707.5**	**1,175**	

In addition to the above list, there are transmission projects that are not part of the Final Determination for the Third Regulatory Period but have been reclassified from connection asset to transmission asset. It also includes ERC approved projects implemented in advance by the concerned power plant proponents. The facilities in this table are either for acquisition or for reimbursement to the power plant proponent.

Project Name	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
LUZON					
Hanjin 230 kV Substation	This is an existing substation constructed to accommodate the connection of Hanjin Heavy Industries and Construction Philippines, Inc. (HHIC-PHIL Inc.) in Subic. Because of its cut-in configuration to the Botolan-Olongapo 230 kV Line, the Hanjin Substation itself is part of the transmission corridor, thus, reclassified by the ERC to transmission asset. The main components reclassified are the cut-in lines and the 230 kV switchyard excluding the existing 2x83 MVA transformers which are dedicated facilities to HHIC-PHIL Inc.			34	2007 (Reclassified in October 2011)

Project Name	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
Mariveles 230 kV Substation	This substation is presently serving the Mariveles Coal-Fired Power Plant and load customers namely PENELCO and AFAB through a 100 MVA 230/69 kV transformer and new 69 kV lines. The ERC has reclassified the substation including the Mariveles-BCCPP A 230 kV Transmission Line from connection asset to transmission asset.	100		36	2013 (Reclassified in June 2014)
MINDANAO					
Toril 138 kV Substation (Stage 1)	This project was implemented in advance by Therma South Inc. (TSI) to accommodate the connection of the 2x150 MW TSI CFPP. It involves a new substation connected as bus-in to the Matanao-Davao 138 kV Transmission Line. Due to limited line capacity, the implemented project also included the reconductoring of the Toril-Davao Line segment.				2015
	TOTAL	100		70	

7.2 Projects for Completion in 2016

The list below summarized the updates on other ERC approved projects and with the indicated expected time of completion or ETC. This includes the previously completed projects but still with some remaining components yet for completion.

Table 7.2: Projects for Completion in 2016

Project Name / Components	Driver	Purpose & Remaining Major Components	ETC
LUZON			
Luzon Voltage Improvement I -Araneta S/S*	PQ	To maintain the voltage profile at various substations within the prescribed limits Doña Imelda: 2-50 MVAR 115 kV capacitor	Feb 2016
Luzon Substation Expansion III -Batangas S/S* -Bay S/S*	LG	To add substation capacity to accommodate load growth. Batangas: 1-300 MVA 230/69 kV transformer Bay: 1-100 MVA 230/69 kV transformer	Mar 2016

Project Name / Components	Driver	Purpose & Remaining Major Components	ETC
Bacnotan Tap-Bacnotan 230 kV T/L*	SR	To improve the reliability of the Bauang-Bacnotan-San Esteban Line by replacing the wood pole structures with steel tower structures in the segment immediate to Bacnotan Substation. This is an ERC approved project originally under O&M capex.	Mar 2016
Luzon Substation Reliability I -San Esteban S/S* -Botoloan -Labo S/S	SR	To add substation capacity to provide N-1 contingency Botolan: 1-50 MVA 230/69 kV transformer Labo: 1-50 MVA 230/69 kV transformer San Esteban: 1-50 MVA 115/69 kV transformer	May 2016
Balingueo (Sta. Barbara) 230 kV S/S*	LG	To provide a new substation to adequately and reliably serve the load centers in the province of Pangasinan Balingueo: 1-100 MVA 230/69 kV transformer	Jun 2016
Dasmariñas EHV Substation	SR	The installation of new 1-600 MVA 500/230 kV transformer has been completed already. The remaining project component is the replacement of some 230 kV PCBs to increase the fault interrupting capability of the substation.	Jul 2016
Las Piñas (Zapote) S/S Expansion	LG,SR	Installation of the 4th transformer unit for N-1 contingency for the 230/115 kV transformers. This will address the ex-ante pricing errors in the WESM Market Operation brought about by the contingency constraint violations in Las Piñas Substation. Las Piñas: 1-300 MVA 230/115 kV transformer	Sep 2016
Eastern Albay 69 kV T/L Stage 1	LG,SR	To provide reliable power service delivery in eastern Albay by developing new 69 kV supply line and a new 69 kV substation in Sto. Domingo. Daraga-Sto. Domingo: 1-336.4 MCM ACSR, SP-SC, 20 km	Dec 2016
Luzon Substation Expansion IV	LG	To add substation capacity to accommodate load growth. Daraga: 1-100 MVA 230/69 kV transformer Gumaca: 1-50 MVA 230/69 kV transformer Santiago: 2-100 MVA 230/69 kV transformer Tuguegarao: 1-100 MVA 230/69 kV transformer Nagsaag EHV: 1-100 MVA 230/69 kV transformer	Dec 2016
Luzon PCB Replacement	SR	To replace old PCBs to improve substation reliability at San Jose, Labo, Malaya and Gumaca.	Dec 2016
Santiago-Tuguegarao 230 kV Line 2	SR	To provide N-1 contingency for the existing transmission corridor serving Isabela and Cagayan Santiago-Tuguegarao: 1-795 MCM ACSR, 118 km	Dec 2016
VISAYAS			
Eastern Panay Transmission Project	GE	To accommodate the grid connection of PCPC's 300 MW CFPP implemented by the power plant proponent	Jun 2016
Sta.Rita-Quinapundan 69 kV T/L	SR	To make Quinapundan Substation closer to its power source and thus, provide a more reliable power delivery system.	Jun 2016
Southern Panay Backbone	LG	To accommodate load growth in Southern Panay by extending the 138 kV backbone. San Jose: 1-50 MVA 138/69 kV transformer	Jun 2016

Project Name / Components	Driver	Purpose & Remaining Major Components	ETC
Colon-Cebu T/L	CA	To provide additional capacity to meet load growth and to accommodate the full dispatch of coal plants Colon-Cebu: 138 kV 1-795 MCM ACSR, ST-DC, 25 km	Jul 2016
Culasi-San Jose 69 kV T/L	SR	To provide N-1 contingency for the existing corridor Culasi-San Jose: 1-336.4 MCM ACSR, ST-SC, 86 km	Jul 2016
Calong-Calong-Toledo-Colon 138 kV T/L	GE	To accommodate the full generation capacity of the 246 MW CEDC Coal and the 82 MW TPC Coal Calong-calong-Colon: 1-795 MCM ACSR, ST-DC, 28 km	Aug 2016
Ormoc-Maasin 138kV T/L	SR	To provide N-1 contingency for the existing corridor Ormoc-Maasin: 138 kV 1-795 MCM ACSR, ST-DC2, 113.97 km	Aug 2016
Ormoc-Babatngon 138 kV T/L	SR	To provide N-1 contingency for the existing corridor by installing the second circuit Ormoc-Babatngon: 1-795 MCM ACSR, ST-DC1, 78.54 km	Oct 2016
Visayas Substation Reliability I	SR	To add substation capacity to provide N-1 contingency Ormoc: 1-150 MVA 230/138 kV transformer Amlan: 1-50 MVA 138/69 kV transformer Bacolod: 1-100 MVA 138/69 kV transformer Cadiz: 1-50 MVA 138/69 kV transformer* Maasin: 1-50 MVA 138/69 kV transformer Samboan: 1-50 MVA 138/69 kV transformer	Dec 2016
Negros V T/L	LG	To accommodate load growth in Northeastern Negros and to provide operational flexibility San Carlos-Guihulngan: 69 kV 1-336.4 MCM ACSR, ST-SC, 58 km	Dec 2016
MINDANAO			
Mindanao Substation Reliability I	SR	To provide N-1 contingency transformers at various substations Jasaan: 1-100MVA 138/69 kV transformer Lugait: 1-75MVA 138/69 kV transformer intended for this substation was installed in Opol Substation instead.	Mar 2016
Malita-Matanao 230 kV T/L*	GE	To accommodate the grid connection of SMCPC's CFPP Malita-Matanao: 230 kV 2-410mm^2 TACSR, ST-DC, 67 km transmission line Malita (New): 1-50 MVA 138/69 kV transformer	Mar 2016
Matanao-Gen. Santos 138 kV T/L	SR	To provide N-1 contingency capability to the transmission corridor Matanao-Gen.Santos: 138 kV 1-795 MCM ACSR, ST-SC, 72.60 km transmission line	Mar 2016
Maramag-Kibawe 138 kV T/L Project*		To strengthen the existing 138 kV double circuit Maramag-Kibawe transmission line and to relieve Maramag-Kibawe 138 kV line from overloading due to the frequent outage of the Agus 2- Kibawe 138 kV line.	Apr 2016

Project Name / Components	Driver	Purpose & Remaining Major Components	ETC
Opol 138 kV S/S	LG, SR, PQ	To address the increase in demand and improve power quality in the area Opol: 1-75 MVA 138/69 kV transformer. This transformer was originally planned for Lugait Substation.	Jun 2016
Mindanao Substation Expansion Project 2	LG	To add substation capacity to meet load growth Gen. Santos SS: 1-100 MVA 138/69 kV transformer Kidapawan SS: Transfer of 1-50 MVA 138/69 kV transformer from General Santos Substation.	Jun 2016
Sultan Kudarat (Nuling) Capacitor Project	SR, PQ	To improve the voltage profile in the area Sultan Kudarat SS: 2-7.5 MVAR 69 kV capacitor	Dec 2016
Agus 6 Switchyard Upgrading / Rehabilitation	SR	To ensure the operational reliability of the plant's switchyard	Dec 2016

GE – Generation Entry; SR – System Reliability; LG – Load Growth; PQ – Power Quality;
*Completed/Energized

7.3 Projects for Completion in 2017 onwards

The list below summarized the updates on the remaining ERC approved projects with ETC by 2017 onwards.

Table 7.3: Projects for Completion in 2017 onwards

Project Name	Driver	Purpose	ETC
LUZON			
San Jose-Angat 115 kV Line Upgrading	SR	To address the old age condition and reliability issues in the existing line serving the Angat Hydroelectric Power Plant.	Jun 2017
San Jose-Quezon 230 kV Line 3	SR	To increase transfer capacity of the existing corridor and maintain the N-1 contingency provision.	Dec 2017
Bataan-Cavite Transmission Line FS	GE	To conduct hydrographic survey and other survey works for the submarine cable project that will support the delivery of bulk generation from Bataan area to the load center in an alternate route.	Dec 2017
Hermosa-Floridablanca 69 kV T/L	LG	To relieve the overloading of the existing Hermosa-Guagua line and address the low voltage issues in the area.	Mar 2018
Tuguegarao-Lal-lo (Magapit) 230 kV T/L	PQ, LG	To improve the power quality and reliability of supply in the province of Cagayan and this will form part of the development of the Northern Luzon 230 kV Loop that will cater the wind power generation potential in the region.	Oct 2018
Western 500 kV Backbone (Stage 1)	GE	To develop a 500 kV western corridor that will accommodate the bulk generation in Zambales area and to improve the overall reliability, security and stability of the 500 kV system.	Dec 2018
Eastern Albay 69 kV Line Stage 2	SR	To provide the looping configuration for the 69 kV line in eastern Albay.	Jun 2019
Ambuklao-Binga 230kV T/L Upgrading	SR	To address the old age condition of the line and accommodate the generation capacity addition in Cagayan Valley area.	Dec 2019
Binga-San Manuel 230 kV T/L Stage 1 & 2	SR	To address the old age condition of the line and provide N-1 contingency during maximum dispatch of the generating power plants in North Luzon.	Dec 2019
New Antipolo 230 kV Substation	LG	To accommodate the demand increase in Metro Manila and maintain the N-1 contingency provision for Taytay Substation.	Dec 2019
Calaca-Dasmariñas 500 kV Transmission Line	GE, SR	To reinforce the outgoing 230 kV line from Calaca Substation and accommodate the full dispatch of the incoming power plants in Batangas area.	Dec 2019
VISAYAS			
Visayas Substation Reliability II	SR	To add substation capacity to provide N-1 contingency	Sep 2017
Cebu-Negros-Panay 230 kV Backbone (Stage 1)	GE,SR	To increase transfer capacity of the existing corridor and maintain the N-1 contingency provision. The Negros-Panay submarine cable component of this project will already be completed by Aug 2016.	Dec 2017
Cebu-Lapu-lapu T/L	SR	To increase transfer capacity of the existing corridor and maintain the N-1 contingency provision.	Dec 2018

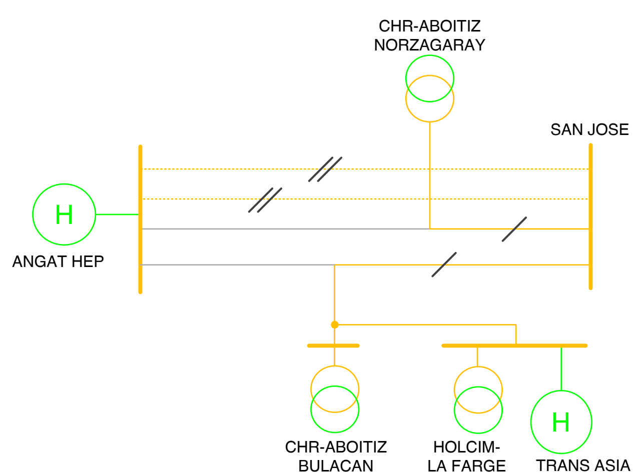
Project Name	Driver	Purpose	ETC
MINDANAO			
Balo-i-Kauswagan-Aurora 230 kV T/L (Phase 1)	GE	To accommodate the proposed 4x100MW coal-fired power plant of GNPower in Kauswagan.	Aug 2017
Aurora-Polanco 138 kV T/L	LG	To serve the growing power demand in Zamboanga del Norte area	Aug 2017
Butuan-Placer 138 kV T/L	SR	To provide N-1 contingency to the existing line Butuan-Placer: 138 kV 1-795MCM ACSR, ST-SC, 96 km transmission line	Dec 2017
Toril 138 kV S/S, Stage 2	GE	To provide 138/69 kV transformer in order to serve load customers such as DASURECO and DLPC	Dec 2017
Agus 2 Switchyard Upgrading Project	SR	To address the deteriorating physical and operational condition of the switchyard	Feb 2018
Tacurong-Kalamansig 69 kV Line	SR	To provide a grid connection to the off-grid municipalities in Sultan Kudarat province	Nov 2019

GE – Generation Entry
SR – System Reliability
LG – Load Growth
PQ – Power Quality

7.3.1 Luzon Grid

7.3.1.1 San Jose-Angat 115 kV Line Upgrading

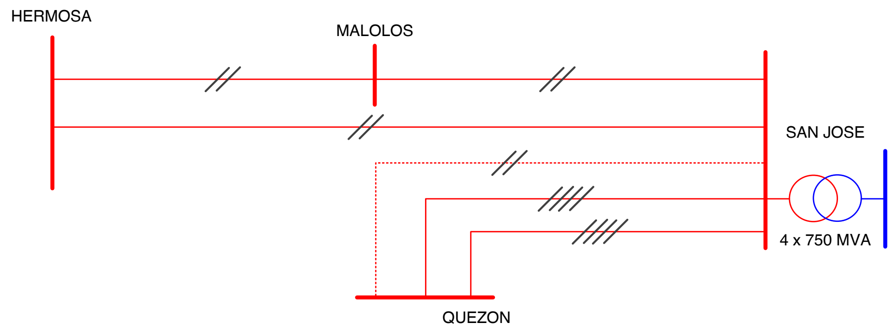
Major Project Components
▪ ***San Jose-Angat 115 kV T/L,*** ST-DC 2-795 MCM ACSR, 18 km;
▪ ***San Jose 115 kV S/S,*** 2-115 kV PCB and associated equipment.



This project aims to ensure the reliability of the existing 115 kV transmission lines connecting Angat HEPP to the Luzon Grid. San Jose-Angat Lines 1 and 2 were built in 1967 while Line 3 (woodpole) was built in 1960. The project involves the construction of a new 115 kV 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 and 2, 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 the completion of this project, the San Jose-Angat 115 kV line will become a more reliable transmission corridor. The 300 MVA capacity per circuit of the project would be sufficient to provide N-1 contingency during maximum dispatch of the 246 MW Angat HEPP. If not implemented, transmission constraints could be experienced when there is an outage in Line 3.

7.3.1.2 San Jose-Quezon 230 kV Line 3

Major Project Components
▪ ***San Jose-Quezon 230 kV T/L***, ST/SP-SC 2-610 mm^2 TACSR, 19 km;
▪ ***San Jose 230 kV S/S***, 5-230 kV PCB and associated equipment;
▪ ***Quezon 230 kV S/S,*** Line Protection and Communication System.



This project involves the construction of the third circuit in the San Jose-Quezon 230 kV transmission corridor. This will increase the transfer capacity of the line to address the projected overloading problem during an outage 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 contingency for the line and this may result in supply adequacy issue and load dropping.

7.3.1.3 Bataan-Cavite Transmission Line (Feasibility Study)

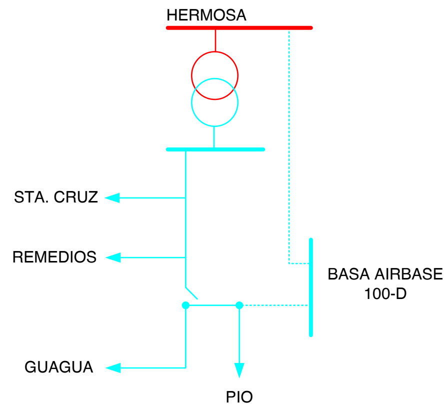
Major Project Components
▪ ***Power System Study***
▪ ***Feasibility Study***

Several power plant projects have been proposed in the Luzon Grid and based on the data from the DOE, the province of Bataan is one of the areas with expected bulk generation capacity additions. To transmit this bulk generation to Luzon load center in Metro Manila, transmission line projects will be required going up to Hermosa then to Metro Manila and submarine cable link from Bataan to Cavite area. For higher level of grid reliability and to support the bulk generation development, the establishment of a looped EHV backbone system including the Bataan – Cavite Transmission Line Project is envisioned for the Luzon Grid. Phase 1 of the project is the conduct of feasibility study to establish the appropriate project scheme and the receiving point in Cavite or Metro Manila through the proposed Pasay 230 kV Substation.

7.3.1.4 Hermosa-Floridablanca 69 kV Transmission Line

Major Project Components
▪ ***Hermosa-Floridablanca 69 kV T/L,*** 1-795 MCM ACSR, SP-SC, 16.86 km;
▪ ***Basa Air Base-100D 69 kV kV T/L***, 1-795 MCM ACSR, SP-SC, 2.86 km.

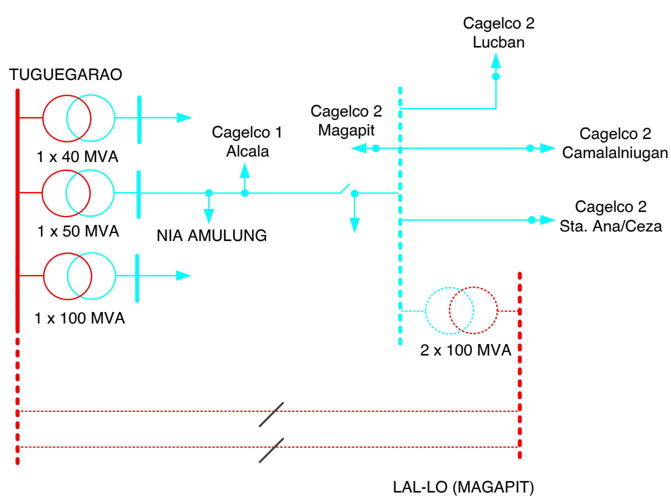
The existing Hermosa-Guagua 69 kV line is a 53 year old asset and is among the subtransmission lines already reverted by the ERC to NGCP's Regulatory Asset Base (RAB). The said line has insufficient transfer capacity to accommodate load growth and the heavy loading condition has been resulting in low voltage issues. The Hermosa-Floridablanca 69 kV will ensure the adequacy, reliability and power quality of supply for the connected customers in the area.



7.3.1.5 Tuguegarao-Lal-lo (Magapit) 230 kV Transmission Line

Major Project Components
▪ ***Tuguegarao-Lal-lo 230 kV T/L,*** ST-DC, 1-795 MCM ACSR, 64 km;
▪ ***Lal-lo 230 kV S/S,*** 2-100 MVA 230/69-13.8 kV Transformer, 6-230 kV PCB and associated equipment, 8-69 kV PCB and associated equipment;
▪ ***Tuguegarao 230 kV S/S***, 3-230 kV PCB and associated equipment.

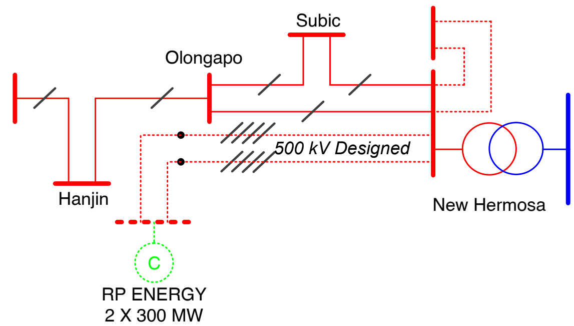
This project aims to improve the power quality and reliability of supply in the northern part of Cagayan Province which is presently being served by a very long 69 kV line. The project involves the construction of a double-circuit 230 kV transmission line from Tuguegarao to Lal-lo and the development of a 230/69 kV Lal-lo drawdown substation. This will improve the power quality and reliability of supply to the growing loads in the area which include the Cagayan Ecozone. Moreover, this project will also become an integral part of the development of the Northern Luzon 230 kV loop which will link the north-western and north-eastern 230 kV backbone.



7.3.1.6 Western 500 kV Backbone (Stage 1)

Major Project Components
▪ ***Castillejos-Hermosa 500 kV T/L,*** ST-DC, 4-410mm^2 TACSR, 32 km;
▪ ***New Hermosa 230 kV S/S,*** 4-230 kV PCB and associated equipment.

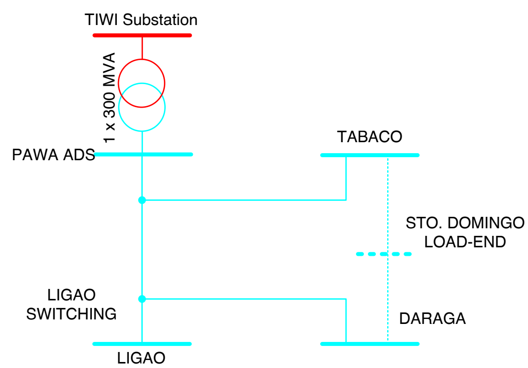
The Castillejos-Hermosa 500 kV Transmission Line is the first stage of the Western Luzon 500 kV Backbone that aims to accommodate the connection of RP Energy Coal-Fired Power Plant. The new line will be initially energized at 230 kV voltage level only. The development of the western 500 kV backbone has been part of the master plan in order to improve the system security and reliability in accommodating bulk generation capacity additions.



7.3.1.7 Eastern Albay 69 kV Transmission Line Stage 2

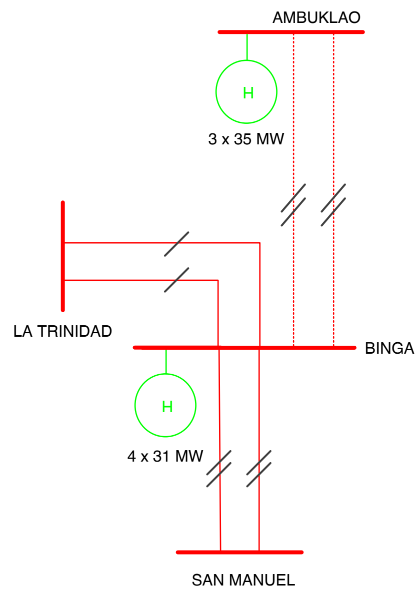
Major Project Components
▪ ***Sto. Domingo-Tabaco 69 kV T/L***, ST/ SP - SC, 1-336.4 MCM ACSR, 18 km.

This project will complete the looping configuration of the 69 kV transmission facility in eastern Albay. This will provide flexibility in operation and would allow continuous supply to the loads even during line maintenance activities. This will be complemented by another project, involving the installation of a 230/69 kV transformer at Tiwi Substation in order to provide adequate and reliable alternate source of power in addition to Daraga Substation.



7.3.1.8 Ambuklao-Binga 230 kV Transmission Line Upgrading

Major Project Components
▪ ***Ambuklao-Binga 230 kV T/L,*** ST-DC, 2-410mm^2 TACSR, 11 km;
▪ ***Ambuklao 230 kV S/S,*** 6-230 kV PCB and associated equipment.

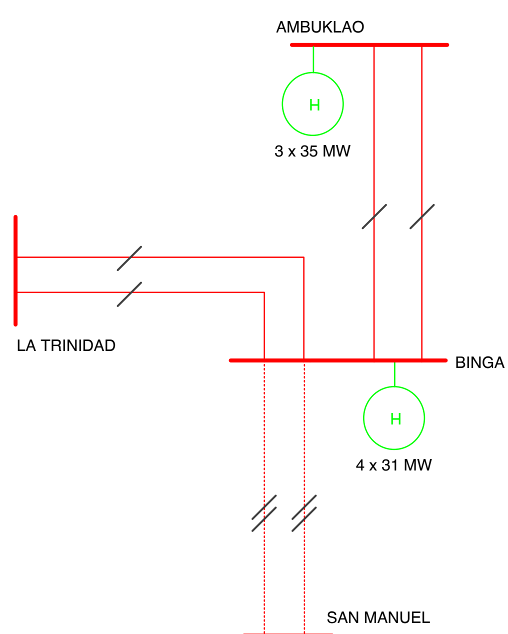


This project aims to upgrade the existing line in order to address its old age condition and also to maintain the N-1 contingency provision taking into consideration the repowering of Ambuklao HEPP to a new capacity of 105 MW and generation capacity additions from Alimit 2-60 MW Hydroelectric Power Plant, Olilicon 1-20 MW Hydroelectric Power Plant, and Alimit 2-125 Pumped Storage. Thus, during maximum generation of the power plants, this project will prevent the overloading under N-1 contingency condition, i.e, outage of one 230 kV circuit.

7.3.1.9 Binga-San Manuel 230 kV Transmission Line

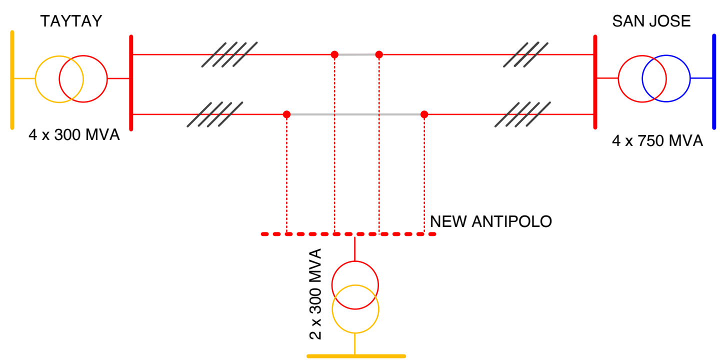
Major Project Components
▪ ***Binga – San Manuel 230 kV T/L,*** ST-DC, 2-410 mm^2 TACSR, 40 km;
▪ ***Binga S/S Expansion,*** 1-50 MVA 230/69-13.8 kV Transformer, 10-230 kV PCB and associated equipment 2-69 kV PCB and associated equipment;
▪ ***San Manuel S/S Expansion,*** 2-230 kV PCB and associated equipment.

This project involves the construction of a new 40 km double circuit Binga-San Manuel 230 kV transmission line using new right–of-way, including the installation of switching facilities at Binga and San Manuel Substations. The project aims to provide N-1 contingency during maximum dispatch of the generating plants, particularly HEPPs, in north Luzon. The existing line, as well as the power circuit breakers at Binga Substation, which were constructed/installed in 1956 have already surpassed the economic life. Moreover, there are developments in the power plants affecting the power flow at Binga-San Manuel 230 kV line. These include the repowering of Ambuklao HEPP to a new capacity of 105 MW (previously at 75 MW capacity) and the completion of Binga HEPP expansion to an additional capacity of 25 MW, and the other generation developments in Cagayan Valley area.



7.3.1.10 New Antipolo 230 kV Substation

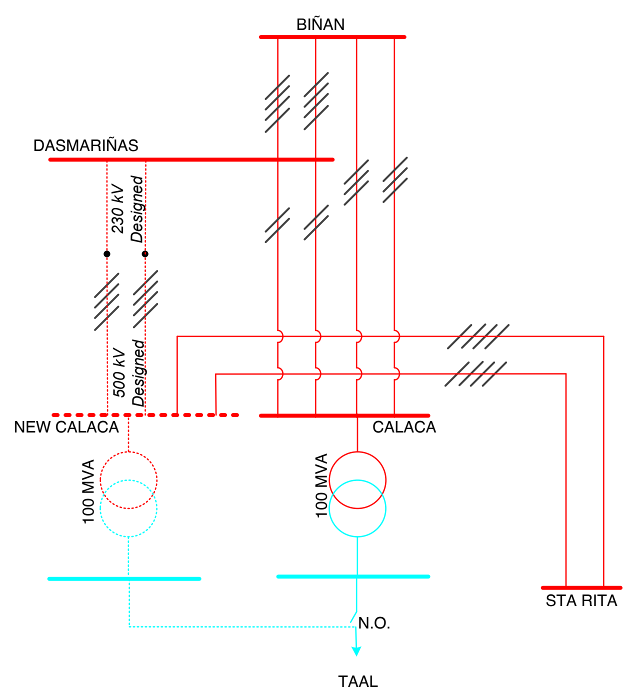
Major Project Components
▪ ***Bus-in point along San Jose-Taytay 230 kV T/L***, ST-DC 4-795 MCM ACSR, 2 km;
▪ ***Antipolo 230 kV S/S,*** 12-230 kV PCB and associated equipment; 2-100 MVAR 230 kV Capacitor.



This involves the new 230 kV substation that will bus-in along the existing ST-DC San Jose-Taytay 230 kV line with 4-794 MCM ACSR conductor. The demand increase in Metro Manila and the expansion constraints at Doña Imelda and Taytay Substations require the development of a new 230 kV delivery substation. Initially, Antipolo 230 kV Substation will have 2-300 MVA capacity with capacitor banks to be installed for voltage support. To draw supply from Antipolo, MERALCO will put up line connections to their existing 115 kV network in the area. In the 3rd Regulatory Period FD, the 2-300 MVA transformers and the 115 kV switchyard components were reclassified as subtransmission assets, thus, only the 230 kV switchyard, 230 kV capacitors, and the 230 kV line extension will be covered by NGCP's project.

7.3.1.11 Calaca-Dasmariñas 500 kV Transmission Line

Major Project Components
▪ ***Calaca – Dasmariñas (500 kV-designed portion),*** ST-DC, 4-410 mm^2 TACSR, 49.7 km; ▪ ***Calaca – Dasmariñas (230 kV-designed portion),*** ST-DC, 4-410 mm^2 TACSR, 8.6 km; ▪ ***Calaca – Taal 69 kV extension,*** SP-SC, 1-336.4 MCM ACSR, 1.5 km; ▪ ***Dasmariñas S/S Expansion,*** 2-230 kV PCB and associated equipment; ▪ ***Sta. Rita Switchyard Expansion,*** Line Protection and Communication System. ▪ ***Old Calaca S/S,*** Replacement of Current Transformers and Busworks; ▪ ***Calaca (new) Substation,*** 12-230 kV PCBs and Associated Equipment, 1-69 kV PCBs and Associated Equipment , 1-100 MVA 230/69-13.8 kV Transformer and Accessories;



With the projected increase in demand in Luzon Grid, bulk generation capacity expansions are programmed in Batangas. The generation capacity additions will turn Calaca Substation into a merging point of more than 2,000 MW of power generation. Based on the results of system study conducted, the existing outgoing 230 kV lines going to Dasmariñas and Biñan would not be enough to accommodate the full dispatch of the plants considering the single outage contingency criterion. Thus, the need to develop a new transmission line corridor from Calaca to Dasmariñas Substation. The resulting configuration would involve the direct delivery of power generation from Sta. Rita to Dasmariñas. In view of the recent developments in the capacity of the proposed power plant projects in the area, 500 kV design for the new line is now being considered but the line will be initially energized at 230 kV voltage level. A new substation in Calaca separate from the existing substation will also be required for the connection of generation capacity expansions in the area.

7.3.2 Visayas Grid

7.3.2.1 Visayas Substation Reliability Project II

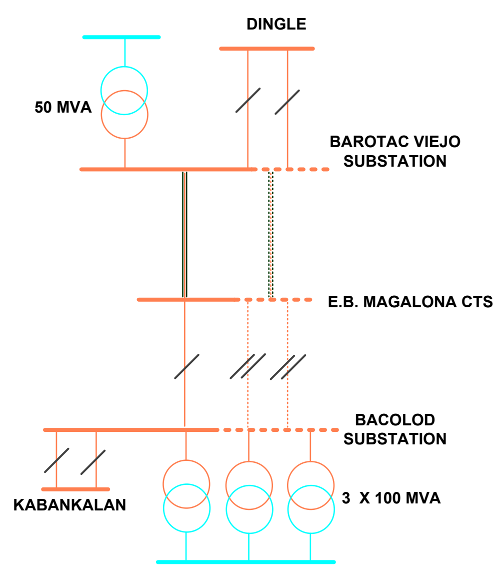
Major Project Components
▪ ***Ormoc 138 kV S/S Expansion,*** 1-100 MVA 138/69-13.8 kV Transformer, 1-69 kV PCB and associated equipment;
▪ ***Babatngon 138 kV S/S Expansion,*** 1-50 MVA 138/69-13.8 kV Transformer, 1-138 kV PCB and associated equipment, 1-69 kV PCB and associated equipment;
▪ ***Sta. Barbara 138 kV S/S Expansion,*** 2-50 MVA 138/69-13.8 kV Transformer, 3-138 kV PCB and associated equipment, 3-69 kV PCB and associated equipment;
▪ ***Mandaue 138 kV S/S Expansion***, 1-100 MVA 138/69-13.8 kV Transformer, 1-138 kV GIS Switch Bay, 1-69 kV GIS Switch Bay;
▪ ***Lapu-lapu 138 kV S/S Expansion***, 1-100 MVA 138/69-13.8 kV Transformer, 1-138 kV GIS Switch Bay, 1-69 kV GIS Switch Bay.

The project is intended to improve the system reliability and maintain continuous supply of power to customers even during N-1 contingency condition at various substations in Visayas. It involves the installation of 450 MVA total substation capacity addition.

7.3.2.2 Cebu-Negros-Panay 230 kV Backbone (Stage 1)

Major Project Components
▪ ***Bacolod S/S - E. B. Magalona CTS, 230 kV (initially energized at 138 kV) T/L***, ST-DC, 2-795 MCM ACSR, 42 km;
▪ ***Barotac Viejo S/S - E. B. Magalona CTS, 230 kV (but will be initially energized at 138 kV) T/L***, Single Circuit, 3-1,600 mm^2 XLPE submarine cable, 22.75 km;
▪ ***Bacolod S/S Expansion***, 2-138 kV PCB and associated equipment;
▪ ***E. B. Magalona CTS Expansion***, associated submarine cable termination equipment;
▪ ***Barotac Viejo S/S Expansion***, 5-138 kV PCB and associated equipment, 1-40 MVAR, 138 kV shunt reactor, associated submarine cable termination equipment.

In line with the projected increase in the generation capacity addition in Visayas, high-capacity transmission facilities are proposed between Cebu, Negros and Panay. The project aims to facilitate the realization of the transmission master plan of having a 230 kV transmission backbone in the Visayas by establishing a 230 kV interconnection from Panay to Cebu.

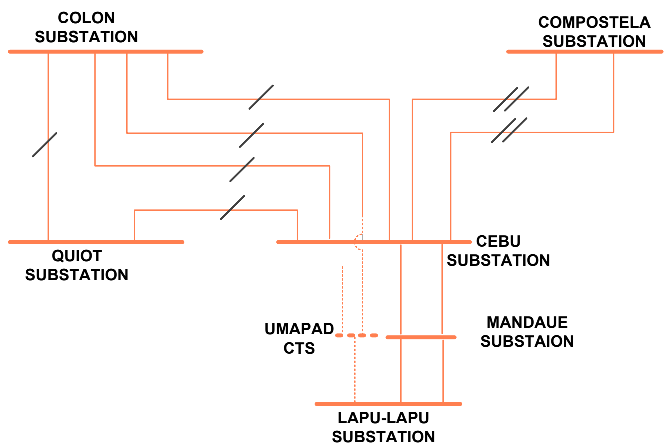


This is part of the major transmission backbone development in the Visayas Grid in order to support the generation developments and also to avert the criticality of island grid separations. The priority segment or the Stage 1 is the additional transmission capacity between Panay and Negros in order to immediately address the congestion and market issues being encountered due to limited capacity of the existing submarine cable. This project involves initial energization to 138 kV voltage level only.

7.3.2.3 Cebu-Lapu-lapu Transmission Line

Major Project Components
▪ ***Cebu-Umapad 230 kV T/L,*** ST/SP-DC, 2-795 MCM ACSR, 9 km; ▪ ***Umapad-Mandaue CJ 138 kV T/L,*** SC, 3-1C 1,000mm^2 XLPE underground cable, 0.3 km; ▪ ***Mandaue-Lapu-lapu CJ 138 kV T/L,*** SC, 2-3C 500mm^2 XLPE Submarine Cable, 0.5km; ▪ ***Lapu-lapu CJ-Lapu-lapu 138 kV T/L,*** SC, 3-1C 1,000mm^2 XLPE underground cable, 0.1km; ▪ ***Lapu-lapu 138 kV S/S,*** 1-138 kV GIS Switchbay; ▪ ***Umapad CTS,*** Cable Sealing End Structures, 3-138 kV Disconnect Switches.

The project, which aims to provide adequate capacity to maintain N-1 contingency provision, originally involves the construction of the third circuit from Cebu to Mandaue and from Mandaue to Lapulapu utilizing the same conductor and configuration as the existing circuits, i.e., underground cable from Banilad to Mandaue and under the bridge cable from Mandaue to Mactan. Due implementation issues and also due to new developments in the area, reconsideration on the project scheme was conducted.



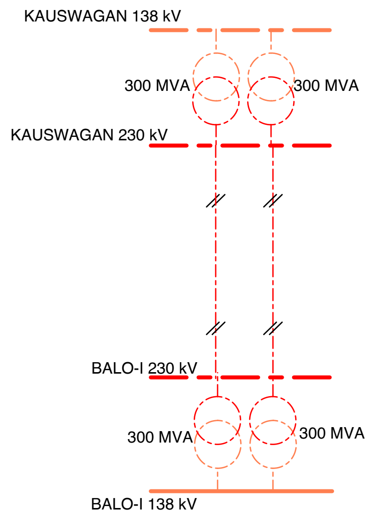
The new project configuration now involves 230 kV-designed overhead line from Cebu to Mandaue and submarine cable from Mandaue to Lapulapu. The overhead line will tap along the existing Colon-Cebu 138kV line and will bypass Cebu and Mandaue Substations to minimize unbalanced loading due to difference in impedance between the proposed overhead line and the existing underground cable. Effectively, the project will connect Lapulapu Substation directly to Colon Substation.

Moreover, the overhead line will already be designed at 230 kV but initially energized at 138 kV taking into consideration the demand growth in Metro Cebu and the difficulty of acquiring available space for future transmission facilities as the area is highly urbanized.

7.3.3 Mindanao Grid

7.3.3.1 Balo-i-Kauswagan-Aurora 230 kV Transmission Line (Phase 1)

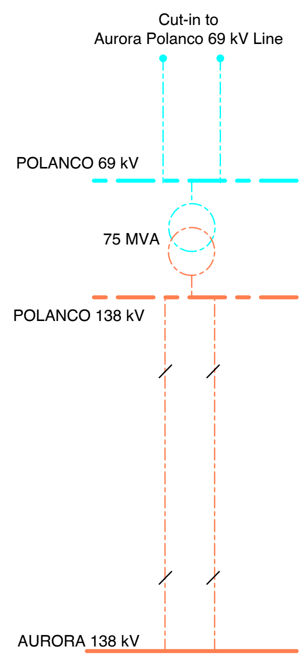
Major Project Components
Phase 1
▪ ***Balo-I – Kauswagan 230 kV T/L,*** ST-DC, 2-410mm^2 TACSR, 11 km;
▪ ***Kauswagan 230 kV S/S***, 10-230 kV PCB and associated equipment;
▪ ***Balo-I S/S Expansion,*** 4-230 kV PCB and associated equipment.



There is a need to implement a new double circuit 230 kV line from Kauswagan Substation to Balo-i Substation to accommodate the proposed 4 x150 MW Coal Plant of GN Power. Moreover, considering the growing demand and reliability of the existing transmission line connecting the Zamboanga Peninsula to the Mindanao Grid, it is also necessary to construct an additional double circuit 230 kV line from Kauswagan Substation to Aurora Substation as part of Phase 2. This is in lieu of the deferred Agus 6 – Aurora 138 kV Transmission Line Project.

7.3.3.2 Aurora-Polanco 138 kV Transmission Line

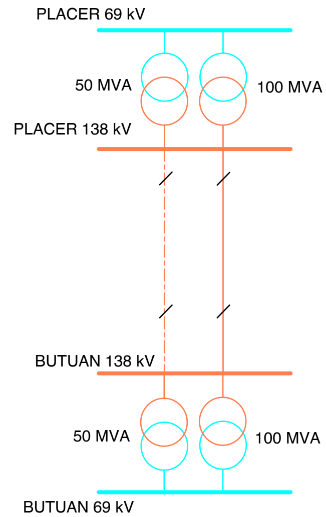
Major Project Components
▪ ***Aurora-Polanco 138 kV T/L,*** ST-DC, 1-795 MCM, 79 km;
▪ ***Polanco-Polanco (LES) 69 kV T/L,*** SP/CP-DC, 1-336.4 MCM ACSR, 11 km;
▪ ***Cut-in 69 kV T/L,*** SC-SP/CP 1-336.4 MCM, 4 km;
▪ ***Polanco 138 kV S/S (new),*** *1x75MVA* 138/69/13.8 kV Transformer, 5-138 kV PCB and associated equipment, 4-69 kV PCB and associated equipment;
▪ ***Aurora 138 kV S/S (Expansion),*** 3-138 kV PCB and associated equipment;
▪ ***Polanco LES,*** 3-69 kV Air Break Switch.



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

7.3.3.3 Butuan-Placer 138 kV Transmission Line

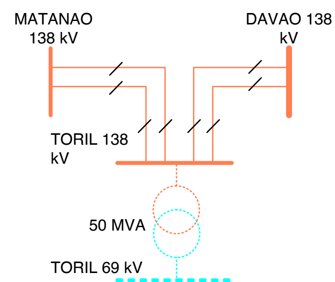
Major Project Components
▪ ***Butuan-Placer 138 kV,*** ST-SC, 1-795MCM, 100km;
▪ ***Placer,*** 2-138 kV PCB and associated equipment;
▪ ***Butuan,*** 2-138 kV PCB and associated equipment.



This project is part of the Reliability Compliance Project I - Mindanao. It involves the installation of the second circuit for the existing Butuan-Placer 138 kV corridor. It will provide N-1 contingency to the existing line, reduce transmission loss, and further improve the voltage profile in Surigao del Norte.

7.3.3.4 Toril 138 kV Substation (Stage 2)

Major Project Components
▪ ***Toril 138 kV S/S***, 3-69 kV PCB and associated equipment and 50 MVA 138/69-13.8 kV Power Transformer including Protection, Control, Metering and Communication Systems;



This is the second stage of the project associated with the entry of TSI plant in Mindanao. The remaining project scope, however, is focused on the installation of a 138/69 kV transformer that will allow the connection of load customers in the area namely: DLPC and DASURECO, thereby optimizing the utilization of the newly developed Toril 138 kV Substation.

7.3.3.5 Agus 2 Switchyard Upgrading Project

Major Project Components
▪ ***Agus 2 Switchyard***, 10-138kV PCB and other old/aged and/or defective equipment and expansion of the existing Control Building Flood Control System.

In addition to addressing the deteriorating physical and operational condition of the high voltage equipment in the switchyard due to old age, this project also aims to provide clear demarcation of asset boundaries between NGCP and the power plant. It will involve the installation of a separate control building and the installation of new monitoring, switching, metering, annunciation and control equipment in order to have full control of the switchyard.

7.3.3.6 Tacurong-Kalamansig 69kV Transmission Line

Major Project Components
▪ ***Tacurong-Kalamansig 69kV T/L,*** ST-SC, 1-336.4MCM ACSR, 80 km transmission line including Communication System System;
▪ ***Tacurong 69kV S/S***, 1-69kV PCB and associated equipment;
▪ ***Kalamansig 69kV SS***, 1-7.5MVAR 69kV capacitor.

With the limited source of power in the area and to support the increasing load in the long term, there is a need to provide grid connection to the off-grid municipalities of Bagumbayan, Ninoy Aquino, Lebak and Kalamansig. The project will allow these towns in Sultan Kudarat to have access to secure, reliable and efficient power delivery services. Thus, it will serve as a catalyst for economic development and likewise accelerates the total electrification of the province.

The DOE list shows that there are many committed and indicative power plant projects in Luzon Grid which can well support the increasing demand for the next 10 years. The incoming large capacity coal-fired power plants as well as natural gas-fired power plants are mainly concentrated in four (4) provinces namely: Batangas, Quezon, Bataan and Zambales, which would result in huge excess power in these areas. Since the remaining transmission capacity of the existing facilities is also very limited for the grid integration of new bulk generation additions, the development of the Luzon Grid is geared towards implementation of new 500 kV transmission facilities that would allow power export from bulk generation sites going to the load center.

With the increasing delivery of bulk power to the 500 kV system, however, the two (2) existing 500 kV substations located in San Jose, Bulacan and Dasmariñas, Cavite which serve as the only EHV drawdown facilities supporting Metro Manila loads would become critical nodes in the grid. The capacity and expansion limitations in these substations could result in grid congestion unless new 500 kV drawdown substations are developed. In the TDP, new 500 kV substations are being proposed with Taguig as the priority site. Being close to the load center, Taguig is a very strategic location but has the major challenge also in the establishment of its associated 500 kV transmission line traversing portion of the Laguna Lake.

Along with the support given to grid integration of new power plants, NGCP is paying special attention in strengthening the transmission facilities in Metro Manila which is the country's load center. The existing 230 kV transmission line traversing from Quezon City to Muntinlupa City is a very critical line given its heavy loading condition and single-circuit configuration. Such conditions also pose great risk both on power quality and supply reliability in the area. In addition, the existing 230/115 kV substations in Metro Manila are heavily loaded already and mostly with capacity expansion limitations, thus, the development of new substations is very important in supporting load growth in the long term.

Being the center of nation's economy, the grid reinforcement projects to ensure the long term adequacy, reliability and security of power supply in Metro Manila can be regarded as "projects of national significance". As can already be expected in a highly urbanized area, securing right-of-way for new transmission facilities is increasingly becoming difficult. It is therefore important to immediately start the implementation to realize the transmission development plans and it should be coupled with support from the local and national government. Aside from Taguig EHV, the proposed new facilities include Pasay and Manila/Navotas Substations which would also involve the implementation of associated 230 kV transmission lines.

After Metro Manila and the already industrialized areas in Cavite and Laguna, the province of Pampanga is expected as the next major load growth area. In the long-term, new 230 kV backbone and new 230/69 kV substations would be needed for Porac and Clark in order support the load increase in the coming years. For other provinces, on the other hand, supporting load growth generally involves installation of additional transformers at existing substations or development of new substations and some reinforcements on the 69 kV transmission lines.

To help improve system reliability and to maintain the power quality within the grid code-prescribed standards, included in the development plans are the implementation of transmission looping configurations even for the 500 kV system, upgrading of old transmission lines and substations as well as installation of reactive power compensation equipment at various substations.

For renewable energy developments particularly in north Luzon, the implementation of the Northern Luzon 230 kV Loop could provide the needed transmission capacity augmentation. In the long-term, however, considering the full wind power generation potential in North Luzon as well as the hydro power generation potential in Cagayan Valley, Abra and Benguet, a new backbone from San Manuel, Pangasinan going up north would also be needed. Solar and other new RE-based plants, on the other hand, are well dispersed in the grid and generally not requiring major grid reinforcements.

8.1 Proposed Transmission Projects for 2016-2025

Shown in Table 8.1 is the list of transmission projects proposed in the period 2016-2025 in addition to the ERC approved projects for Luzon Grid as discussed in Chapter 5.

Table 8.1: Proposed Transmission Projects for Luzon

Project Name/Driver(s)	Province(s)	ETC
Generation Entry		
Pagbilao 500 kV Substation	Quezon	Aug 2018
Hermosa-San Jose 500 kV Transmission Line	Bataan, Bulacan	May 2018
Bataan 230 kV Grid Reinforcement	Bataan, Pampanga	Dec 2018
Bolo 5th Bank	Pangasinan	Jun 2019
Mariveles-Hermosa 500 kV Transmission Line	Bataan	Nov 2019
Northern Luzon 230 kV Loop	Ilocos Norte, Cagayan	Jun 2024
Sta Maria / Ibaan 500 kV Substation	Batangas	Oct 2024
Liberty-Nagsaag 230 kV Transmission Line	Nueva Ecija, Pangasinan	Dec 2024
La Trinidad-Sagada 230 kV Transmission Line	Benguet	Dec 2024
Pagbilao-Tayabas 500 kV Transmission Line	Quezon	Dec 2024
Santiago-Nagsaag 500 kV Transmission Line	Isabela, Pangasinan	Dec 2024
Load Growth		
Clark-Mabiga 69 kV Transmission Line	Pampanga	Jun 2018
North Luzon Substation Upgrading Project – Stage 1 / Stage 2	Ilocos Norte, Ilocos Sur, Isabela, Nueva Vizcaya, Pangasinan, Bulacan, Nueva Ecija, Tarlac	Dec 2018/ Jun 2022
Calamba 230 kV Substation	Laguna	Mar 2019
Manila (Navotas) 230 kV Substation	Metro Manila	May 2020
Mexico-San Simon 69 kV Transmission Line	Pampanga	Jun 2020
Tanauan 230 kV Substation	Batangas	Jun 2020
Pasay 230 kV Substation	Metro Manila	Jul 2020
Taguig 500 kV Substation	Metro Manila	Nov 2020
South Luzon Substation Upgrading Project – Stage 1 / Stage 2	Cavite, Metro Manila, Laguna, Quezon, Camarines Sur, Albay	Dec 2021 / Jun 2022
Daraga-Ligao 69 kV Transmission Line Upgrading	Albay	Dec 2022
Naga-Pili 69 kV Transmission Line Upgrading	Camarines Sur	Dec 2022
Marilao 500 kV Substation	Bulacan	Jun 2023
Abuyog 230 kV Substation	Sorsogon	Dec 2023
San Simon 230 kV Substation	Pampanga	Feb 2024

Project Name/Driver(s)	Province(s)	ETC
Malvar 230 kV Substation	Batangas	Dec 2024
Porac 230 kV Substation	Pampanga	Dec 2024
Liberty-Baler 230 kV Transmission Line	Nueva Ecija, Aurora	Apr 2025
Magalang 230 kV Substation	Pampanga	Jun 2025
System Reliability		
Relocation of Steel Poles along Hermosa-Duhat 230 kV Transmission Line	Pampanga	Dec 2018
La Trinidad-Calot 69 kV Transmission Line	Benguet	Jun 2019
Tiwi Substation Upgrading Project	Albay	Jul 2019
Pinili 115 kV Substation	Ilocos Norte	Dec 2019
Navotas-Pasay 230 kV Transmission Line	Metro Manila	Jul 2020
Taguig-Taytay 230 kV Transmission Line	Metro Manila	Oct 2020
Balayan 69 kV Switching Station	Batangas	Jun 2021
San Manuel-Nagsaag 230 kV Transmission Line	Pangasinan	Dec 2021
Dasmariñas-Las Piñas 230 kV Transmission Line	Metro Manila	Dec 2023
Manila(Navotas)-Dona Imelda 230 kV Transmission Line	Metro Manila	Dec 2023
Mexico-Clark 69 kV Transmission Line Upgrading	Pampanga	Apr 2024
Minuyan 115 kV Switching Station	Bulacan	Apr 2024
Western 500 kV Backbone – Stage 2	Pangasinan, Zambales	Jun 2024
Baras 500 kV Switching Station	Rizal	Dec 2024
Alaminos 500 kV Switching Station	Laguna	Dec 2024
Silang-Taguig 500 kV Transmission Line	Cavite, Metro Manila	Dec 2024
Calaca-Salong 230 kV Transmission Line 2	Batangas	Mar 2025
Santiago-Dinadiawan-Baler 230 kV Transmission Line	Isabela, Aurora	Nov 2025
Liberty – Cabanatuan - San Rafael - Mexico 230 kV Transmission Line Upgrading	Nueva Ecija, Pampanga	Jun 2025
Power Quality		
Luzon Voltage Improvement Project 3 – Stage 1 / Stage 2	Ilocos Norte, Ilocos Sur, Cagayan, Zambales, Pampanga, Bulacan, Nueva Ecija, Pangasinan	Jan 2018 / Jun 2022
Luzon Voltage Improvement Project 4 – Stage 1 / Stage 2	Albay, Sorsogon, Rizal, Laguna, Cavite, Camarines Sur	Dec 2019/ Jun 2022

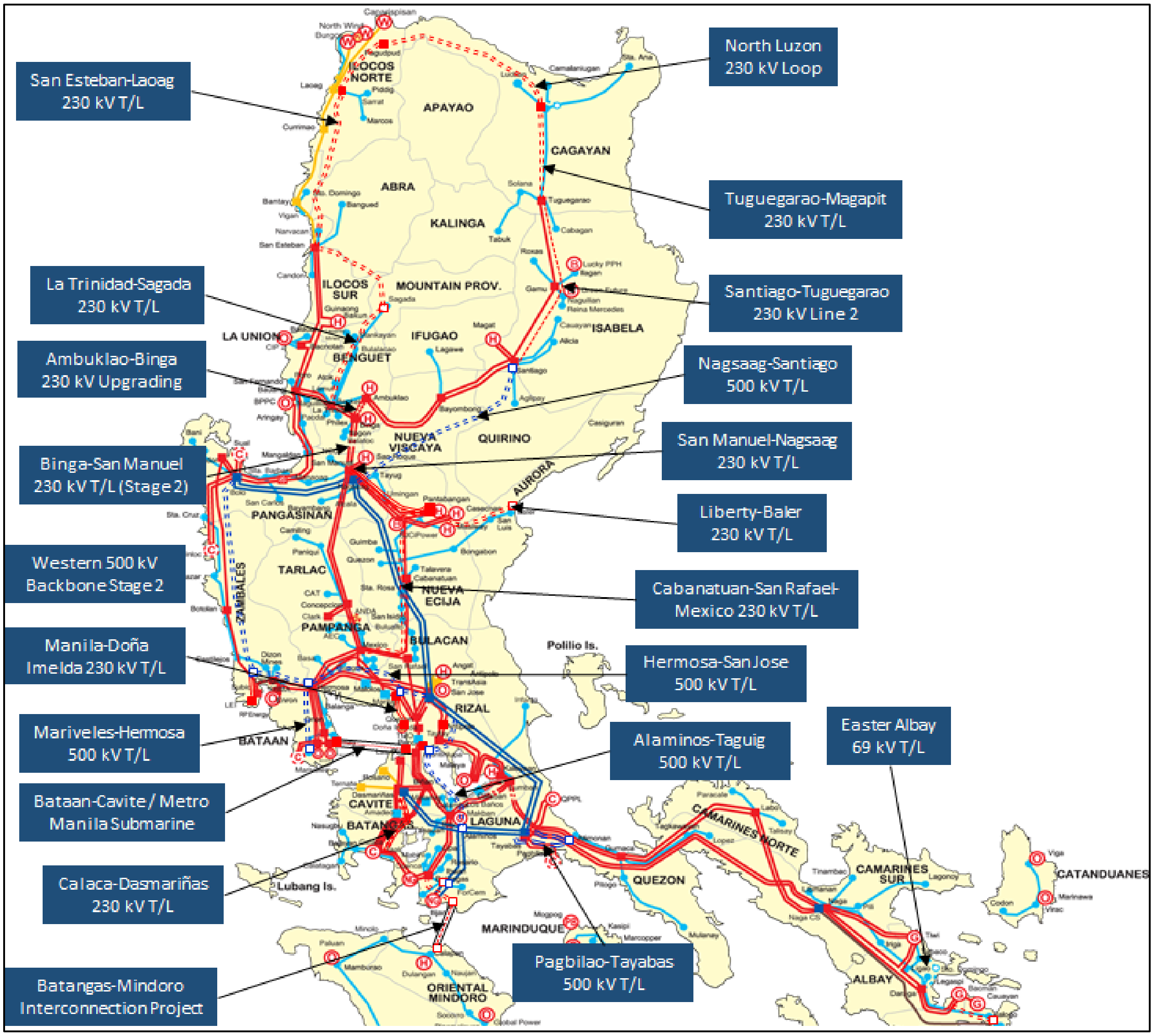
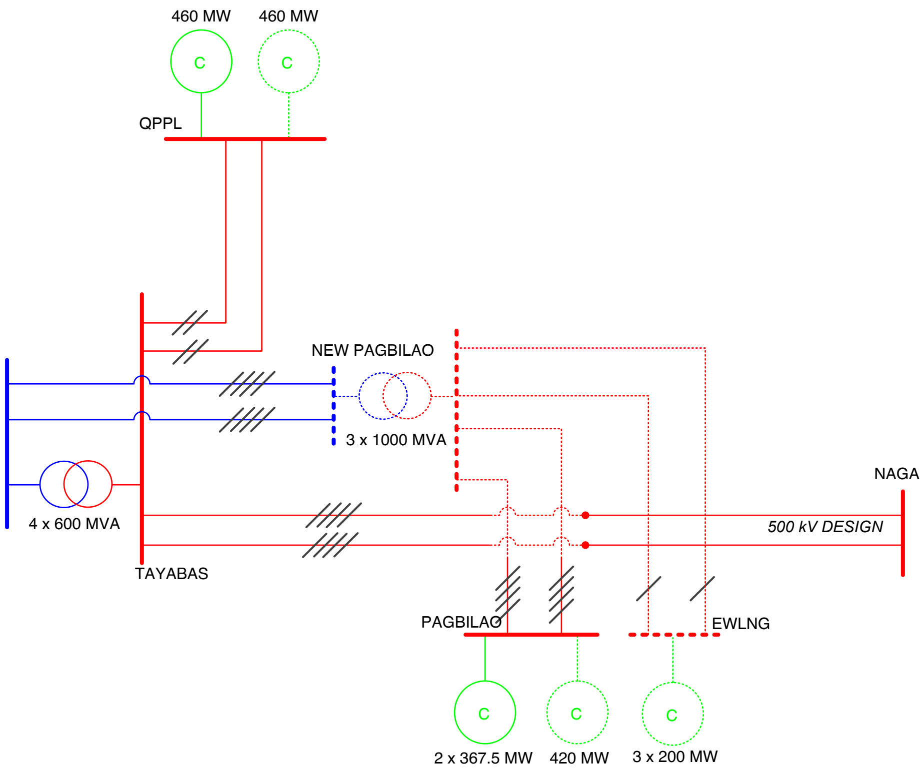


Figure 8.1: Proposed Projects for Luzon

8.1.1 Pagbilao 500 kV Substation

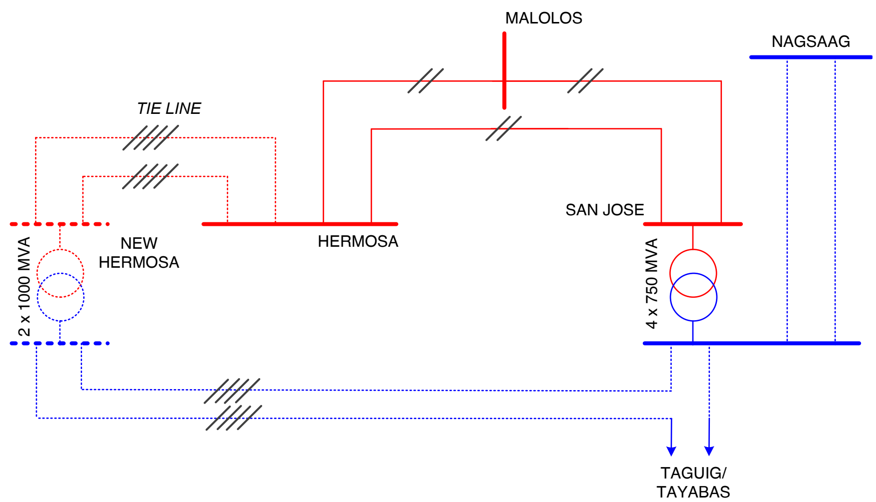
Major Project Components
▪ ***Pagbilao 500 kV S/S,*** 3-1,000 MVA, 500/230 kV Power Transformers and Accessories, 8-500 kV PCBs and 11-230 kV PCBs and associated equipment;
▪ ***Tayabas 500 kV S/S Expansion,*** 3-500 kV PCBs and 1-230 kV PCBs and associated equipment;
▪ ***Swinging of Naga-Tayabas EHV Line at Tayabas 500 kV S/S,*** ST-DC, 4-795 MCM ACSR, 0.5 km;
▪ ***Naga-Tayabas Line Extension to Pagbilao 500 kV S/S,*** 500 kV, ST-DC, 4-795 MCM ACSR, 0.5 km;
▪ ***Pagbilao-Tayabas Line Extension to Pagbilao 500 kV S/S,*** 230 kV, ST-DC, 4-795 MCM ACSR, 2.75 km;
▪ ***Pagbilao-Tayabas connection to Naga-Tayabas,*** 230 kV, ST-DC, 4-795 MCM ACSR, 2.75 km



The project aims to accommodate the generation capacity additions for the Luzon Grid which will be located in Quezon Province. These include 600 MW Energy World Plant, 420 MW Pagbilao Expansion, 500 MW San Buenaventura Coal-Fired Power Plant. The development of a new 500 kV substation in Pagbilao is in lieu of further expanding the existing Tayabas 500/230 kV Substation which has transformer capacity limitations and with high fault level issue in the 230 kV side of the substation. The project scheme involves the energization to 500 kV of a segment of the Naga-Tayabas Transmission Line.

8.1.2 Hermosa-San Jose 500 kV Transmission Line

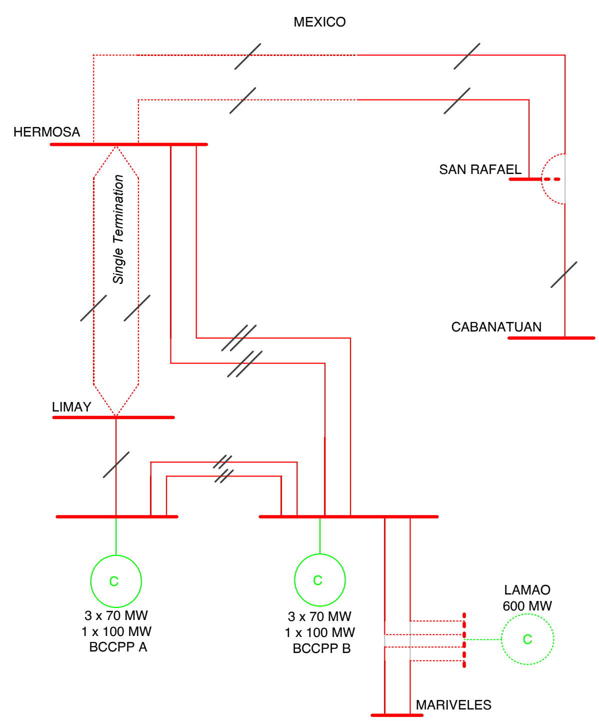
Major Project Components
▪ ***Hermosa-San Jose 500 kV T/L,*** ST-DC, 4-410 mm² TACSR/AS, 82.41 km;
▪ ***New Hermosa-Old Hermosa Tie Line,*** SP-DC, 4-795 MCM ACSR, 0.5 km;
▪ ***New Hermosa 500 kV S/S,*** 2-1000 MVA, 500/230-13.8 kV Power Transformer and Accessories, 10-500 kV PCBs and 12-230 kV PCBs and associated equipment;
▪ ***New Hermosa 500 kV S/S,*** 2-60 MVAR 500 kV Shunt Reactors and Accessories, 1-90 MVAR 500 kV Line Reactor and Accessories; and 2-100 MVAR, 230 kV Capacitor Banks and Accessories;
▪ ***Old Hermosa 230 kV S/S,*** 2-230 kV PCBs and Associated Equipment and 9-69 kV PCBs and associated equipment.



This project is very important in accommodating the generation capacity additions in Bataan and Zambales area. Hermosa Substation serves as a merging point of bulk power generation coming from the existing Limay CCPP, Petron RSFF, Subic Enron DPP, Mariveles CFPP and the programmed generation capacity additions which include RP Energy CFPP, SMC CFPP and others. With an aggregate dependable capacity reaching about 4,000 MW from the existing and incoming power plants, the system study has determined the need to develop a 500 kV transmission backbone which will serve as the additional outgoing circuits from Hermosa to San Jose Substation in order to allow simultaneous maximum dispatch of associated power plants. Because of the expansion limitation of San Jose 500 kV Substation which is a GIS, the scheme would have one 500 kV line that will need to initially by-pass San Jose Substation. This will be permanently addressed by the Marilao 500 kV Substation Project.

8.1.3 Bataan 230 kV Grid Reinforcement Project

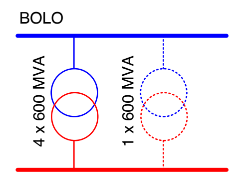
Major Project Components
▪ ***Limay-Hermosa Reconductoring (single circuit termination),*** 230 kV, 1-795 MCM ACSR/AS to 1-410 mm^2 TACSR/AS, 38.01 km;
▪ ***Limay-BCCPP Line Extension,*** 230 kV, SP-SC, 2-410 mm^2 TACSR/AS, 1.0 km;
▪ ***Hermosa-Mexico Reconductoring,*** 230 kV, 1-795 MCM ACSR/AS to 1-410 mm^2 TACSR/AS, 35.0 km;
▪ ***Lamao (Limay) bus-in to the existing Mariveles – BCCPP B 230 kV lines,*** 230 kV, ST – DC, 4-795 MCM ACSR/AS, 2-1.0 km;
▪ ***Mexico-Cabanatuan 230 kV Line bus-in to San Rafael S/S,*** SP-DC, 1-795 MCM ACSR, 1.0 km;
▪ ***Limay S/S (Replacement),*** 10-230 kV PCBs and associated equipment;
▪ ***BCCPP A and B Switchyard (Replacement/Expansion),*** 9-230 kV PCBs and Associated Equipment;
▪ ***Lamao Switchyard (New),*** 12-230 kV PCBs and associated equipment;
▪ ***San Rafael 230 kV S/S (Expansion),*** 4-230 kV PCBs and associated equipment.



This project aims to accommodate the connection of the 600 MW SMC Consolidated Power Corporation Coal-Fired Power Plant (SMC CPC CFPP) Project to the Luzon Grid through 'bus-in' connection to the existing Mariveles – BCCPP-B 230 kV transmission line. The project involves construction of the Lamao 230 kV substation, reconductoring of Limay – Hermosa and Hermosa – Mexico 230 kV lines, replacement of underrated Power Circuit Breakers (PCBs) at Limay Substation and BCCPP Block A & B Switchyard as well as the reconfiguration of the Mexico – Cabanatuan 230 kV corridor to fully dispatch the generation capacity of the existing and the proposed power plant, which is already classified by the Department of Energy (DOE) as a "committed" power plant. While a new 500 kV backbone will also be developed from Mariveles to Hermosa, the Bataan 230 kV Grid Reinforcement has been considered to optimize the existing transmission lines by increasing the capacity without acquiring new right-of-way.

8.1.4 Bolo 5th Bank

Major Project Components
▪ ***Bolo 500 kV S/S (Expansion),*** 1-600 MVA 500/230 kV Transformer, 3-500 kV PCB and associated equipment.

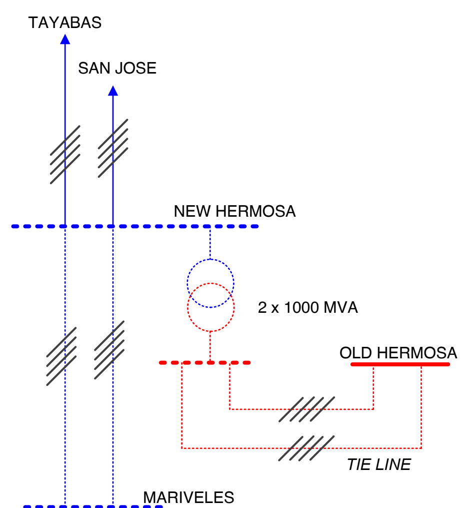


Bolo 500 kV Substation collects the generation from the major coal-fired power plants in the area namely: Sual and Masinloc. The power flow in the transformers at this substation is also being influenced by the dispatch of the hydro power plants and other generators in north Luzon. With the proposed 600 MW expansion of Masinloc CFPP and the generation developments in North Luzon, the substation capacity would no longer be adequate to maintain the N-1 contingency provision, thus, a 5th transformer bank is being proposed. This will provide the required grid augmentation while the Western 500 kV Backbone is not yet in place.

8.1.5 Mariveles-Hermosa 500 kV Transmission Line

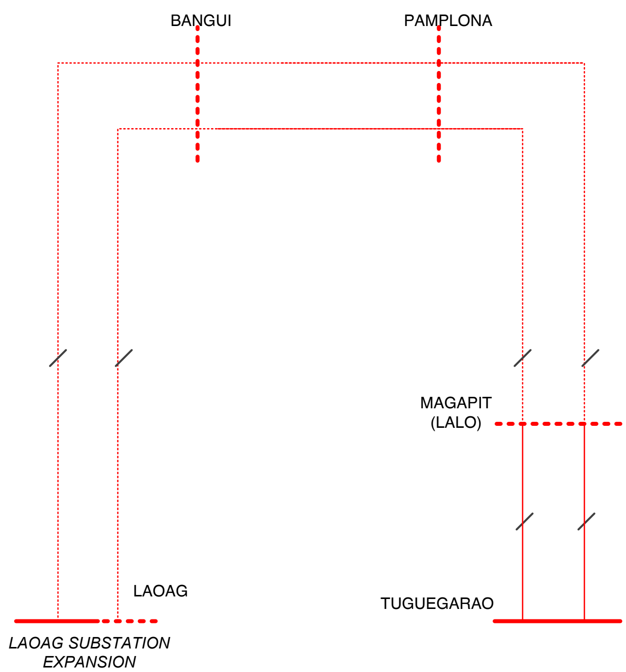
Major Project Components
▪ ***Mariveles-Hermosa 500 kV T/L,*** ST-DC, 4-410 mm^2 TACSR/AS, 40 km;
▪ ***New Mariveles 500 kV S/S,*** 9-500 kV PCB and associated equipment.

This involves the establishment of the 500 kV backbone at Bataan peninsula in order to support the entry of large capacity plants in the area namely: 1,336 MW GNPower Dinginin CFPP and 1,200 MW SMC CFPP. While the Bataan 230 kV Grid Reinforcement Project can increase the capacity of the existing 230 kV corridor in the area, the huge generation capacity addition of 2,536 MW cannot be accommodated unless a new transmission highway is developed. This new backbone will form part of the loop from Hermosa to Mariveles then to Cavite/Metro Manila upon completion of the future submarine cable. This project was previously named Cabcaben-Hermosa 500 kV Transmission Line.



8.1.6 Northern Luzon 230 kV Loop

Major Project Components
▪ ***Laoag-Bangui 230 kV T/L,*** ST-DC, 1-795 MCM ACSR/AS, 50 km; ▪ ***Bangui – Pamplona – Lal-lo (Magapit),*** 230 kV, ST-DC, 1-795 MCM, ACSR, 130 km; ▪ ***Laoag 230 kV S/S (Expansion),*** 4-230 kV PCBs and associated equipment; ▪ ***Bangui 230 kV S/S (New),*** 2-300 MVA, 230/115-13.8 kV Power Transformer and Accessories, 10-230 kV PCBs, 11-115 kV PCBs and associated equipment; ▪ ***Pamplona 230 kV S/S (New),*** 2-300 MVA, 230/115-13.8 kV Power Transformers and Accessories, 10-230 kV PCBs and associated equipment, 6-115 kV PCBs and associated equipment; ▪ ***Lal-lo (Magapit) 230 kV S/S (Expansion),*** 4-230 kV PCBs and associated equipment.

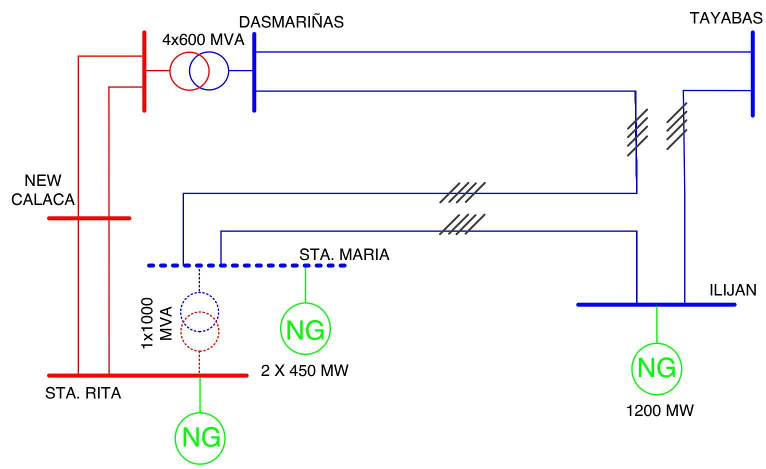


The Ilocos Region has been identified as among the areas with huge wind power generation potential. In addition to the existing 282 MW of total wind power plant capacity, at least 500 MW additional wind power generation is already being proposed. Even with the completion of the San Esteban-Laoag 230 kV Transmission Line Project, the Ilocos Region will still need additional power outlet to accommodate not only the renewable energy-based plants but also other power plants that may be located in the area. The looping to Cagayan Valley area will provide the required additional transmission line capacity. In terms of system reliability and operational flexibility, both the Ilocos Region and Cagayan Valley area will benefit from the looping of the 230 kV backbone. Even when there are toppled tower structures in a segment of the transmission lines during typhoons or other calamity, the loads can continuously be served due to the supply line redundancy brought about by the looping configuration. Also, the looping will ensure that any available generation capacity in the area can be delivered to the rest of the grid. Moreover, as regards substation siting where Bangui and Pamplona are the initially identified locations of collector substations, further optimization and evaluation of alternative sites can still be considered in coordination with the wind power plant proponents. Similarly, there are possible reconsiderations also for the scheme for the Laoag-Bangui Line segment given the existing facilities in the area.

It should be noted that due to generation additions also in the Cagayan Valley Area, the transmission line from Santiago to Ambuklao Substations will also be requiring grid reinforcement together with the implementation of the Northern Luzon 230 kV Loop.

8.1.7 Sta. Maria / Ibaan 500 kV Substation

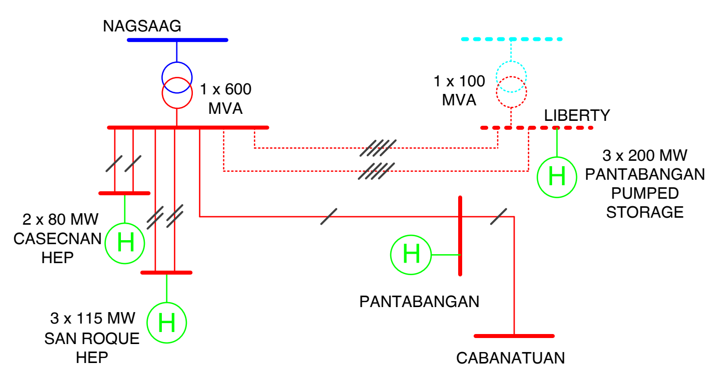
Major Project Components
▪ ***Sta. Maria / Ibaan 500 kV S/S,*** 10-500 kV PCB and associated equipment;
▪ ***Sta. Maria 500 kV Cut-in Lines,*** ST/SP-DC, 4-795 MCM ACSR, 9 km.



Batangas has been an existing bulk generation site with the presence of the huge LNG-fired power plants namely: Ilijan, Sta. Rita, San Lorenzo and including the San Gabriel Plant which is already committed. In addition, further generation installations near this site are still being proposed. The 230 kV system has a very limited capacity already while the 500 kV lines connected to Ilijan Substation still have some room. To be able to utilize the remaining capacity of the available 500 kV backbone, a new 500 kV substation either in Sta. Rita or Ibaan will be required. This is an alternative in directing the plant connection down south at the Ilijan 500 kV Switchyard which is still owned by the power plant. The site of the new 500 kV Substation would still be subject to further optimization and coordination with the power plant proponents in the area.

8.1.8 Liberty-Nagsaag 230 kV Transmission Line

Major Project Components
▪ ***Liberty-Nagsaag 230 kV T/L***, 4-795 MCM ACSR/AS, ST-DC, 68 kms;
▪ ***Liberty 230 kV S/S,*** 1-100 MVA 230/69 kV Power Transformer, Control Room, 11-230 kV PCB and associated equipment;
▪ ***Nagsaag 230 kV S/S Expansion,*** 3-230 kV PCBs and associated equipment.

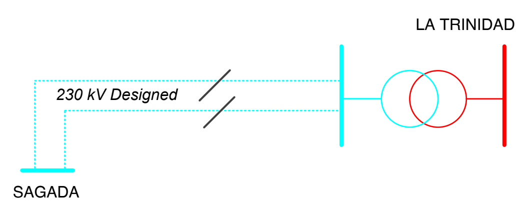


The Liberty-Nagsaag 230 kV line project aims to accommodate the entry of potential regulating plant for the Luzon Grid which is the proposed 600 MW Pump - Storage Hydroelectric Power Plant Project of First Gen Prime Energy Corporation. Because of the limited capacity of the transmission corridor going down to Mexico, this new transmission line will establish the delivery of power going up to Nagsaag where the link to the 500 kV backbone and to the high capacity San Manuel-Concepcion-Mexico 230 kV Transmission Line are connected. It can be noted that the Liberty-Nagsaag 230 kV Transmission Line, will already form part of the upgrading project of the old single circuit Nagsaag-Pantabangan-Cabanatuan-Mexico 230 kV line. The Liberty 230 kV Substation, on the other hand, will also be utilized to serve the existing loads connected at the Cabanatuan-Pantabangan 69 kV line. This new substation will allow the shifting of loads connected at the far-end of the Cabanatuan-Pantabangan 69 kV Line thereby improving operational flexibility, supply reliability as well as provision to accommodate future loads in the area.

8.1.9 La Trinidad-Sagada 230 kV Transmission Line

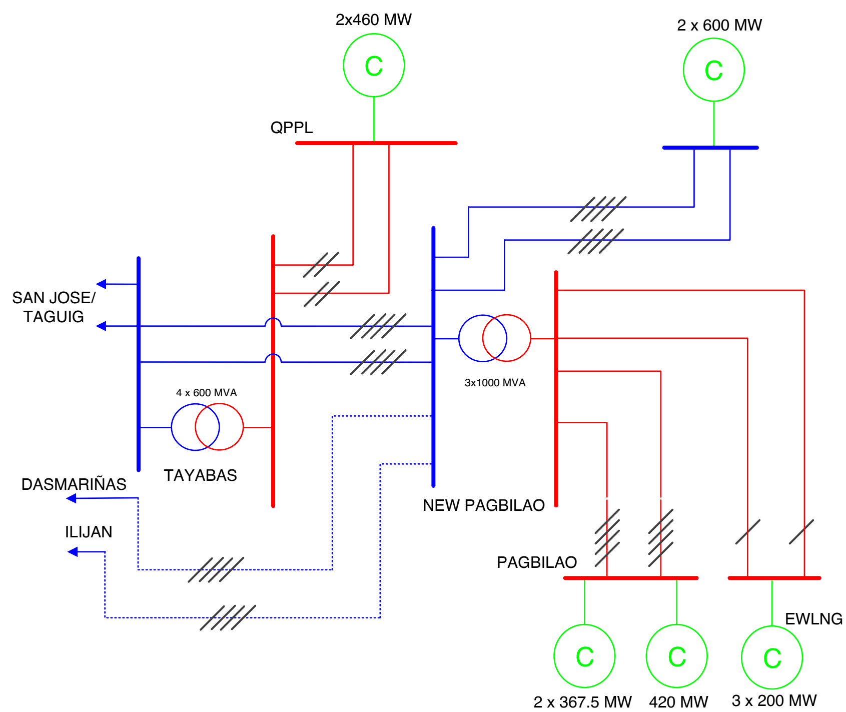
Major Project Components
▪ ***La Trinidad-Sagada 230 kV T/L*** *(to be initially energized at 69 kV),* ST/SP-DC, 1-795 MCM ACSR, 93.25 km transmission line;
▪ ***La Trinidad 69 kV S/S Expansion,*** 2-69 kV PCB and associated equipment;
▪ ***Sagada Switching Station,*** 6-69 kV PCB and associated equipment.

In order to cater the proposed generation capacity additions in the area which are mostly hydro power plants, the La Trinidad-Sagada 230 kV T/L is proposed. The project will also help improve the supply reliability in the area which is presently relying on the old La Trinidad-Bulalacao 69 kV Line.



8.1.10 Pagbilao-Tayabas 500 kV Transmission Line

Major Project Components
▪ ***Pagbilao-Tayabas 500 kV T/L,*** ST-DC, 4-795 MCM ACSR/AS, 17 km;
▪ ***Pagbilao 500 kV S/S,*** 4-500 kV PCB and associated equipment.

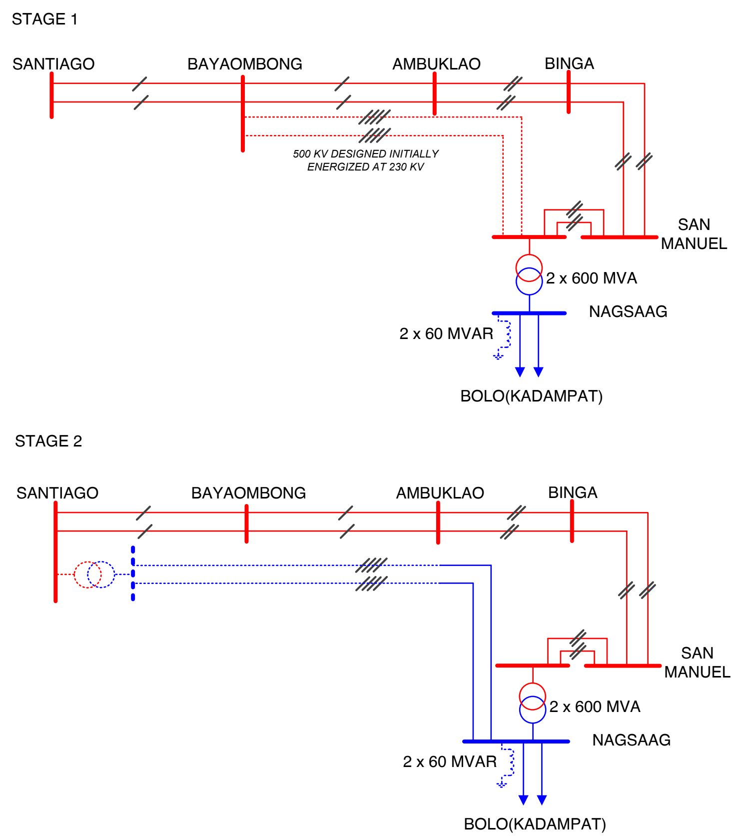


This is the second stage of the system development in Quezon province associated with the expected further generation capacity additions. In particular, with the entry of the proposed 1,200 MW Atimonan CFPP, the existing Tayabas Substation will become a more critical node being the merging point of more than 3,500 MW generation capacity in the area. The new transmission line is needed to establish a by-pass line to Tayabas 500 kV Substation such that the Pagbilao 500 kV Substation will already become part of the backbone loop.

8.1.11 Santiago-Nagsaag 500 kV Transmission Line

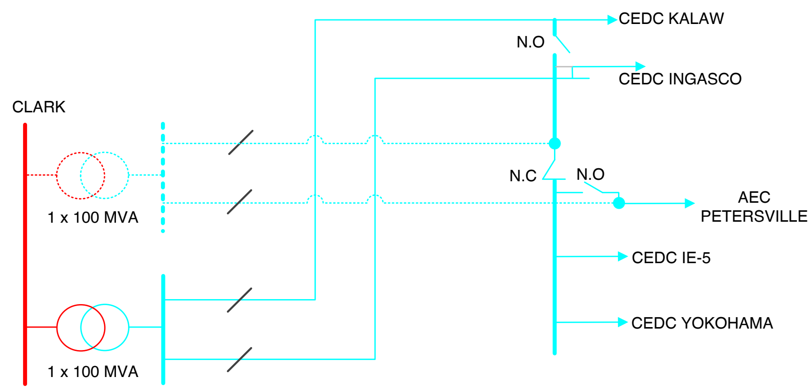
Major Project Components
▪ ***Santiago-Nagsaag 500 kV T/L,*** ST-DC, 4-795 MCM ACSR/AS, 140.0 km; ▪ ***Old and new Santiago S/S 230 kV tie-line,*** ST-DC, 4-795 MCM ACSR/AS, 1.0 km; ▪ ***New Santiago 500 kV S/S,*** 2-750 MVA 500/230-13.8 kV Power Transformer and Accessories, 6-500 kV PCBs and 6-230 kV PCBs and associated equipment; ▪ ***Santiago 230 kV S/S,*** 4-230 kV PCBs and associated equipment; ▪ ***Nagsaag 500 kV S/S,*** 4-500 kV PCBs and Accessories, 2-60 MVAR 500 kV Line Reactor and Accessories.

This project will serve as a new transmission backbone to support the generation developments in Cagayan Valley area including hydro power plants, wind farms and other conventional power plants. Without this project, the double-circuit Santiago – Bayombong - Ambuklao 230 kV Line, which is at 300 MVA capacity only per circuit, will become congested. This project will be implemented by stages and it includes the strategy of initially energizing the line at 230 kV only and also with initial termination at Bayombong Substation only due to the required long transmission line development. It will also complement the Northern Luzon 230 kV Loop Project.



8.1.12 Clark-Mabiga 69 kV Transmission Line

Major Project Components
▪ ***Clark-Mabiga 69 kV T/L,*** 1-410mm² TACSR/AS, SP-DC, 6 km; ▪ ***Clark 230 kV S/S (Expansion),*** 1-300 MVA 230/69-13.8 kV Power Transformer and Accessories, 1-230 kV PCB and Associated Equipment and 3-69 kV PCB and associated equipment.



The load growth in the area of Angeles and Mabalacat together with the new industries in Clark Freeport Zone will result in overloading of the existing Mexico-Clark 69 kV Line. Given the limitation in developing new 69 kV lines coming from Mexico Substation, the development of new 69 kV lines from Clark Substation is proposed to provide an alternate source of power. The recent installation of a new 100 MVA transformer at Clark Substation by CEDC has initially provided the needed relief for the existing Mexico-Clark 69 kV Lines whose heavy loading condition has been resulting in low voltage issues already. The Clark-Mabiga 69 kV Line Project will provide operational flexibility as it will form a loop configuration in the 69 kV system from Mexico Substation. This will optimize first the utilization of the existing Clark 230 kV Substation which has been reclassified already by the ERC as transmission asset.

8.1.13 North Luzon 230 kV Substation Upgrading Project

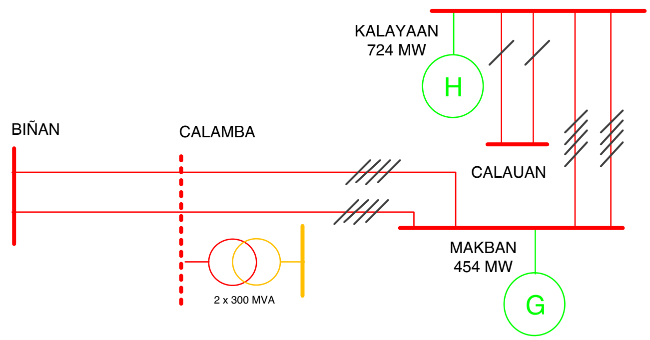
Major Project Components
STAGE 1 ▪ ***Bauang 230 kV S/S (Replacement)***, 1-100 MVA 230/115/69-13.8 kV Power Transformer and Accessories, 7-230 kV PCB and associated equipment; ▪ ***Gamu 230 kV S/S (Expansion)***, 1-100 MVA 230/69-13.8 kV Power Transformer and accessories, 10-230 kV PCB and associated equipment, 2-69 kV PCB and associated equipment; ▪ ***Bayombong 230 kV S/S (Replacement)***, 1-100 MVA 230/69-13.8 kV Power Transformer and Accessories, 5-230 kV PCB and associated equipment, 3-69 kV PCB and associated equipment; ▪ ***Hermosa 69 kV S/S,*** 12-69 kV PCB and associated equipment; ▪ ***Pantabangan 230 kV S/S,*** 4-230 kV PCBs and associated equipment; ▪ ***Doña Imelda S/S,*** 1-115 kV PCB and associated equipment and neutral grounding transformer; ▪ ***Malaya 230 kV S/S (Expansion),*** 1-300 MVA, 230/115-13.8 kV Power Transformer and Accessories, 9-230 kV PCB and associated equipment, 1-115 kV PCB and associated equipment; ▪ ***San Jose 230 kV S/S (Expansion),*** 1-300 MVA, 230/115-13.8 kV Power Transformers and Accessories, 1-230 kV PCB and associated equipment, 7-115 kV PCB and associated equipment. **STAGE 2** ▪ ***Balingueo 230 kV S/S (Expansion)***, 1-100 MVA 230/69-13.8 kV Power Transformer and Accessories, 5-230 kV PCB and associated equipment, 4-69 kV PCB and associated equipment; ▪ ***Bacnotan 230 kV S/S (Expansion)***, 1-50 MVA 230/69-13.8 kV Power Transformer and Accessories, 1-230 kV PCB and associated equipment, 6-69 kV PCB and associated equipment; ▪ ***Labrador 230 kV S/S (Replacement)***, 1-100 MVA 230/69-13.8 kV Power Transformer and Accessories, 5-230 kV PCB and associated equipment, 2-69 kV PCB and associated equipment; ▪ ***San Rafael 230 kV S/S (Expansion)***, 1-300 MVA 230/69-13.8 kV Power Transformer and Accessories, 1-230 kV PCB and associated equipment.

This project package contains the transformer capacity installation components at various substations in North Luzon which aim to ensure the continuous adequacy of substation capacity in serving the increasing loads both during normal and N-1 contingency conditions. It also involves replacement of PCBs at Pantabangan switchyard due to historical equipment failure and installation of neutral grounding transformer at Doña Imelda to energize the spare 4th transformer bank.

Such developments would allow NGCP to meet the grid code standard and to have operational flexibility especially during the maintenance activities for power transformers at the substations, thereby, avoiding supply interruption to the loads.

8.1.14 Calamba 230 kV Substation

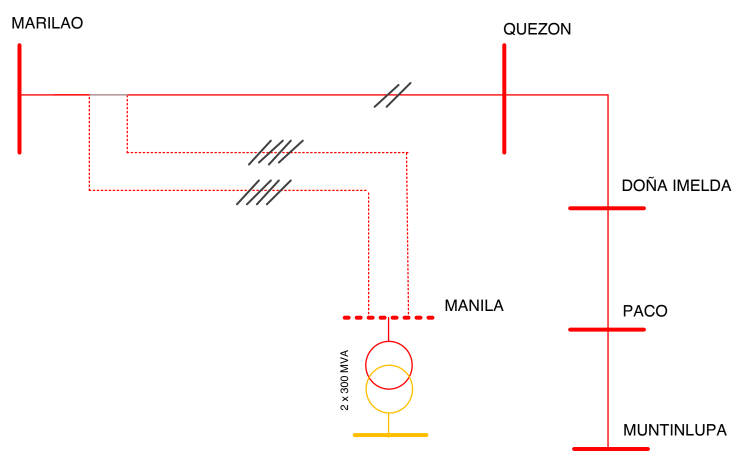
Major Project Components
▪ ***Calamba 230 kV S/S,*** 2-300 MVA, 230/115-13.8 kV Power Transformers to be implemented by MERALCO, 10-230 kV PCB and associated equipment; ▪ ***Bus-in Lines,*** 230 kV T/L, SP-DC, 2-610 mm^2 TACSR/AS, 1.5km.



There is a need to develop a new drawdown substation strategically located near the industrial parks in Laguna and Batangas and midway of Sta. Rosa and Calauan Substations to provide the long-term power requirement of the loads, provide higher level of transmission reliability and flexibility of operation. Thus, Calamba Substation is proposed via bus-in connection along the new Biñan-Bay (Makban) 230 kV line. This will also unload and address the single-outage contingency overloading in other adjacent 230 kV drawdown substations namely Sta. Rosa and Calauan Substations, and at the same time, it has the benefit of addressing also the load growth and expected overloading in Calauan-Los Baños 115 kV distribution line during contingency events.

8.1.15 Manila (Navotas) 230 kV Substation

Major Project Components
▪ ***Manila 230 kV S/S,*** 2-300 MVA, 230/115-13.8 kV Power Transformers and Accessories, 9-230 kV PCBs (GIS) and 15-115 kV PCBs (GIS) and associated equipment; ▪ ***From Marilao-Quezon cut-in point to Manila S/S,*** 230 kV ST/SP-DC, 4-795 MCM ACSR/AS, 21 km.

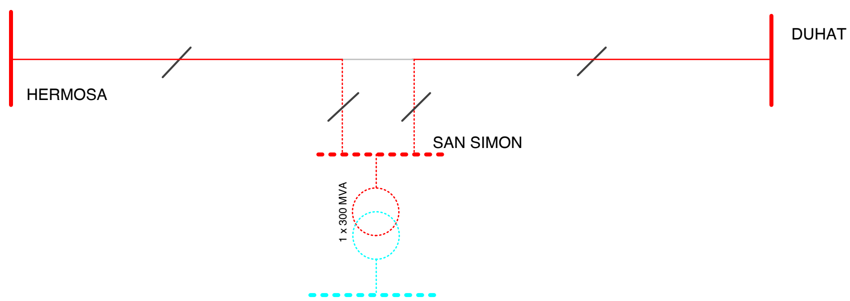


With the further increase in load, the existing 230/115 kV substations in Metro Manila become heavily loaded and have been losing already the provision for N-1 contingency. This will expose the Metro Manila loads to supply reliability risk as well as power quality concerns during system peak load condition. Manila/Navotas has been identified as a strategic site to augment the supply for MERALCO's load sector 1 which is presently relying on Quezon, Duhat, and Paco Substations. The proposed Manila/Navotas 230 kV Substation will be temporarily linked to the grid through "cut-in" connection along the existing Marilao-Quezon 230 kV line and ultimately terminated to the new 500/230 kV substation in Marilao in the future. Furthermore, due to the space constraints for a conventional substation, a Gas Insulated

Switchgear (GIS) substation has been considered. This substation can also serve as a connection point for TMO and Millenium power plants in the area, thus, facilitate direct plant connection to NGCP.

8.1.16 Mexico-San Simon 69 kV Transmission Line

Major Project Components
▪ ***Mexico-San Simon 69 kV T/L***, ST/SP-DC, 1-410 mm^2 TACSR, 6.9 km;
▪ ***Mexico 69 kV S/S Expansion,*** 9-69 kV PCB and associated equipment.

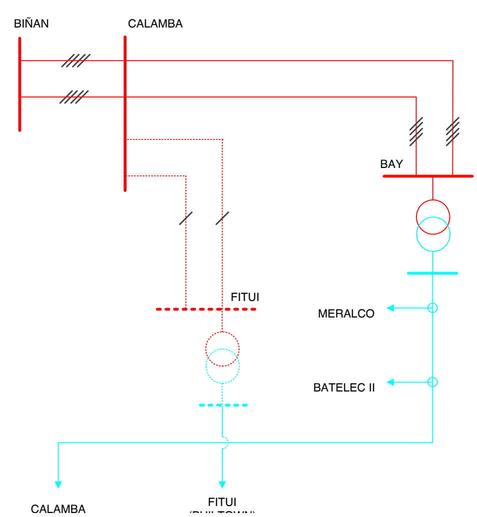


The Mexico-San Simon 69 kV Line is the first stage of the development to accommodate the incoming steel plants and load growth in San Simon, Pampanga. To serve the immediate needs of the new steel plants, additional 69 kV lines for Mexico Substation are required. If more steel plants or other industrial facilities will be built in San Simon in the future, a new 230 kV drawdown substation, which is a separate project, will serve as the long term solution.

8.1.17 Tanauan 230 kV Substation

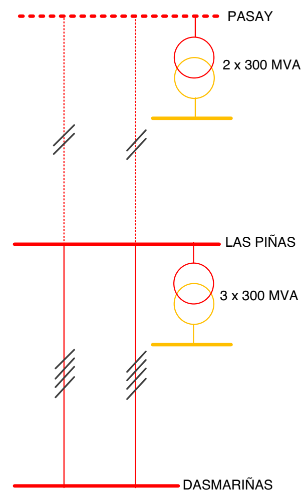
Major Project Components
▪ ***Tanauan 230 kV S/S,*** 1-100 MVA, 230/69 kV Power Transformer, 7-230 kV PCBs and associated equipment; 3-69 PCBs and associated equipment;
▪ ***230 kV Bus-in Lines,*** 230 kV, ST/SP-DC, 1-795 MCM ACSR/AS, 12 km.

This project is another proposed 230 kV substation geared towards supporting the development of industrial loads in Batangas. The area which is presently relying on the old single circuit 69 kV line coming from Bay Substation will not be adequately served due to load growth. In lieu of 69 kV line development coming from Bay, which has implementation challenges due to right-of-way concerns, this new 230 kV substation to be supplied from Calamba 230 kV Substation is an alternative.



8.1.18 Pasay 230 kV Substation

Major Project Components
▪ ***Pasay 230 kV S/S,*** 5-230 kV PCBs (GIS) and associated equipment; ▪ ***Las Piñas-Pasay 230 kV T/L,*** 230 kV, 2-795 MCM ACSR/AS, SP-DC, 4.2 km; 230 kV 2-1C-2,000 mm² XLPE, UG-DC, 3.9 km.

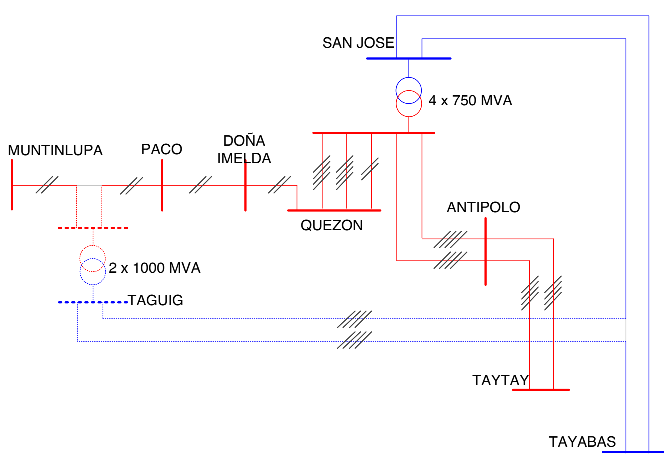


The Pasay Substation project will augment the supply for MERALCO's load sector 3 presently being served by Las Piñas and Muntinlupa Substations. These substations have recent projects for the installation of the 4th transformer unit, but these would serve as medium-term solution only to address the increasing load and to provide single outage (N-1) contingency. Ultimately, new drawdown substation will have to be developed and Pasay was identified as a strategic site being close to the load growth area in the Entertainment City in Pasay and can also help support the loads in Makati City. As its supply line, a new 230 kV transmission highway from Las Piñas is required where right-of-way is expected as a major challenge.

8.1.19 Taguig 500 kV Substation

Major Project Components
▪ ***Taguig 500 kV S/S,*** 2-1,000 MVA, 500/230-13.8 kV Power Transformers and Accessories, 1-90 MVAR, 500 kV Shunt Reactor and Accessories, 3-100 MVAR, 230 kV Capacitor Banks and Accessories, 8-500 kV PCBs (GIS), 10-230 kV PCBs (GIS), and Associated Equipment; ▪ ***Taguig cut-in to San Jose-Tayabas 500 kV T/L,*** 500 kV, ST-DC, 4-795 MCM ACSR, 37 km; ▪ ***Taguig bus-in to Muntinlupa-Paco 230 kV T/L,*** 230 kV, SP-DC1, 2-410 mm² TACSR, 2-2.4 km.

The Taguig 500 kV Substation will decongest the San Jose and Dasmariñas 500 kV Substations. This is one of NGCP's transmission network development plans for Metro Manila to ensure that the power requirements of the country's load center will be adequately and reliably served in the long term. The Taguig 500 kV Substation Project will be addressing the following issues: need for a new 500 kV drawdown substation to address the increase in bulk power injection to the 500 kV



system and need to reinforce the single-circuit 230 kV transmission line traversing within Metro Manila. The implementation of the Taguig 500 kV Substation will improve the reliability of the transmission network by providing direct power injection within Metro Manila through the Muntinlupa-Paco 230 kV Transmission Line segment and at the same time, this will also address the power quality issues. It should be noted that Taguig 500 kV has been prioritized over the previous Baras (Antipolo) 500 kV Substation Project but this could still be implemented in the far future as part of the 500 kV system development.

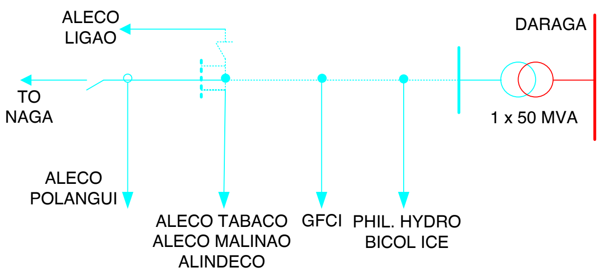
8.1.20 South Luzon 230 kV Substation Upgrading Project

Major Project Components
STAGE 1
▪ ***Las Piñas 230 kV S/S (Expansion)***, 1-300 MVA, 230/115-13.8 kV Power Transformer and Accessories;
▪ ***Lumban 230 kV S/S (Expansion)***, 1-100 MVA, 230/69-13.8 kV Power Transformer and Accessories, 1-230 kV PCB and associated equipment;
▪ ***San Juan (Kalayaan) S/Y***, 8-230 kV PCBs and associated equipment;
▪ ***Naga 230 kV S/S (Replacement)***, 1-300 MVA, 230/69-13.8 kV Power Transformer and Accessories, 1-230 kV PCB and associated equipment, 1-69 kV PCB and associated equipment.
STAGE 2
▪ ***Gumaca 230 kV S/S (Replacement)***, 1-100 MVA 230/69-13.8 kV Power Transformer, 1-230 kV PCB and associated equipment, 3-69 kV PCBs and associated equipment ;
▪ ***Daraga 230 kV S/S (Replacement)***, 1-100 MVA 230/69-13.8 kV Power Transformer and Accessories.
▪ ***Labo 230 kV S/S***, Bus works and protection control equipment

This project package contains the transformer capacity installation components at various substations in South Luzon which aim to ensure the continuous adequacy of substation capacity in serving the increasing loads both during normal and N-1 contingency conditions. Such developments would allow NGCP to meet the grid code standard and would also allow to have operational flexibility especially during the maintenance activities for power transformers at the substations, thereby, avoiding supply interruption to the loads. For the case of Las Piñas Substation, the proposed installation of additional transformer under this project package, which will already serve as the 5th transformer unit for the substation, is considered only as an interim measure should the development of the new Pasay 230 kV Substation experience a considerable delay particularly in establishing its 230 kV supply line from Las Piñas which is the more challenging part.

8.1.21 Daraga-Ligao 69 kV Transmission Line Upgrading

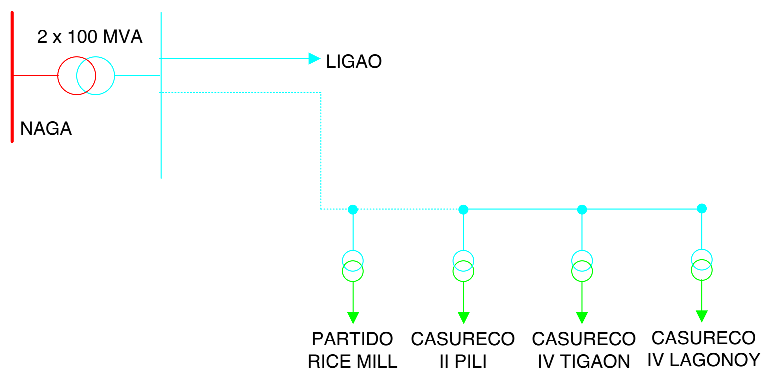
Major Project Components
▪ ***Daraga-Ligao 69 kV T/L,*** 1-795 MCM ACSR/AS, ST-SC, 22 km; ▪ ***Daraga 69 kV S/S Expansion,*** 1-69 kV PCB and associated equipment; ▪ ***Ligao Switching Station,*** 1-69 kV PCB and associated equipment.



The total projected loading of the directly-connected customers and distribution utility in Albay is projected to exceed the capacity of the existing Daraga-Ligao 69 kV Line, thus the need to reinforce the existing line to accommodate load growth and at the same time ensure the reliability of supply to the customers. It can be noted that the decision on September 22, 2009 for ERC Case No. 2008-105 MC cited that the Tabaco-Ligao-Daraga 69 kV Line will already be reclassified as Network/Transmission Assets upon the closing of the Daraga-Tabaco-Ligao 69 kV loop due to the implementation of Eastern Albay 69 kV Line Project.

8.1.22 Naga-Pili 69 kV Transmission Line Upgrading

Major Project Components
▪ ***Naga-Pili 69 kV T/L,*** 1-795 MCM ACSR/AS, SP-DC, 10.5 km.

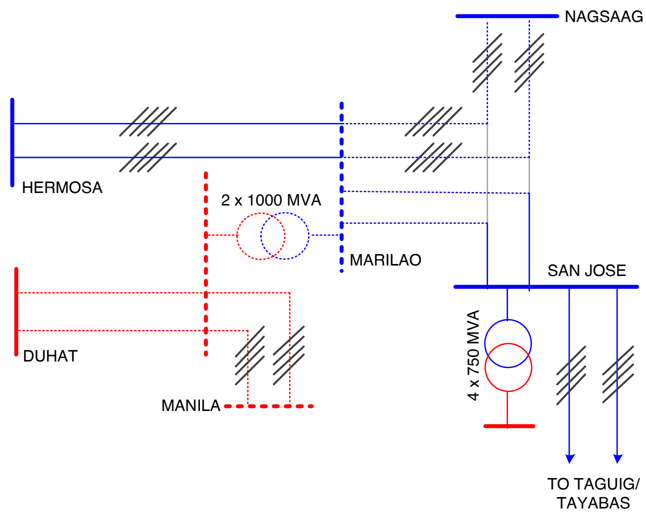


The existing Naga-Pili 69 kV Line is a double circuit facility serving as a main trunk of the supply for the northeastern part of Camarines Sur. The other circuit of this line is also extended to the city of Ligao in Albay and also linked to Daraga Substation. With the further increase of the loads being served and considering also the age of the existing 69 kV line, the upgrading project will be able to ensure continuous adequate and reliable operation including the benefit of providing operational flexibility during contingency or maintenance in the 69 kV facility.

8.1.23 Marilao 500 kV Substation

Major Project Components
▪ ***Marilao 500 kV S/S,*** 2-1,000 MVA, 500/230-13.8 kV Power Transformers and Accessories, 14-500 kV PCBs, 14-230 kV PCBs, and associated equipment;
▪ ***Nagsaag -San Jose 500 kV Line Extension to Marilao 500 kV S/S,*** 500 kV, ST-DC, 4-795 MCM ACSR/AS, 8.7 km;
▪ ***Marilao bus-in to Hermosa-San Jose 500 kV Line,*** 500 kV, ST-DC, 4-410mm^2 TACSR, 1.5 km;
▪ ***Marilao- Duhat 230 kV T/L,*** SP-DC, 2-795 MCM ACSR/AS, 3.2 km;
▪ ***Marilao-Manila 230 kV T/L,*** SP-DC, 4-795 MCM ACSR, 3.6 km;

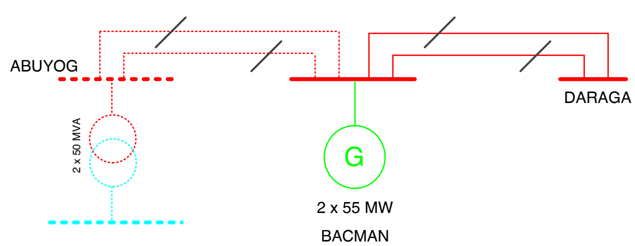
This new 500 kV substation, which is also part of the master plan, will provide another drawdown substation to support the increasing demand in the load center and will also address the further increase in bulk power injection to the 500 kV system coming from the new power plants in the grid. This project will also address the initial line by-pass scheme at San Jose Substation under the project Hermosa-San Jose 500 kV Transmission Line which is brought about by the GIS expansion limitation at San Jose 500 kV. With the new scheme, the criticality of San Jose 500 kV, presently at ring-bus configuration, will already be reduced as new Marilao Substation will now serve as the main node in the grid.



8.1.24 Abuyog 230 kV Substation

Major Project Components
▪ ***Abuyog (Sorsogon) 230 kV S/S,*** 2-50 MVA 230/69-13.8 kV Power Transformer, 6-230 kV PCB, 5-69 kV PCB and associated equipment;
▪ ***Bacman 230 kV S/S Expansion,*** 4-230 kV PCB and associated equipment;
▪ ***Bacman-Abuyog 230 kV T/L,*** 1-795 MCM ACSR/AS, ST-DC, 25 km.

There is a need to establish a 230 kV drawdown substation closer to the loads in Sorsogon to address the supply reliability issues, meet the projected demand in the long term and address the power quality issues at the load-end substations. It can be noted that the whole province of Sorsogon is solely relying on a single-circuit 69 kV line being supplied from Daraga Substation which is located in

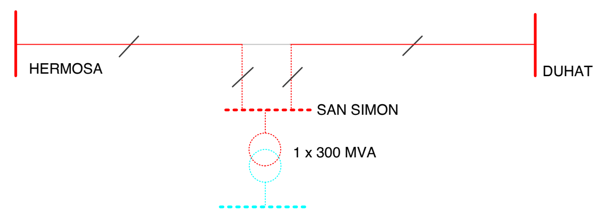


Albay. The 230 kV backbone is already extended up to Bacman Geothermal Plant in Sorsogon and may already be used as part of the supply facilities for the proposed Abuyog Substation.

8.1.25 San Simon 230 kV Substation

Major Project Components
▪ ***San Simon 230 kV S/S***, 1-300 MVA 230/69 kV transformer, 5-230 kV PCB, 9-69 kV PCB and associated equipment;
▪ ***230 kV T/L Extension,*** 2-795 MCM ACSR, ST-DC, 4-km. from the bus-in point along Hermosa-Duhat Line.

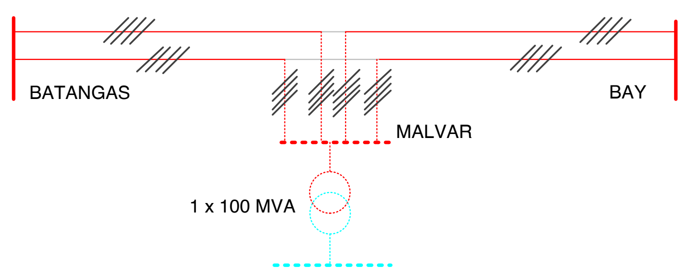
This project will alleviate the Mexico Substation in the long term by providing an alternate source substation for the loads in the southeastern part of the province of Pampanga. The new substation in San Simon will accommodate the further load growth of the steel plants in the area and will also support the entry of other new industrial loads.



8.1.26 Malvar 230 kV Substation

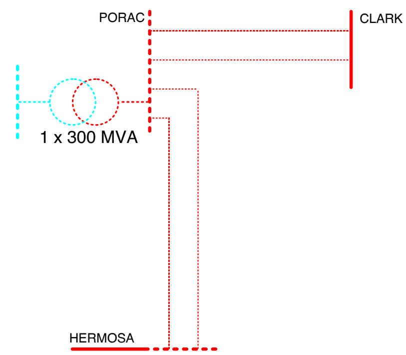
Major Project Components
▪ ***Extension from the bus-in point (Batangas side) to Malvar S/S,*** 230 kV, ST-DC, 4-795 MCM ACSR/AS, 5.0 km;
▪ ***Extension from the bus-in point (Bay side) to Malvar S/S,*** 230 kV, ST-DC, 4-795 MCM ACSR/AS, 5.0 km;
▪ ***Malvar 230 kV S/S (New),*** 1-100 MVA, 230/69-13.8 kV Power Transformer, 9-230 kV PCB and 9-69 kV PCB and associated equipment.

The Malvar 230 kV Substation will serve the incoming new industrial loads in Malvar and Lipa City as well as the load growth of the existing customers in the area. This will relieve the loading of both Batangas and Bay Substations and will provide operational flexibility. The Malvar 230 kV Substation is also in lieu of constructing more 69 kV lines from Batangas Substation or upgrading of existing 69 kV lines.



8.1.27 Porac 230 kV Substation

Major Project Components
▪ ***Porac 230 kV S/S***, 1-300 MVA 230/69 kV transformer, 5-230 kV PCB, 9-69 kV PCB and associated equipment;
▪ ***Hermosa-Porac-Clark,*** 4-795 MCM ACSR, ST-DC, 54-km.
▪ ***Hermosa 230 kV S/S (Expansion),*** 4-230 kV PCB and associated equipment;
▪ ***Clark 230 kV S/S (Expansion),*** 4-230 kV PCB and associated equipment.

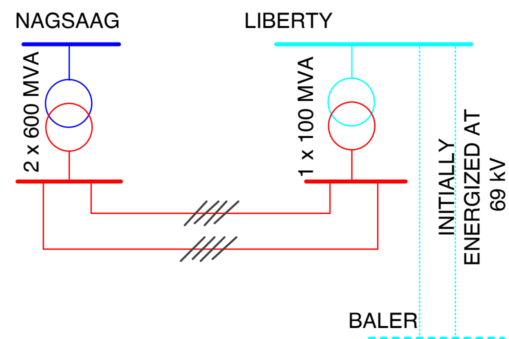


This project, which will be implemented by stages, has the primary goal of supporting load growth in Pampanga and establishing the 230 kV backbone loop from Hermosa to Clark thereby providing a more direct access to the generation hub in Bataan. Among the expected major load developments include Alviera and Clark Green City.

8.1.28 Liberty-Baler 230 kV Transmission Line

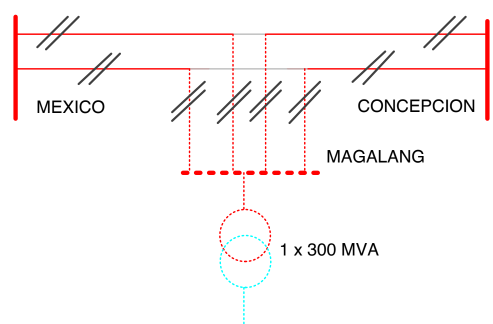
Major Project Components
▪ ***Liberty-Baler 230 kV T/L,*** 1-795 MCM ST-DC, 56.5 km;
▪ ***Liberty 69 kV S/S,*** 4-69 kV PCB and associated equipment;
▪ ***Baler 69 kV S/S,*** Control Room, 4-69 kV PCB and associated equipment.

The Liberty-Baler 230 kV line project (initially energized at 69 kV) will provide improvement in the reliability of supply as well as voltage quality in Baler, Aurora, which is presently being served by a long 69 kV line from Cabanatuan Substation. This line will also support the development of line extension going to Casiguran and will serve as a link to connect other loads in Aurora Province which are not grid-connected yet.



8.1.29 Magalang 230 kV Substation

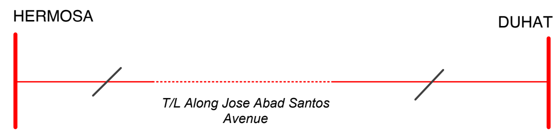
Major Project Components
▪ ***Magalang 230 kV S/S,*** 1-300 MVA 230/69 kV Power Transformer, 8-230 kV PCB, and associated equipment;
▪ ***230 kV Bus-in Lines,*** 230 kV, ST-DC, 2-410 mm^2 TACSR, 5 km.



This new substation project was originally conceptualized as an alternative in addressing the heavy loading condition of the existing Mexico-Clark 69 kV Lines. Without any augmentation for this 69 kV facility, the loads will not be adequately served even the expected load growth and that low voltage problems will continue as a major issue in the area. With the installation of additional transformer at Clark Substation and the implementation of the Clark-Mabiga 69 kV Line, present issues will already be addressed. In the long-term, however, this new substation project would still serve as future augmentation in adequately and reliably serving the loads in the area.

8.1.30 Relocation of Steel Poles Along Hermosa-Duhat 230 kV Transmission Line

Major Project Components
▪ ***Hermosa – Duhat 230 kV T/L,*** 18 steel poles.

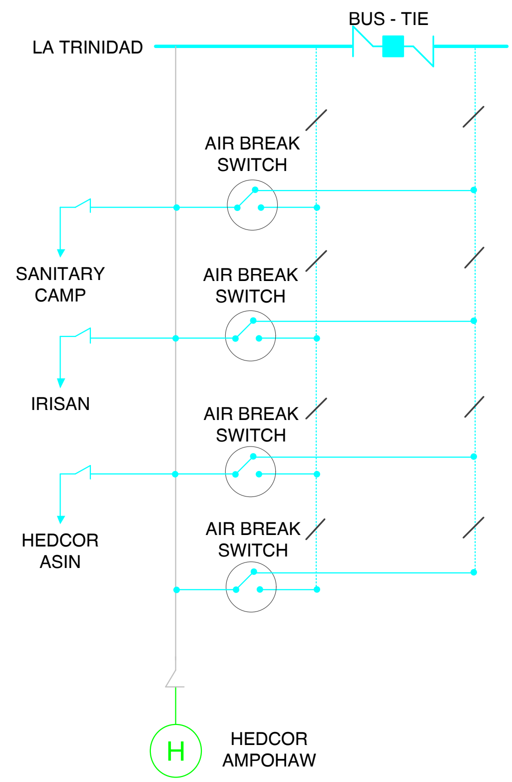


Hermosa–Duhat–Quezon 230 kV Transmission Line is a 110 km, steel pole, single-circuit transmission facility commissioned in 1994. A segment of the said line was constructed along the Jose Abad Santos Avenue (JASA) which is a portion of the Olongapo–Gapan Road in Brgy. Dolores, City of San Fernando, Pampanga. The recent road widening project along JASA, which is implemented through the Korean Economic Development Cooperation Fund (KEDCF) under the Project Management Office of the Department of Public Works and Highways (DPWH), left some 18 steel poles at the middle of the road. As this will endanger the safety of the motorists plying along JASA especially during dark hours and bad weather conditions, the Local Government Unit of San Fernando City, as well as the DPWH, requested for the relocation of the affected 18 steel poles.

8.1.31 La Trinidad-Calot 69 kV Transmission Line

Major Project Components
▪ ***La Trinidad–Calot 69 kV T/L***, SP/ST-DC, 1-795 MCM ACSR/AS, 21 km; ▪ ***69 kV Line Tapping Points,*** *5-72.5 kV, 3-way Air Break Switch* ▪ ***La Trinidad 69 kV S/S Expansion,*** 1-69 kV PCB and Associated Equipment.

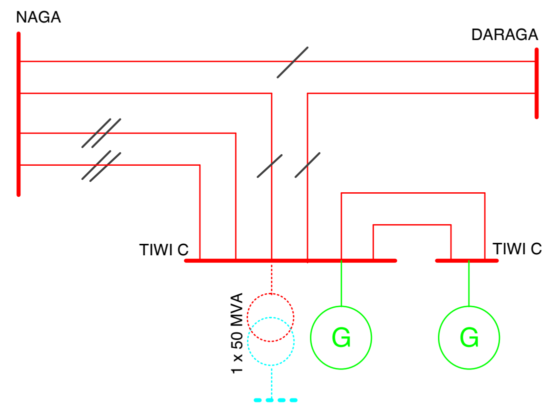
This will improve the reliability of the transmission facilities serving Baguio City and the other loads in Benguet including the hydro power plants in the area. The existing 69 kV line in the area is more than 50 years old already and it needs the provision for N-1 contingency.



8.1.32 Tiwi Substation Upgrading

Major Project Components
▪ ***Tiwi A 230 kV S/S,*** 4-230 kV PCBs and associated equipment; ▪ ***Tiwi C 230 kV S/S,*** 1-50 MVA, 230/69-13.8 kV Power Transformer and Accessories, 15-230 kV PCBs and associated equipment and 3-69 kV PCBs and associated equipment.

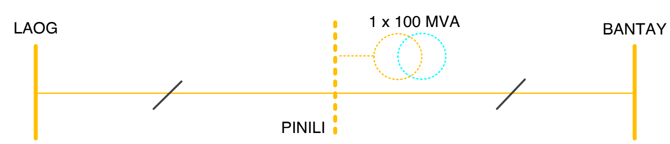
The project aims to upgrade the old and deteriorated substation equipment at Tiwi A and C Substations to improve the reliability of the system. It will also augment the power requirement of Malinao/Ligao LES by installation of additional power transformer at Tiwi C Substation and will clearly identify asset boundaries within the Tiwi Geothermal Power Plant Complex through construction of NGCP's own control facilities. It also involves diversion of the Daraga/Naga 230 kV Lines to Tiwi C Substation and extension of the Malinao/Ligao 69 kV Line from Tiwi A to Tiwi C Substation.



8.1.33 Pinili 115 kV Substation

Major Project Components
▪ ***Pinili 115 kV S/S (New)***, 1-100 MVA 115/69-13.8 kV Power Transformer and Accessories, 6-115 kV PCB and associated equipment, 5-69 kV PCB and associated equipment.

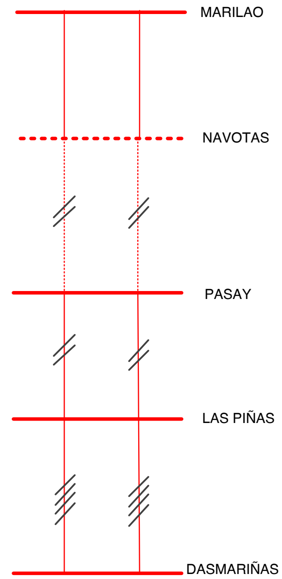
This new substation will replace the Currimao 115 kV Substation to accommodate the load growth and provide N-1 contingency for the loads of Ilocos Norte Electric Cooperative (INEC), Ilocos Sur Electric Cooperative (ISECO) and Abra Electric Cooperative (ABRECO). It will also serve as a connection point to the new renewable energy power plants in the area.



8.1.34 Navotas-Pasay 230 kV Transmission Line

Major Project Components
▪ ***Navotas-Pasay 230 kV T/L,*** 4-795 MCM ACSR, SP-DC, 13 km.

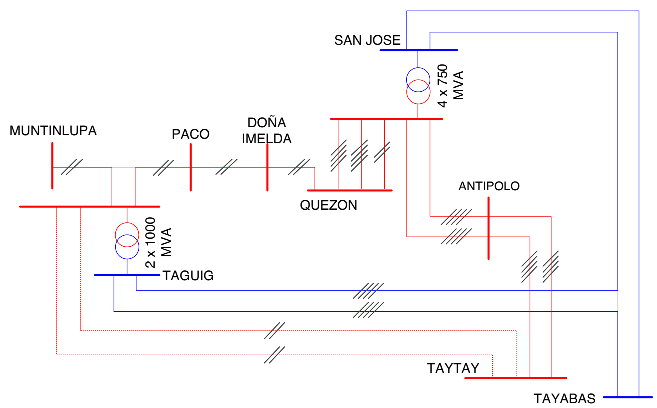
This proposed line will effectively form a new highway within Metro Manila by forming a new 230 kV loop. Such scheme will result in more robust transmission network for the area. While the scheme has been conceptualized already, further assessment of the option to use underground power cable will still be considered especially that the new line will traverse along the Roxas Boulevard.



8.1.35 Taguig-Taytay 230 kV Line

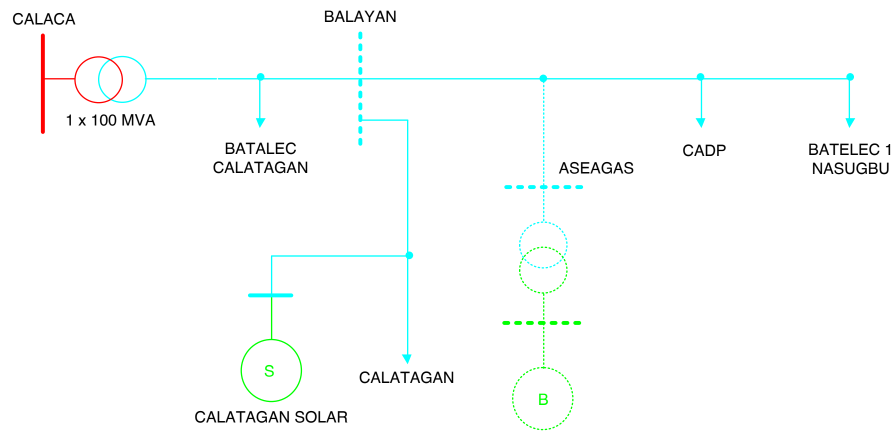
Major Project Components
▪ ***Taguig-Taytay 230 kV T/L,*** 2-610 mm^2 TACSR, SP-DC, 10 km;
▪ ***Taytay 230 kV S/S,*** 4-230 kV PCBs and Associated Equipment.

This project will provide additional outgoing circuits from the new Taguig 500/230 kV Substation. With the link from Taguig to Taytay, the decongestion of San Jose EHV Substation will become more effective, the utilization of the new substation in Taguig will be optimized, and it will further improve the reliability of supply for Taytay and also for the new Antipolo 230 kV Substations. It can be observed also that this project will form part of the 230 kV transmission loop surrounding the Laguna Lake.



8.1.36 Balayan 69 kV Switching Station

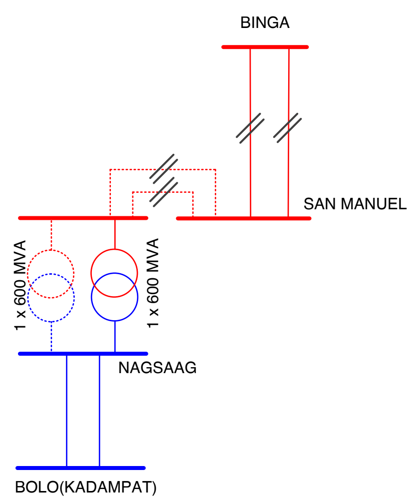
Major Project Components
▪ ***Balayan-Calatagan Line extension,*** 69 kV 1-336.4 MCM ACSR SP/CP-SC, 0.7 km;
▪ ***Balayan Switching Station,*** 6-69 kV PCBs and Associated Equipment



The Calaca – Balayan – Nasugbu / Calatagan 69 kV line is currently serving load and generator customers. The Balayan to Nasugbu 69 kV line segment serves the BATELEC I Nasugbu and Natipuan loads together with the newly commissioned Aseagas Biomass Plant while the Balayan to Calatagan 69 kV line segment serves the BATELEC I Calatagan and the incoming Calatagan Solar Plant of Solar Philippines. The Balayan Switching Station aims to provide a more reliable supply of power through continuous transmission service even in case of fault in either one of the line segments.

8.1.37 San Manuel-Nagsaag 230 kV Transmission Line

Major Project Components
▪ ***San Manuel-Nagsaag 230 kV Tie-Line Upgrading,*** SP-DC, 2-410 mm^2 TACSR, 0.6 km;
▪ ***Binga Line Extension,*** 230 kV, SP-DC, 2-795 MCM ACSR, 0.6 km;
▪ ***Nagsaag 500 kV S/S (Expansion),*** 3-200 MVA, 500/230-13.8 kV Power Transformers and Accessories, 2-500 kV PCB and Associated Equipment and 8-230 kV PCB and Associated Equipment;
▪ ***San Manuel 230 kV S/S (Expansion),*** 3-230 kV PCB and Associated Equipment;

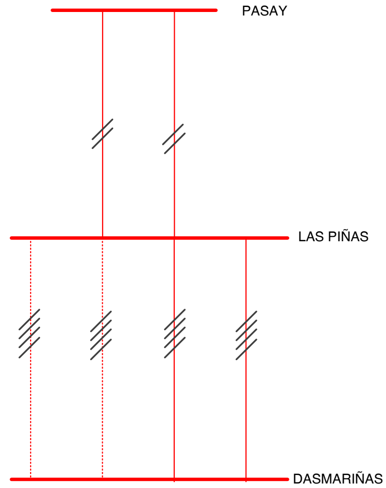


The existing 230 kV tie-line connecting Nagsaag and San Manuel 230 kV Substations is a single-circuit facility only. During outage of the existing tie-line, the identified problems include low voltage issues and overloading of the Pantabangan-Cabanatuan 230 kV Line particularly during maximum dispatch of the hydro plants in North Luzon. This project will help improve system security by ensuring continuous connectivity between the concerned substations and will allow optimal utilization of the high capacity San Manuel-Concepcion-Mexico transmission corridor.

8.1.38 Dasmariñas-Las Piñas 230 kV Transmission Line

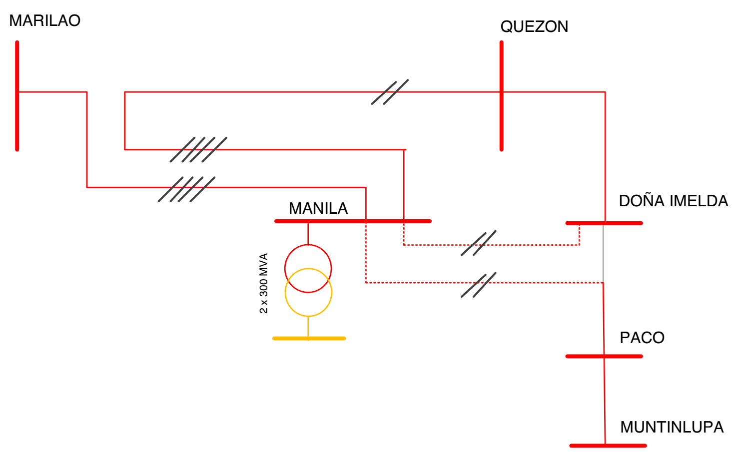
Major Project Components
▪ ***Dasmariñas-Las Piñas 230 kV T/L,*** 4-795 MCM ACSR SP-DC, 32 km;
▪ ***Las Piñas 230 kV S/S (Expansion),*** 4-230 kV PCB GIS and associated equipment.

This line is interrelated with the Navotas-Pasay 230 kV Transmission Line Project. Without the looping to Navotas or any augmentation, the substation capacity for Las Piñas and Pasay as well the allowable loads that can be served by these two substations will just be constrained by the capacity of the existing radial Dasmariñas-Las Piñas 230 kV Line. In this regard and in view of the challenges in the right-of-way for a new transmission line from Pasay to Navotas, the development of another circuits from Dasmariñas to Las Piñas has been considered. This new line, which may be able to align with the route of the Cavite-Laguna Expressway or CALAX, will further improve system reliability by providing a separate corridor. Moreover, substation expansion in Las Piñas will also be required.



8.1.39 Manila (Navotas)-Dona Imelda 230 kV Transmission Line

Major Project Components
▪ ***Manila/Navotas-Dona Imelda 230 kV T/L,*** 2-410 mm^2 TACSR, SP-DC, 10 km;

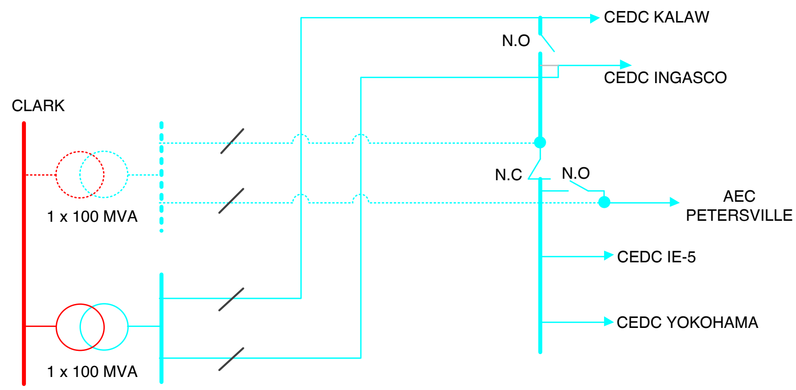


This project aims to provide additional transmission corridor that will complement the existing single circuit Quezon-Doña-Paco-Muntinlupa 230 kV line and will help address its criticality. Effectively, the Marilao-Manila/Navotas 230 kV Line and the Manila/Navotas-Doña Imelda 230 kV Line together with the existing Marilao-Quezon-Doña Imelda 230 kV Line will form a loop configuration thus creating a more resilient transmission corridor to serve the Metro Manila loads. As can be expected, securing right-of-way for this new transmission line would be a major concern.

8.1.40 Mexico-Clark 69 kV Line

Major Project Components
▪ ***Mexico-Clark Line 69 kV T/L,*** ST-DC 2-795 MCM ACSR, 18 km

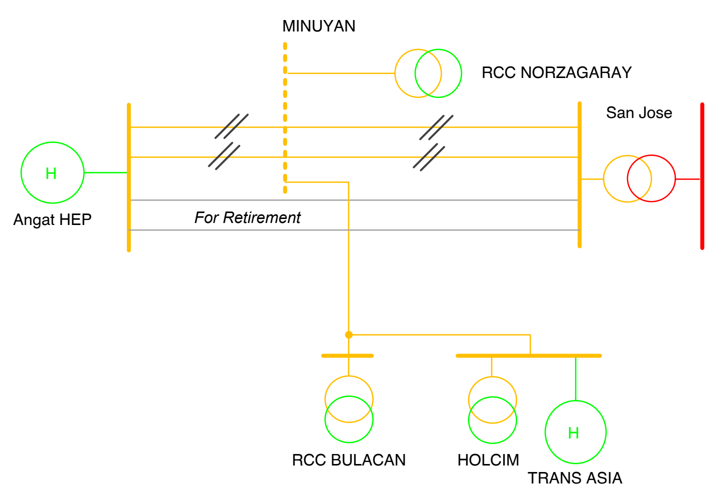
This project aims to increase the capacity and improve the reliability of the existing 69 kV transmission line. The existing facility, having been built in 1958, is already due for upgrading. To implement this and to be able to use the existing ROW, Clark-Mabiga 69 kV Line project should be completed first to afford segment by segment upgrading. It can be noted that the line is serving both load and generator customers in the area.



8.1.41 Minuyan 115 kV Switching Station

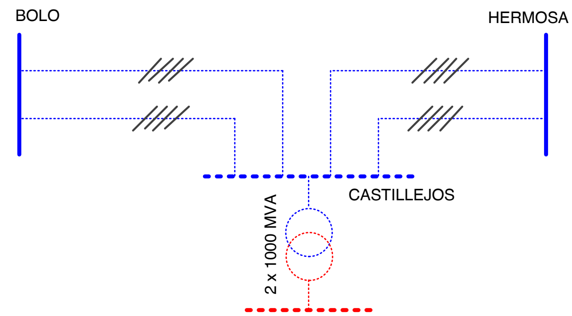
Major Project Components
▪ ***Minuyan Switching Station,*** 8-115 kV PCBs and Associated Equipment

Upon completion of the new double-circuit San Jose-Angat 115 kV Line using the right-of-way of Line 3, the industrial loads (cement plants) in the area will still continue to use the old San Jose-Angat Lines 1&2. However, as Lines 1&2 are also for later retirement, a new connection point for the load customers is required to provide continuous reliable supply. This will be addressed by this new 115 kV switching station which will bus-in along the new double-circuit line.



8.1.42 Western 500 kV Backbone – Stage 2

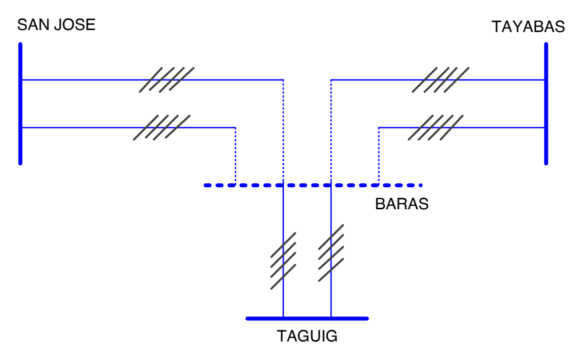
Major Project Components
▪ ***Castillejos-Bolo 500 kV T/L,*** 4-410 mm^2 TACSR, ST-DC, Castillejos-Masinloc: 84 km, Masinloc-Bolo: 90 km; ▪ ***Castillejos 500 kV S/S,*** 2-1000 MVA, 500/230-13.8 kV Power Transformer, 1-90 MVAR 500 kV Shunt Reactor, 11-500 kV PCB, 6-230 kV PCB, and associated equipment.



This project will complete the increase in capacity of the western transmission corridor presently consisting of a single-circuit line from Labrador down to Botolan to Hanjin then to Olongapo. The long-term development plan considers providing higher level of reliability up to N-2 contingency for the 500 kV backbone system of the Luzon grid. It should be noted that the existing double-circuit 500 kV transmission line from Bolo to Nagsaag to San Jose is on common tower structures and that toppling of a tower (e.g. due to typhoon) would result in simultaneous outage of two circuits which will completely disrupt the power flow in the 500 kV corridor. Such scenario can be expected to result in grid congestion due to the required curtailment to the base load coal-fired power plants in the north. The capacity expansion of Masinloc Plant and entry of other new plants in the area would further highlight the critical role of the existing 500 kV backbone in ensuring security of supply, thus, the need to reinforce the transmission network by developing the Western 500 kV backbone corridor. For the case of Castillejos 500 kV Substation, it will serve as the new connection point for RP Energy CFPP and can also help support any future bulk generation development in the area. This Stage 2 project involving very long transmission lines may still be divided into further staging during implementation.

8.1.43 Baras 500 kV Switching Station

Major Project Components
▪ ***Baras 500 kV S/S,*** 10-500 kV PCBs and associated equipment.

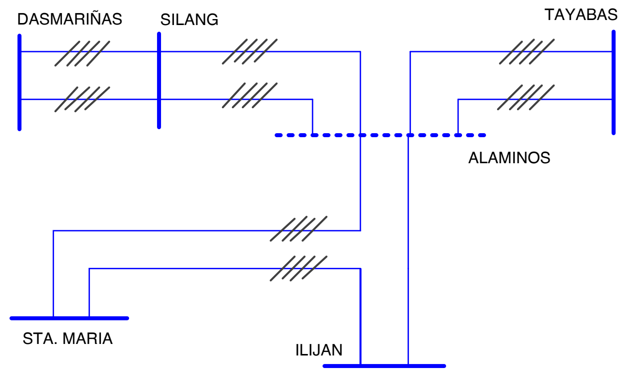


This project aims to address the reliability and stability concerns brought about by the initial cut-in scheme of Taguig 500 kV Substation. With the increasing bulk power injection to the 500 kV system in the southern part of Luzon grid particularly in Quezon Province area, the worst contingency event will be the tripping of the San Jose-Tayabas 500 kV Line which would result in bulk power swing towards Taguig and Hermosa then back to San Jose. This is under the scenario with Marilao 500 kV Substation not yet in place.

8.1.44 Alaminos 500 kV Switching Station

Major Project Components
▪ ***Alaminos 500 kV S/S,*** 12-500 kV PCB, 2-30 MVAR 500 kV Shunt Reactor and associated equipment.

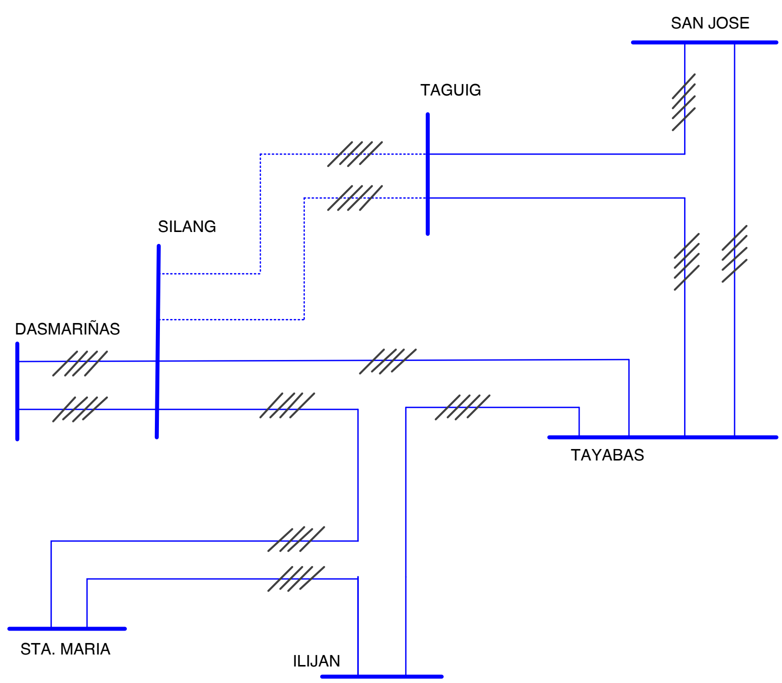
This aims to address the reliability and stability concerns brought about by the cut-in scheme of the 500 kV lines connected to the Ilijan 500 kV Substation in Batangas. In the present scheme, the worst contingency event is tripping of the Dasmariñas-Ilijan 500 kV Line which would result in bulk power swing towards Tayabas then back to Dasmariñas. With the increasing bulk power injection to the 500 kV system, the development of this new 500 kV substation in Alaminos will become more important.



8.1.45 Silang-Taguig 500 kV Transmission Line

Major Project Components
▪ ***Silang 500 kV S/S,*** 11-500 kV PCB, 2-30 MVAR 500 kV Shunt Reactor and associated equipment; ▪ ***Silang-Taguig 500 kV T/L,*** 4-410mm^2 TACSR ST-DC, 50 km; ▪ ***Taguig 500 kV S/S (Expansion),*** 4-500 kV PCB and associated equipment.

This project consists of the major segment of the looping configuration of the 500 kV backbone system of the Luzon Grid. Due to space constraints at Dasmariñas 500 kV Substation, a new substation in Silang has been considered which will bus-in to the existing 500 kV line and will serve as the termination point of the 500 kV-energized line from Calaca. Morever, the substation also intends to receive the looping line coming from Bataan which involves submarine cable. The new substation site may still involve further reconsideration to take into account the feasibility of the routes of the new 500 kV lines to be connected to this substation.

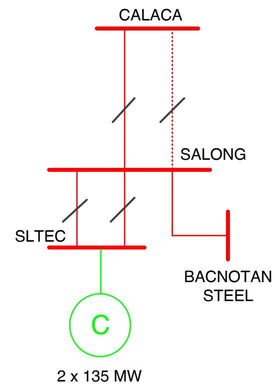


As conceptualized, the Silang-Taguig Line will be traversing the Laguna Lake near the shoreline as the solution to right-of-way problems in establishing a 500 kV backbone within Metro Manila.

8.1.46 Calaca-Salong 230 kV Transmission Line 2

Major Project Components
▪ ***Calaca-Salong 230 kV T/L,*** SP-SC, 1-795 MCM ACSR, 6 km;
▪ ***Salong 230 kV S/S,*** 2-230 kV PCB and associated equipment.

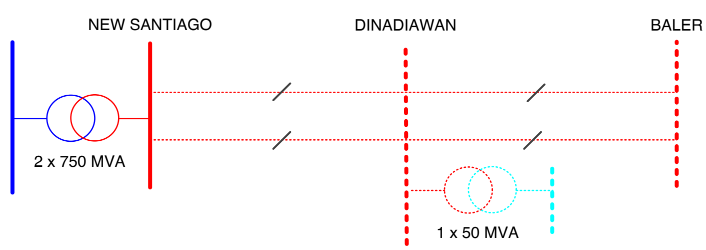
The Calaca – Salong 230 kV Transmission Line 2 Project will provide provision for single outage contingency for the existing Calaca – Salong 230 kV Transmission Line. Presently, the Salong 230 kV Switching Station serves the 2-135 MW SLTEC Coal-Fired Power Plant and the Bacnotan Steel Plant.



8.1.47 Santiago-Dinadiawan-Baler 230 kV Transmission Line

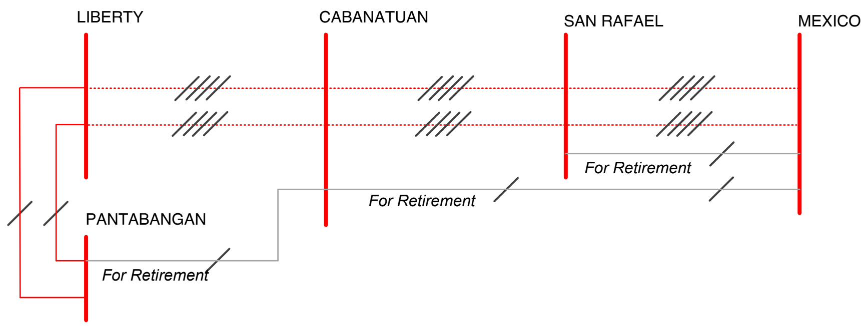
Major Project Components
▪ ***Santiago-Dinadiawan 230 kV T/L,*** ST-DC, 1-795 MCM ACSR/AS, 100.0 km;
▪ ***Dinadiawan-Baler 230 kV T/L,*** ST-DC, 1-795 MCM ACSR/AS, 52.6 km;
▪ ***New Santiago 230 kV S/S,*** 4-230 kV PCBs and associated equipment;
▪ ***Dinadiawan 230 kV S/S,*** 1-50 MVA 230/69-13.8 kV Power Transformer and Accessories, 8-230 kV PCBs and associated equipment;
▪ ***Baler 230 kV S/S,*** 6-230 kV PCBs and associated equipment.

The Santiago-Dinadiawan-Baler 230 kV Line project will be developed as another outgoing circuits from Santiago Substation and at the same time, it will form part of the transmission backbone for the province of Aurora. Among the expected load developments in the province is the Aurora Pacific Economic Zone and Freeport. The project involves the development of a new substation at Dinadiawan to serve as the connection point for the Ecozone and other loads. This project is expected to be implemented by stages.



8.1.48 Liberty-Cabanatuan-San Rafael-Mexico 230 kV Transmission Line

Major Project Components
▪ ***Liberty-Cabanatuan-San Rafael-Mexico 230 kV T/L,*** ST-DC, 4-795 MCM ACSR, 140 km.



This project aims to increase the capacity and improve the reliability of the existing single-circuit 230 kV transmission line. At the same this project will help support the entry of the Pantabangan Pumped-Storage Hydro Plant and other new plants in the future by providing a stronger transmission corridor. Having been built in the 1960s, the old age condition is also a major project driver. As it consists several line segments, the project implementation will be divided into various stages.

8.1.49 Luzon Voltage Improvement Project 3

Major Project Components
STAGE 1 ▪ ***Laoag 230 kV S/S,*** 1-35 MVAR & 1-25 MVAR 230 kV Shunt Reactors and Accessories, 2-25 MVAR 230 kV Capacitor Banks and Accessories; ▪ ***Cabanatuan 230 kV S/S,*** 2-50 MVAR, 230 kV Capacitor Banks and Accessories; ▪ ***Nagsaag 500 kV S/S,*** 1-90 MVAR, 500 kV Shunt Reactor and Accessories; ▪ ***Tuguegarao 230 kV S/S,*** 1-25 MVAR Capacitor Bank and Accessories and 1-25 MVAR, 230 kV Shunt Reactor and Accessories; ▪ ***Baler Load-End 69 kV S/S***, 3-2.5 MVAR, 69 kV Capacitor Bank and Accessories; ▪ ***Pantabangan Load-end 69 kV S/S,*** 1-5 MVAR, 69 kV Capacitor Bank and Accessories ; ▪ ***Umingan Load-end 69 kV S/S,*** 3-5 MVAR 69 kV Capacitor Bank and Accessories; ▪ ***Paniqui Load-end 69 kV S/S***, 3-5 MVAR 69 kV Capacitor Bank ▪ ***Bantay 115 kV S/S,*** 1-7.5 MVAR, 115 kV Capacitor Bank and Accessories ; **STAGE 2** ▪ ***San Esteban 230 kV S/S,*** 2-25 MVAR, 230 kV Capacitor Banks and Accessories; ▪ ***Botolan 230 kV S/S,*** 1-25 MVAR 230 kV Shunt Reactor and Accessories; ▪ ***Mexico 230 kV S/S,*** 1-100 MVAR 230 kV Capacitor Bank and Accessories ; ▪ ***San Jose 230 kV S/S,*** 1-100 MVAR 230 kV Capacitor Bank and Accessories; ▪ ***Itogon Load-end 69 kV S/S,*** 1-7.5 MVAR, 69 kV Capacitor Bank and Accessories; ▪ ***Antipolo 230 kV S/S,*** 2-100 MVAR, 230 kV Capacitor Banks and Accessories; and ▪ ***Bayambang Load-end 69 kV S/S***, 3-5 MVAR 69 kV Capacitor Bank and Accessories.

The network analyses conducted have identified power quality issues at various 230 kV, 115 kV substations, 69 kV load-end substations as well as 500 kV substation in north Luzon. In order to maintain the system voltages within the PGC-prescribed limits both during normal and N-1 contingency conditions, installation of capacitor banks and shunt reactors will be required.

8.1.50 Luzon Voltage Improvement Project 4

Major Project Components
STAGE 1 ▪ ***Ligao Switching Station,*** 3-5 MVAR, 69 kV Capacitor Banks and Accessories***;*** ▪ ***Iriga Load-end 69 kV S/S,*** 2-5 MVAR, 69 kV Capacitor Banks and Accessories; **STAGE 2** ▪ ***Biñan 230 kV S/S,*** 2-100 MVAR, 230 kV Capacitor Banks and Accessories; ▪ ***Dasmariñas 230 kV S/S,*** 2-100 MVAR, 230kV Capacitor Banks and Accessories; ▪ ***Mabini Load-end 69 kV S/S,*** 3-7.5 MVAR, 69 kV Capacitor Banks and Accessories; ▪ ***Cuenca Load-end 69 kV S/S,*** 3-7.5 MVAR, 69 kV Capacitor Banks and Accessories; ▪ ***Taysan Load-end 69 kV S/S,*** 3-7.5 MVAR, 69 kV Capacitor Banks and Accessories; ▪ ***San Juan Load-end 69 kV S/S,*** 3-5 MVAR, 69 kV Capacitor Banks and Accessories; ▪ ***Lagonoy Load-end 69 kV S/S,*** 3-5 MVAR, 69 kV Capacitor Banks and Accessories.

The conduct of system study has identified these 230 kV substations and 69 kV load-end substations that will experience power quality issues. In order to maintain the 230 kV and 69 kV system voltages within the PGC-prescribed limits both during normal and N-1 contingency conditions, installation of capacitor banks at various substations is required.

In addition to the projects presented in Chapter 7 which are on various stages of implementation, this section will provide the other identified system requirements in the Visayas Grid but are still subject to regulatory approval prior to implementation. ERC applications for some of the new projects have been made already.

In reference to the DOE list, Cebu and Panay are the main sites for large generation capacity additions specifically for coal-fired power plants. For RE-based plants, on the other hand, it can be observed that the concentration is in Negros and Panay Islands. Such direction of generation development would further emphasize the need to reinforce the 138 kV submarine cable interconnections between Cebu, Negros and Panay.

Presently, the 230 kV facilities are in Leyte and Cebu only but the development of a 230 kV transmission backbone to reach up to Panay Island has been part of the master plan in order to support the generation developments and also to avert the criticality of island grid separations due to the present long radial line configuration of the Visayas Grid. The implementation of this project, which is called Cebu-Negros-Panay 230 kV Backbone, is divided into three (3) stages. The first stage is the additional submarine cable between Negros and Panay. As presented in Chapter 7, this project is already in the construction stage to immediately address the congestion and market issues being encountered due to the limited capacity of the existing single-circuit 138 kV link. Also, the existing Negros-Cebu 138 kV can only export a maximum of 180 MW of excess generation capacity. This will be insufficient just with the entry of committed power plants only. Thus, the second and third stages of the new 230 kV backbone, which will be discussed in this chapter, are the next major requirements in the Visayas Grid.

The upgrading of the Panitan-Nabas and Ormoc-Tongonan-Isabel 138 kV Lines is also a priority project of NGCP. While these lines have been restored already after the onslaught of typhoon Yolanda in 2013, the implemented Emergency Restoration Systems (ERS) or temporary structures would remain susceptible to line interruption concerns especially during times of another calamity. The temporary facilities will be replaced with permanent tower structures which will already adopt new wind design standards to further improve grid security.

Within Cebu Island where the load center is located, the development of new 230 kV load substations and implementation of new 230 kV transmission line extensions are required to ensure adequate supply facilities in the long term. Although not yet included in the DOE list as of August 15, 2015, there are other bulk generation additions such as the proposed coal-fired power plant of Salcon Power Corporation and Ludo Power Corporation which will also require grid reinforcements. Similar with other urbanized area, securing right-of-way in Cebu is also a major challenge in transmission project implementation.

In Panay, the new developments in the tourism industry in Boracay Island would result in an increase in power supply requirements. It is projected that the existing 69 kV submarine cable serving the island would not be adequate in supporting load growth in the coming years. Thus, this is also one of the areas requiring grid reinforcements through the installation of additional submarine cable under the Nabas-Caticlan-Boracay 138 kV Transmission Project.

Another major submarine cable project to be implemented within the next 10 years is the Cebu-Bohol 138 kV Interconnection Project. Presently, Bohol Island has power deficiency issue due to limited power sources in the island. In 2014, the maximum demand in Bohol reached 71MW. Almost 90% of the island's demand comes from Leyte via the Leyte-Bohol submarine cable which is already equivalent to 70% of the submarine cable's capacity. By 2020, it is expected that the Leyte-Bohol interconnection will be overloaded. The implementation of this Cebu-Bohol Interconnection Project would significantly boost the supply reliability to support the load growth in the island as will be brought about by its direct access to the bulk generations located in Cebu. It can be noted also that during the Typhoon Yolanda incident affecting the transmission facilities in Ormoc, Leyte area, the supply for Bohol Island was also interrupted because there is no alternate source for the island. Such concern will also be addressed by the Cebu-Bohol Interconnection Project.

9.1 Proposed Transmission Projects for 2016-2025

Shown in Table 9.1 is the list of transmission projects planned for Visayas in the period 2016-2025 in addition to the projects already approved by the ERC.

Table 9.1: Proposed Transmission Projects for Visayas

Project Name/Driver(s)	Province(s)	ETC
Generation Entry		
CNP 230 kV Backbone Project - Stage 2 (Cebu Substation 230 kV Upgrading)	Cebu	Dec 2018
Panay-Guimaras 138 kV Interconnection Project	Panay	Dec 2019
CNP 230 kV Backbone Project - Stage 3 (Negros-Cebu Interconnection)	Negros Occidental, Cebu, Panay	Aug 2020
Sta. Barbara-Dingle 138 kV Line 3 Project	Iloilo	Dec 2023
Load Growth		
New Naga (Colon) Substation Project (Remaining Works)	Cebu	Apr 2018
Nabas-Caticlan-Boracay Transmission Project	Aklan	Mar 2021
Laray 230 kV Substation Project	Cebu	Nov 2020
Babatngon-Palo 138 kV Transmission Line Project	Leyte	Dec 2022
Amlan - Dumaguete 138 kV Transmission Line Project	Negros Oriental	Jun 2023
Umapad 230 kV Substation Project	Cebu	Jun 2023
System Reliability		
Upgrading of Ormoc / Tongonan - Isabel 138 kV Transmission Line	Leyte	May 2017
Upgrading of Panitan - Nabas 138 kV Transmission Line	Aklan, Capiz	Apr 2017
Tagbilaran 69 kV Substation Project	Bohol	Dec 2017
Panitan-Nabas 138 kV Transmission Line 2 Project	Aklan, Capiz	Mar 2018
Naga (Visayas) Substation Upgrading Project	Cebu	Mar 2019
Cebu-Bohol Interconnection Project	Cebu, Bohol	Dec 2020
Calbayog-Allen 69 kV Transmission Line Project	Samar, Northern Samar	Dec 2021
Visayas Substation Upgrading Project - 1	Cebu, Leyte, Samar,	Dec 2021
Barotac Viejo – Natividad 69kV Transmission Line	Iloilo	Dec 2023
Kabankalan Substation Reliability Improvement Project	Negros Occidental	Jun 2024
Reconfiguration of Babatngon - Sta. Rita 138 kV Transmission Corridor	Leyte, Samar	Dec 2024
Palo-Javier 138 kV T/L Project	Leyte	Jun 2025
Visayas Substation Upgrading Project - 2	Negros, Panay,Cebu	Dec 2025
Power Quality		
Visayas Voltage Improvement Project	Cebu, Northern Samar, Leyte, Southern Leyte	Dec 2018
Maasin-Javier 138 kV Transmission Line Project	Leyte, Southern Leyte	Jun 2025

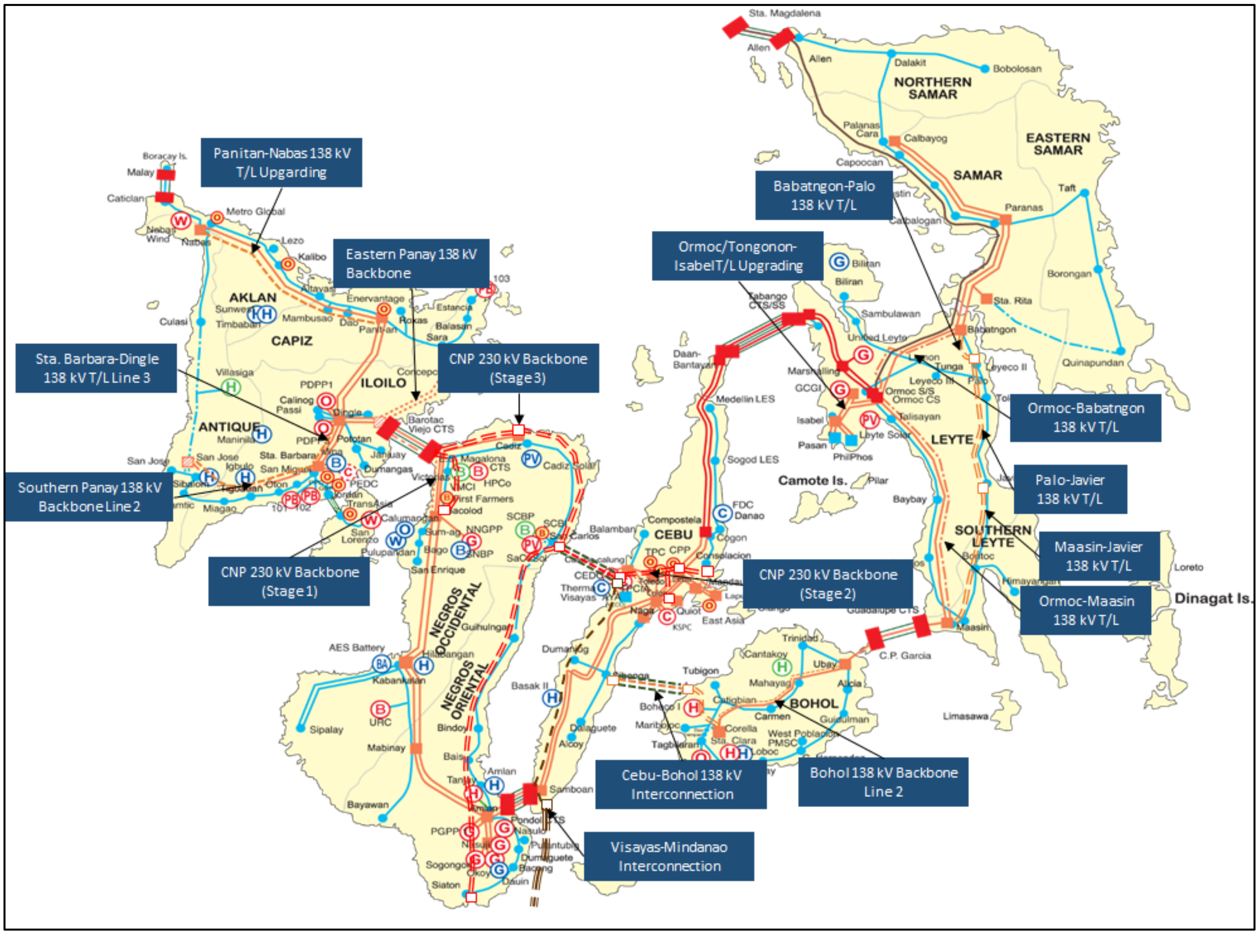
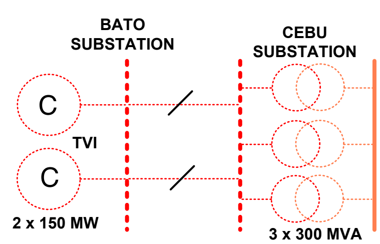


Figure 9.1: Proposed Projects for Visayas

9.1.1 Cebu-Negros-Panay 230 kV Backbone Project –Stage 2 (Cebu Substation)

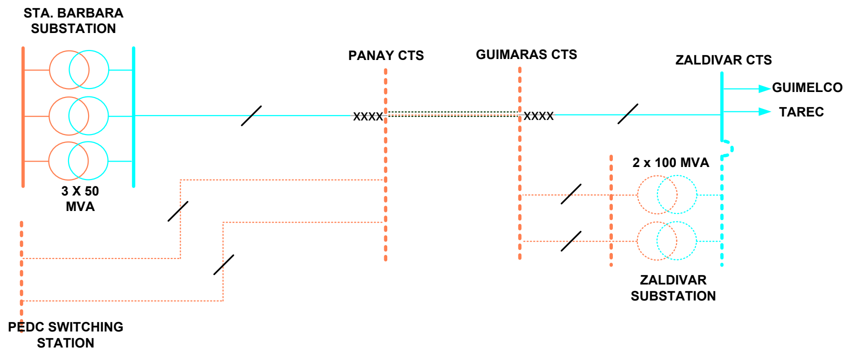
Major Project Components
▪ ***Cebu 230 kV S/S***, 3-300 MVA 230/138 kV Power Transformers, 8-230 kV PCB (GIS) and 3-138 kV PCB and associated equipment.



Therma Visayas, Inc. is developing a 300 MW coal-fired power plant in Toledo City. It is targeted for commissioning in 2017 (150 MW) and in 2018 (150 MW) and requires a high-capacity transmission system to ensure full generation dispatch towards the load centers in Metro Cebu and the rest of the Visayas Grid. However, due to the limited available transmission capacity of the 138 kV system in Central Cebu Grid, the power plant is proposed to be directly connected to Cebu Substation via 230 kV transmission line, which will be constructed by the proponent as part of its connection assets. Relative thereto, a new 230 kV facility will be constructed in Cebu Substation to facilitate the termination of the proposed overhead transmission line from the power plant. The project is also consistent with the planned 230 kV transmission backbone in Visayas which will extend from Cebu to Panay.

9.1.2 Panay-Guimaras 138 kV Interconnection Project

Major Project Components
Reclassification and Acquisition
▪ ***Guimaras-Panay 138 kV Submarine Cable,*** XLPE, 100 MW, 3km; ▪ ***Zaldivar CTS,*** Cable Sealing End Equipment.
Expansion
▪ ***Panay CTS – PEDC Switching Station,*** ST-DC, 1-795 MCM ACSR, 2km; ▪ ***PEDC Switching Station,*** 4-138 kV PCB and associated equipment; ▪ ***Zaldivar 138 kV S/S,*** 2-100 MVA, 138/69 kV Power Transformer, 5-138 kV PCB, 4-69 kV PCB and associated equipment; ▪ ***Panay CTS,*** Cable Sealing End Equipment.



The project is intended to ensure the full dispatch of the San Lorenzo Wind Plant and other prospective generators in the area.

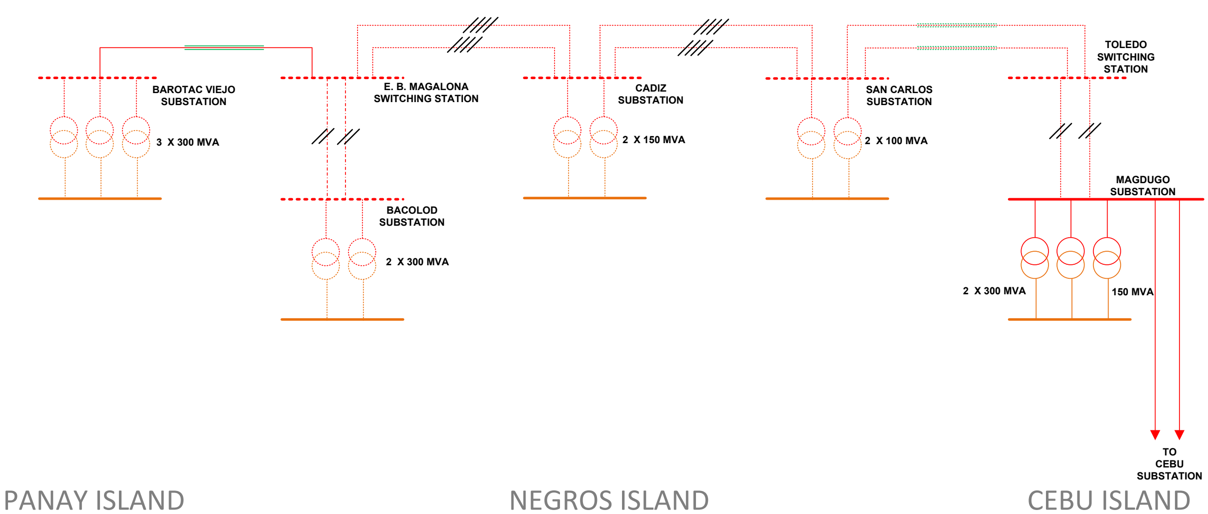
The project involves the energization of the Panay-Guimaras Interconnection at 138 kV by expanding Zaldivar CTS into a substation and construction of a 2 km overhead line terminating to PEDC substation.

9.1.3 Cebu-Negros-Panay 230 kV Backbone Project - Stage 3

Major Project Components
▪ ***Magdugo 230 kV S/S,*** 2-300 MVA and 1-150 MVA 230/138 kV Power Transformers, 15-230 kV PCB, 15-138 kV PCB and associated equipment;
▪ ***Toledo CTS-Magdugo 230 kV T/L,*** ST-DC, 4-795 MCM ACSR, 6 km;
▪ ***Toledo CTS,*** 8-230 kV PCB, 4-50 MVAR 230 kV Reactor;
▪ ***San Carlos-Toledo CTS 230 kV Submarine Cable,*** Double Circuit, 400 MW-capacity XLPE subcable, 29 km;
▪ ***San Carlos 230 kV S/S,*** 2-100 MVA 230/69 kV Power Transformer, 14-230 kV PCB, 14 -69 kV PCB, 4-50 MVAR 230 kV Reactor;
▪ ***Cadiz-San Carlos 230 kV T/L,*** ST-DC, 4-795 MCM ACSR, 80 km;
▪ ***Cadiz 230 kV S/S,*** 2-150 MVA 230/138 kV Power Transformers, 10-230 kV PCB, 7-138 kV PCB and associated equipment;
▪ ***Cadiz- E. B. Magalona 230 kV T/L,*** ST-DC, 4-795 MCM ACSR, 45 km;
▪ ***E. B. Magalona Switching Station,*** 9-230 kV PCB and associated equipment, 1-70 MVAR 230 kV Reactor;
▪ ***Barotac Viejo 230 kV S/S,*** 3-300 MVA 230/138 kV Power Transformers, 8-230 kV PCB, 6-138 kV PCB and associated equipment, 1-70 MVAR 230 kV Reactor;
▪ ***Bacolod 230 kV S/S,*** 2-300 MVA 230/138 kV Power Transformer, 6-230 kV PCB, 1-138 kV PCB and associated equipment;
▪ ***Colon 138 kV S/S,*** 2-138 kV PCB and associated equipment;
▪ ***Transfer of the CEDC 138 kV Line from AYA S/S to Colon S/S***
▪ ***Reconductoring of the Cut-in Line from Quiot S/S.***
For Acquisition
▪ ***Magdugo-Cebu 230 kV T/L,*** ST-DC, 4-795 MCM ACSR, 35 km.

The project aims to accommodate the excess generation from baseload plants in Cebu and Panay and the RE based generation in Negros and Panay.

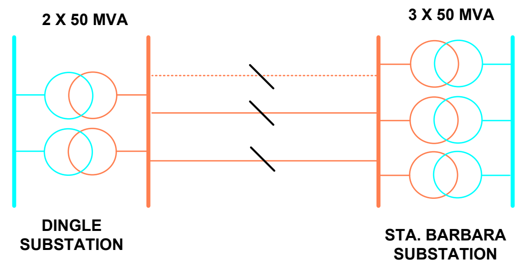
The project includes the development of a high capacity transmission corridor that will extend from Barotac Viejo Substation in Panay to a new Magdugo Substation in Cebu. It will involve construction of new substations, switching stations, overhead lines and installation of submarine cables. Further, it will also involve the reconfiguration of the Colon-Quiot-Cebu 138 kV Lines and the transfer of the termination of the CEDC 138 kV Line from AYA Substation to Colon Substation. The project will also facilitate the 230 kV energization of the Barotac Viejo-Bacolod Transmission Line which was proposed to be initially energized at 138 kV and the acquisition of the Magdugo-Cebu 230 kV Transmission Line.



9.1.4 Sta. Barbara-Dingle 138 kV Line 3 Project

Major Project Components
▪ ***Sta. Barbara-Dingle 138 kV T/L***, ST-DC, 1-795 MCM ACSR, 24 km;
▪ ***Sta. Barbara 138 kV S/S***, 2-138kV PCB and associated equipment;
▪ ***Dingle 138 kV S/S***, 2-138 kV PCB and associated equipment.

To provide a reliable transmission corridor for the generation located in southern and western part of Panay, the Sta. Barbara-Dingle 138 kV Line 3 is required to ensure that all generators can be fully dispatched even during N-1 contingency condition.



9.1.5 New Naga (Colon) Substation Project (Remaining Works)

Major Project Components
▪ ***Colon 138 kV S/S***, 1-100 MVA 138/69-13.8 kV Power Transformers, 2-138 kV PCB, 2-69 kV PCB and associated equipment;
▪ ***Transfer of Naga-Sibonga-Dumanjug 69 kV Feeder from Naga S/S to Colon S/S***, SP-SC, 1-336.4 MCM ACSR, 1.5 km.

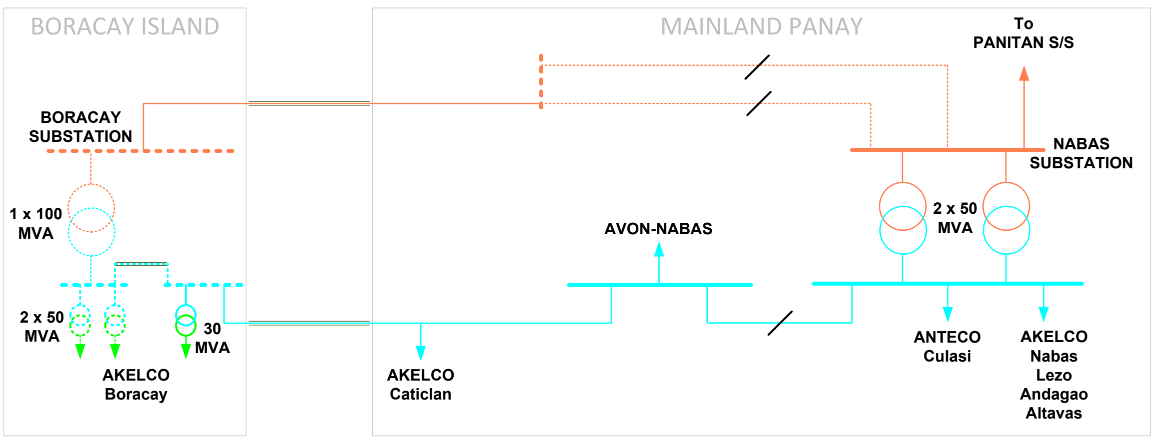
The project is intended to improve the delivery of power to the loads connected to the Naga-Sibonga-Dumanjug 69 kV line. It involves the installation of a new transformer at Colon S/S and the transfer of the Naga-Sibonga-Dumanjug 69 kV Feeder from Naga S/S to Colon S/S, which were originally part of the formerly known and ERC-approved New Naga (Cebu) Substation Project, however, were not implemented as proposed during the 3rd Regulatory Period since the projected load to be catered by the transformer did not materialize.

The implementation of the remaining works under the New Naga (Colon) Substation Project will be pursued in the 4th Regulatory Period in consideration of the renewed need to address, among others, the increase in power demand along the Naga-Sibonga-Dumanjug 69 kV Line.

9.1.6 Nabas-Caticlan-Boracay Transmission Project

Major Project Components
STAGE 1 ▪ ***Boracay 138 kV S/S (New)***, 1-100 MVA 138/69/13.2 kV Power Transformer, 2-50 MVA 69/13.2 kV Power Transformer, 1-138 kV PCB, 4-69 kV PCB and associated equipment; ▪ ***Caticlan-Boracay Power Cable***, XLPE Submarine Cable System of 100 MW capacity at 138 kV, 2 km; ▪ **Boracay-Manocmanoc Power Cable,** XLPE Underground Cable of 50 MW capacity at 69 kV, 1km. ▪ ***Caticlan CTS (New)***, Cable Sealing End.
STAGE 2 ▪ ***Nabas-Caticlan 138 kV T/L***, Combination of ST/SP-DC, 1-795 MCM ACSR, 14 km. and Underground Cable System of 100 MW capacity at 138 kV, 8 km; ▪ ***Nabas 138 kV S/S***, 4-138 kV PCB and associated equipment; ▪ ***Unidos CTS (New)***, Cable Sealing End.

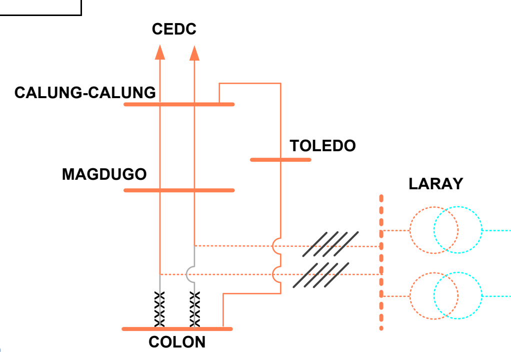
In line with the developments in the tourism industry in Boracay Island, the power requirement is expected to increase. To meet the projected demand, additional substation and submarine cable need to be implemented. The project aims to provide additional transmission and substation capacity to cater the growing demand of Caticlan and Boracay Island. The power quality in the area will also improve upon completion of the project.



9.1.7 Laray 230 kV Substation Project

Major Project Components
▪ ***Laray 230 kV S/S (New)***, 2-150 MVA 230/69-13.8 kV Power Transformers, 6-230 kV PCB (GIS), 5-69 kV PCB (GIS) and associated equipment; ▪ ***Naga-Laray 230 kV T/L***, ST/SP-DC, 2-610 mm^2 TACSR, 4-795 MCM ACSR, 22 km.

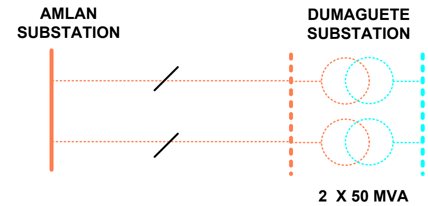
In line with the continuing economic and infrastructure development within Metro Cebu, the power requirement in the area is projected to increase. In order to accommodate the projected increase in the power demand, a new drawdown substation is proposed. The new substation is also intended to provide alternative connection point to power



consumers. This project was previously named as SRP Substation.

9.1.8 Amlan-Dumaguete 138 kV Transmission Line Project

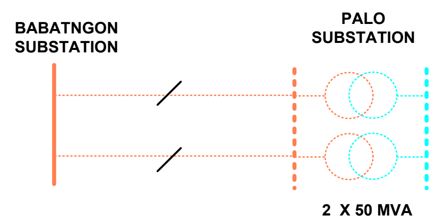
Major Project Components
▪ ***Amlan-Dumaguete 138 kV T/L***, ST-DC, 1-795 MCM ACSR, 22 km; ▪ ***Dumaguete 138 kV S/S (New),*** 2-50 MVA, 138/69-13.8 kV Power Transformers, 6-138 kV PCB and 4-69 kV PCB and associated equipment; ▪ ***Amlan 138 kV S/S,*** 4-138 kV PCB and associated equipment.



To address the projected load growth and improve the system reliability in Dumaguete City and vicinity, there is a need to implement another transmission line with bigger capacity and at higher voltage. The proposed new line will also allow Negros Oriental Electric Cooperative II (NORECO II) to source its power from the proposed Dumaguete Substation, thereby unloading Amlan Substation and the Amlan-Siaton 69 kV line. The proposed implementation scheme will also minimize transmission loss and improve the power quality to the customers served by the 69 kV line.

9.1.9 Babatngon-Palo 138 kV Transmission Line Project

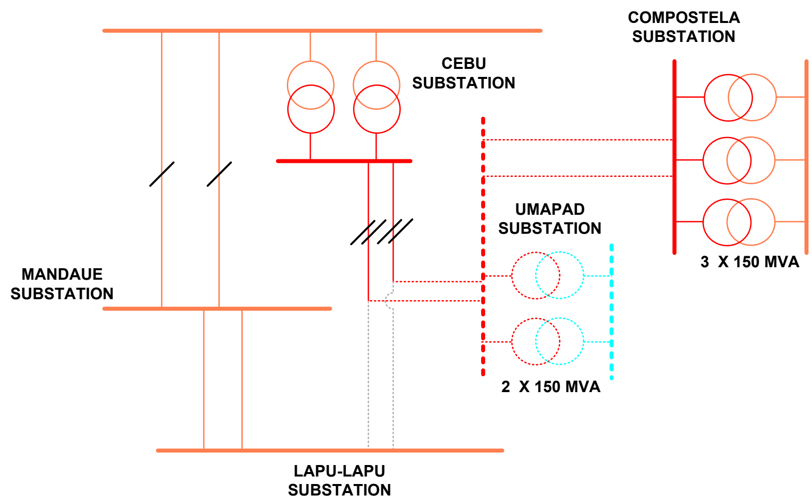
Major Project Components
▪ ***Babatngon-Palo 138 kV T/L***, ST-DC, 1-795 MCM ACSR, 20 km ▪ ***Palo 138 kV S/S (New),*** 2-50 MVA 138/69-13.8 kV Power Transformer and 6-138 kV PCB, 8-69 kV PCB and associated equipment; ▪ ***Babatngon 138 kV S/S,*** 3-138 kV PCB associated equipment.



To meet the projected demand and provide an alternate source of power, a new line with higher transfer capacity and at higher voltage is required. There is also a need to establish a 138 kV drawdown substation in the vicinity of Palo to serve Don Orestes Romualdez Electric Cooperative, Inc. (DORELCO) and LEYECO II and provide alternate power supply source (during N-1 contingency event) for the load customers in the area.

9.1.10 Umapad 230 kV Substation Project

Major Project Components
▪ ***Umapad 230 kV S/S (New),*** 2-150 MVA 230/69-13.8 kV Power Transformer, 7-230 kV PCB (GIS), 5-69 kV PCB (GIS) and associated equipment.



In line with the continuing economic and infrastructure development in the northern part of Metro Cebu, the power requirement in the area is projected to increase. In order to accommodate load growth, a new drawdown substation is proposed. To achieve this, the double circuit overhead component of the Cebu-Lapulapu Transmission Project will be energized to 230 kV from 138 kV. This line will connect Umapad 230 kV Substation to the Cebu 230 kV substation via 2-795 MCM ACSR. This will then be stepped down to 69 kV via 2-150 MVA transformer. This is intended to relieve the Cebu – Mandaue 138 kV line and Mandaue 138 kV substation by providing an alternative 230 kV drawdown substation for VECO.

9.1.11 Upgrading of Ormoc/Tongonan-Isabel 138 kV Transmission Line

Major Project Components
▪ ***Ormoc/Tongonan-Isabel 138 kV T/L,*** 72 tower structures and associated overhead line component to be replaced.

In 2013, the super typhoon Yolanda has caused the toppling of 72 steel tower structures of the Ormoc/Tongonan-Isabel 138 kV T/L. The restoration of the transmission line was undertaken through the use of Emergency Restoration System (ERS) and steel pole structures, which offer limited capability in terms of reliably transmitting power.

The project is intended to address the system limitation and restore the reliability of the Ormoc/Tongonan-Isabel 138 kV Transmission Line. It involves the construction of new steel tower structures and installation of associated overhead line component. It also aims to provide N-1 contingency for the transmission corridor between the Isabel, Tongonan and Ormoc Substations.

The upgrading project also involves the use of steel tower structures with higher wind design capability.

9.1.12 Upgrading of Panitan-Nabas 138 kV Transmission Line

Major Project Components
▪ ***Panitan-Nabas 138 kV T/L,*** 128 tower structures and associated overhead line component to be replaced.

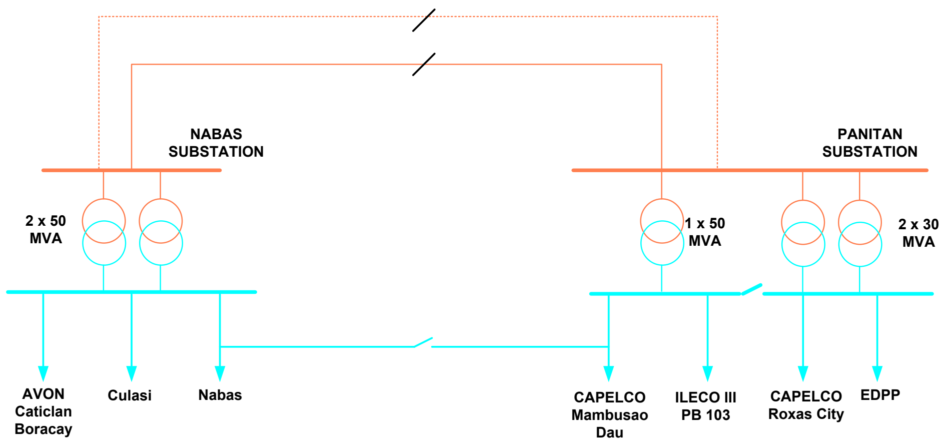
In 2013, the super typhoon Yolanda has caused the toppling of 128 steel tower structures of the Panitan-Nabas 138 kV T/L. The restoration of the transmission line was undertaken through the use of ERS and steel pole structures, which offer limited capability in terms of reliably transmitting power.

The project is intended to address the system limitation and improve the reliability of the Panitan-Nabas 138 kV Transmission Line. It involves the construction of new steel tower structures and installation of associated overhead line component.

The upgrading project also involves the use of steel tower structures with higher wind design capability.

9.1.13 Panitan-Nabas 138 kV Transmission Line 2 Project

Major Project Components
▪ ***Panitan-Nabas 138 kV T/L,*** ST-DC2 (2nd circuit stringing), 1-795 MCM ACSR, 105 km;
▪ ***Panitan 138 kV S/S,*** 1-138 kV PCB and associated equipment;
▪ ***Nabas 138 kV S/S,*** 3-138 kV PCB and associated equipment.



The northwestern part of Panay, which includes the Boracay Island, draws power from the grid through the existing Panitan-Nabas Transmission Corridor which is composed of a single circuit 138 kV line and a single circuit 69 kV line. However, during the outage of the 138 kV line, the 69 kV line will have limited transmission capacity to cater the entire load of the area, hence, will result in power curtailment.

The project is intended to improve the reliability of the power transmission system towards the northwestern part of Panay by providing N-1 contingency to the existing single circuit Panitan-Nabas 138 kV Transmission Line.

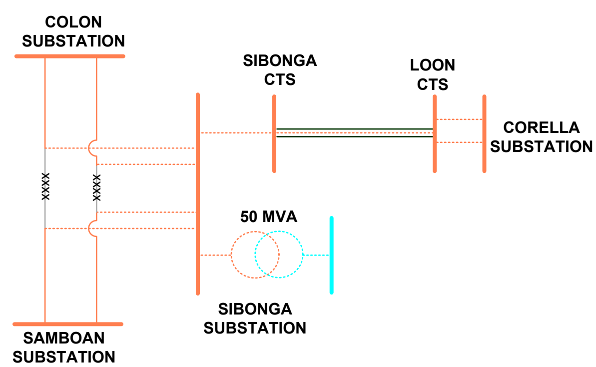
9.1.14 Naga (Visayas) Substation Upgrading Project

Major Project Components
▪ ***Naga 138 kV S/S,*** 6-138 kV PCB and associated equipment.

The project is being proposed to improve the operational reliability of Naga Substation in Cebu by minimizing outages due to equipment failure, maintenance and repair works which are expected to occur more frequently and at longer duration. The Naga Substation was commissioned in 1977, hence, most of the equipment are already antiquated and are difficult to maintain. This project was formerly named as Naga Substation Rehabilitation Project.

9.1.15 Cebu-Bohol Interconnection Project

Major Project Components
▪ ***Sibonga 138 kV S/S (New)***, 1-50MVA, 138/69 kV Transformer, 13-138 kV PCB and associated equipment, 3-40 MVAR Reactor, 3-69 kV PCB and associated equipment;
▪ ***Corella 138 kV S/S***, 3-138 kV PCB and associated equipment;
▪ ***Sibonga CTS-Corella CTS***, Single circuit submarine cable system of 200 MW capacity at 138 kV, 30km;
▪ ***Loon CTS-Corella S/S***, ST-DC, 1-795 MCM, 17 km.



Currently, Cebu, Leyte and Bohol are connected radially which are prone to isolations. By year 2020, the Leyte-Bohol submarine cable will be overloaded which could result in load curtailment in Bohol. Outage of the 138 kV overhead lines such as Ubay-Corella, Tugas-Ubay, Maasin-Guadalupe and Ormoc-Maasin will result in system collapse. During the outage of the Leyte-Bohol 138 kV Interconnection, power delivery towards the entire Bohol Island will be interrupted. Since the existing power plants in Bohol do not have sufficient generation capacity to cater the power demand in the island during N-1 contingency condition, there is a need to provide additional transmission line towards Bohol.

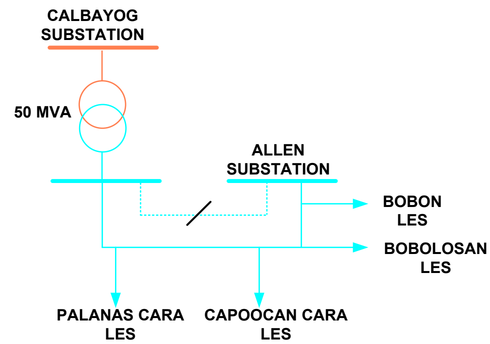
Initially, the Leyte-Bohol Line 2 Interconnection Project was proposed to address the projected increase in Bohol's power demand. However, additional considerations, which include the need to establish a more reliable transmission system towards Bohol, triggered the proposed development of the Cebu-Bohol Interconnection Project. In comparison with the initially proposed project, the Cebu-Bohol Interconnection will address the increasing demand and at the same time improve the reliability of power supply in Bohol Island. It will also serve as an alternative transmission corridor between Cebu and Leyte/Samar Islands.

Nonetheless, the Leyte-Bohol Line 2 Interconnection may still be implemented in the future and would serve as a feasible interconnection scheme for the long-term system requirement.

9.1.16 Calbayog-Allen 69 kV Transmission Line Project

Major Project Components
▪ ***Calbayog-Allen 69 kV T/L,*** SP-SC 1-336.4 MCM ACSR, 78 km;
▪ ***Calbayog 69 kV S/S,*** 1-69 kV PCB and associated equipment.

In line with the frequent and extended outage of the 69 kV lines in the area, construction of a 69 kV line from Calbayog to Allen is needed to form a loop and provide single outage contingency (N-1) capability to the transmission lines serving Northern Samar.



9.1.17 Tagbilaran 69 kV Substation Project

Major Project Components
▪ ***Tagbilaran 69 kV S/S (New),*** 10 MVA 69/13.8 kV Power Transformer and 3-69 kV PCB and associated equipment.

This project involves the installation of a 10 MVA transformer for Tagbilaran Substation that will allow continuous reliable supply of power for Bohol Electric Incorporated (BEI) and for the Loboc Hydroelectric Power Plant (LHEP). Presently, these customers are just relying on the 2x10 MVA transformers at Bohol Diesel Power Plant (BDPP) Switchyard, thus, any outage or maintenance works in the BDPP-owned transformers, the grid connection of BEI and LHEP is being disrupted. With the project, BEI and LHEP will have dedicated connection to Tagbilaran substation.

9.1.18 Visayas Substation Upgrading Project - 1

Major Project Components
LEYTE ▪ ***Tabango 230 kV S/S***, 1-50 MVA 230/69-13.8 kV Power Transformer, 2-230 kV PCB, 1-69 kV PCB and associated equipment. ▪ ***Maasin 138 kV S/S,*** 1-50 MVA 138/69-13.8 kV Power Transformer, 2-138 kV PCB, 1-69 kV PCB and associated equipment; **SAMAR** ▪ ***Calbayog 138 kV S/S,*** 1-50 MVA 138/69-13.8 kV Power Transformer, 1-138 kV PCB, 2-69 kV and associated component; **CEBU** ▪ ***Daanbantayan 230 kV S/S,*** 1-100 MVA 230/69-13.8 kV Power Transformer, 1-230 kV PCB, 3-69 kV PCB and associated equipment.

To accommodate the projected demand and avoid overloading of the transformer, there is a need to upgrade the substation capacity of Tabango Substation.

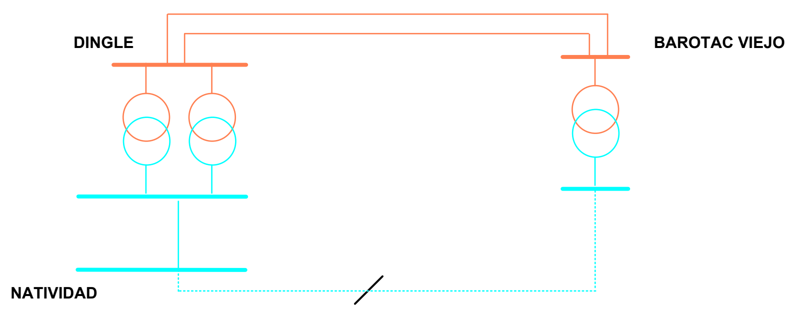
To accommodate the proposed 100MW CEKO Solar Power Plant, there is a need to upgrade the substation capacity in Daanbantayan Substation.

To comply with N-1 contingency criterion of the PGC, an additional 50 MVA transformer needs to be installed at Maasin Substation.

9.1.19 Barotac Viejo – Natividad 69kV Transmission Line

Major Project Components
▪ ***Barotac Viejo – Natividad 69kV T/L,*** *SP–SC, 1-336.4MCM ACSR, 7km* ;

To improve reliability by providing N-1 in Natividad LES of ILECO III, Barotac Viejo- Natividad transmission line is needed to form a loop that will enable transfer of load from Natividad LES to Barotac Viejo Substation during outage of one transformer in Dingle Substation.



9.1.20 Kabankalan Substation Reliability Improvement Project

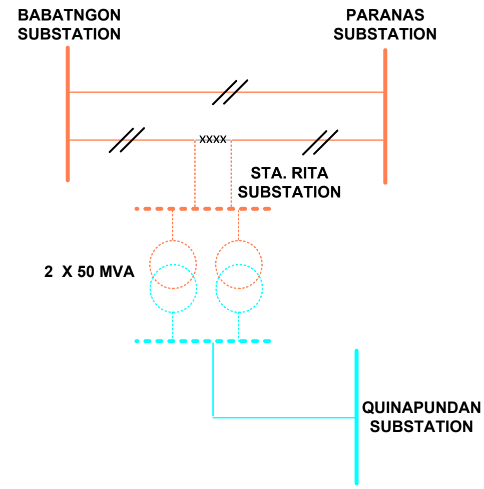
Major Project Components
▪ Substation Reconfiguration (no additional major equipment)

To improve the system reliability of the 138 kV lines to Bacolod and Mabinay Substations and prevent partial blackout during double-bus outage in Kabankalan Substation, the Kabankalan-Bacolod and Kabankalan-Mabinay 138 kV lines should be connected in the same switchbay. The proposed connection scheme will ensure continuity of supply in Northern Negros and Panay during the simultaneous outage of the two 138 kV buses at Kabankalan Substation.

9.1.21 Reconfiguration of Babatngon-Sta. Rita 138 kV Transmission Corridor

Major Project Components
▪ ***Babatngon-Paranas 138 kV T/L (portion along San Juanico Strait),*** ST-DC, 2-795 MCM ACSR, 1.8 km; ▪ ***Sta. Rita 138 kV S/S,*** 2-50 MVA 138/69-13.8 kV Power Transformer, 10-138 kV PCB, 4-69kV PCB and associated equipment.

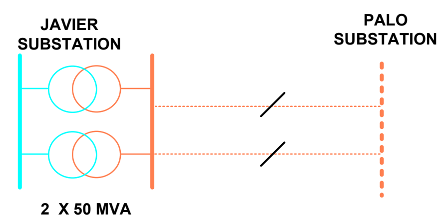
The project aims to address the need to increase the transmission capacity of the Babatngon-Paranas 138 kV line, which, due to portion of the line that utilizes smaller conductor size, has a limited capacity of 100 MW or equivalent only to half of the capacity designed for the entire line. It will also involve the construction of a permanent substation at Sta. Rita which aims to improve the system reliability in the area by eliminating the 138 kV tap connection of the existing Sta. Rita Substation.



9.1.22 Palo-Javier 138 kV Transmission Line Project

Major Project Components
▪ ***Palo-Javier 138 kV T/L,*** ST-DC, 1-795 MCM ACSR, 45 km; ▪ ***Palo 138 kV S/S,*** 4-138 kV PCB and associated equipment; ▪ ***Javier 138 kV S/S,*** 4-138 kV PCB and associated equipment.

The project aims to improve the reliability of the transmission backbone in Leyte by establishing a 138 kV transmission loop. The project will link the Babatngon-Palo 138 kV Line in the north and the Maasin-Javier 138 kV Line in the south, therefore, will provide N-1 contingency to the loads connected to the 138 kV transmission corridor.



9.1.23 Visayas Substation Upgrading Project – 2

Major Project Components
CEBU ▪ ***Colon 138 kV S/S***, 1-100 MVA 138/69-13.8 kV Power Transformer, 1-138 kV PCB, 1-69 kV PCB and associated equipment; ▪ ***Calong-calong 138 kV S/S***, 1-50 MVA 138/69-13.8 kV Power Transformer, 2-138 kV PCB, 2-69 kV PCB and associated equipment; ▪ ***Compostela 138 kV S/S***, 1-50 MVA 138/69-13.8 kV Power Transformer, 2-138 kV PCB, 1-69 kV PCB and associated equipment. **NEGROS** ▪ ***Kabankalan 138 kV S/S***, 1-50 MVA 138/69-13.8 kV Power Transformer, 2-138 kV PCB, 1-69 kV PCB and associated equipment; ▪ ***Mabinay 138 kV S/S***, 1-50 MVA 138/69-13.8 kV Power Transformer, 2-138 kV PCB, 1-69 kV PCB and associated equipment; ▪ ***E.B. Magalona 138 kV S/S***, 2-30 MVA, 138/69-13.8 kV Power Transformer (transferred from Panitan S/S), 4-138 kV PCB, 2-69 kV PCB and associated equipment. **PANAY** ▪ ***Dingle 138 kV S/S,*** 1-50 MVA 138/69-13.8 kV Power Transformer, 2-138 kV PCB, 1-69 kV PCB and associated equipment; ▪ ***San Jose 138 kV S/S,*** 1-50 MVA 138/69-13.8 kV Power Transformer, 2-138 kV PCB, 1-69 kV PCB and associated equipment; ▪ ***Panit-an 138 kV S/S,*** 2-50 MVA 138/69-13.8 kV Power Transformer, 4-138 kV PCB, 2-69 kV PCB and associated equipment.

To comply with N-1 contingency criterion of the PGC, an additional 50 MVA transformer needs to be installed at Dingle, San Jose and Calbayog Substations. Considering the 10-year projected demand of the distribution utilities and electric cooperatives being served by Panit-an Substation, the existing 2-30 MVA, 138/69-13.8 kV transformer needs to be upgraded to 2-50 MVA to increase the substation capacity and improve the reliability up to the substation level. Kabankalan, Mabinay, and E.B. Magalona Substations need upgrading to provide N-1 contingency capability and increase reliability at the substation level.

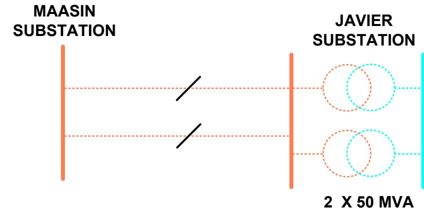
9.1.24 Visayas Voltage Improvement Project

Major Project Components
▪ ***Compostela 138 kV S/S,*** 2-20 MVAR, 138 kV Capacitor Banks; ▪ ***Cebu 138 kV S/S,*** 2-20 MVAR, 138 kV Capacitor Banks; ▪ ***Corella 138 kV S/S,*** 3-5 MVAR, 138 kV Capacitor Banks; ▪ ***Himayangan LES,*** 1-5 MVAR, 69 kV Capacitor Bank; ▪ ***Bobolosan LES,*** 1-5 MVAR, 69 kV Capacitor Bank; ▪ ***Tolosa LES,*** 1-5 MVAR, 69 kV Capacitor Bank.

Maintaining the system voltages within the PGC-prescribed limits both during normal and N-1 contingency condition requires the installation of capacitor banks at the identified substations in Visayas.

9.1.25 Maasin-Javier 138 kV Transmission Line Project

Major Project Components
▪ ***Maasin-Javier 138 kV T/L,*** ST-DC, 1-795 MCM ACSR, 105 km;
▪ ***Maasin 138 kV S/S,*** 3-138 kV PCB and associated equipment;
▪ ***Javier 138 kV S/S (New),*** 2-50 MVA 138/69-13.8 kV Power Transformer, 6-138 kV PCB, 5-69kV PCB and associated equipment.



To address the low voltage and improve reliability, the system needs another transmission line with bigger transfer capacity, at higher voltage and a new drawdown substation in the vicinity of Javier. This proposed Javier Substation could serve the entire SOLECO customers. DORELCO and LEYECO II Load-end Substations may also be shifted to this proposed substation during N-1 contingency event.

The recent major transmission development in Mindanao is the completion of a 230 kV-designed transmission backbone system from Balo-i, Lanao del Sur to Villanueva, Misamiz Oriental then down to the Bunawan in Davao del Sur. This facility, which is initially energized at 138 kV, facilitates the transfer of bulk power from the hydro power plant complex in the north going to the load centers in the south of Mindanao.

In its generation capacity mix in the past years, Mindanao is known as a hydro generation dependent grid, thus, the adequacy of supply has always been a major concern during dry season. However, the power supply deficiency being experienced in Mindanao is slowly being averted by the entry of bulk generation capacity additions from a number of coal-fired power plant projects. To facilitate its integration to the grid, further extensions of the 230 kV system have been required to reach the bulk generation sites as in the case of GNPower Kauswagan, TSI, and SMC Malita. It can be noted also that the new power plants have plans for generation capacity expansions in the future which would reach a total of 600 MW to 1,200 MW capacity in each site. Such developments would already necessitate the energization of the Mindanao backbone to 230 kV voltage level to increase its transmission capacity.

Furthermore, because of the aggressive plans for future plant expansion which could be more than enough for the Mindanao loads particularly during wet season, there is an increasing clamour to pursue already the Visayas-Mindanao Interconnection Project in order to allow export of power to the other grids. This major interconnection project, which is the final link to interconnect the Philippine Grid, is further discussed in Chapter 11.

In other parts of Mindanao, the requirements generally include reinforcements of the existing 138 kV transmission lines and extension also of some 69 kV facilities for system reliability improvement, and the usual transformer capacity additions in the substations for continuous adequate supply for the load customers.

In terms of backbone system configuration, Mindanao is a relatively robust grid. However, because of the security concerns for some of the transmission lines in Mindanao, NGCP is facing major challenges.

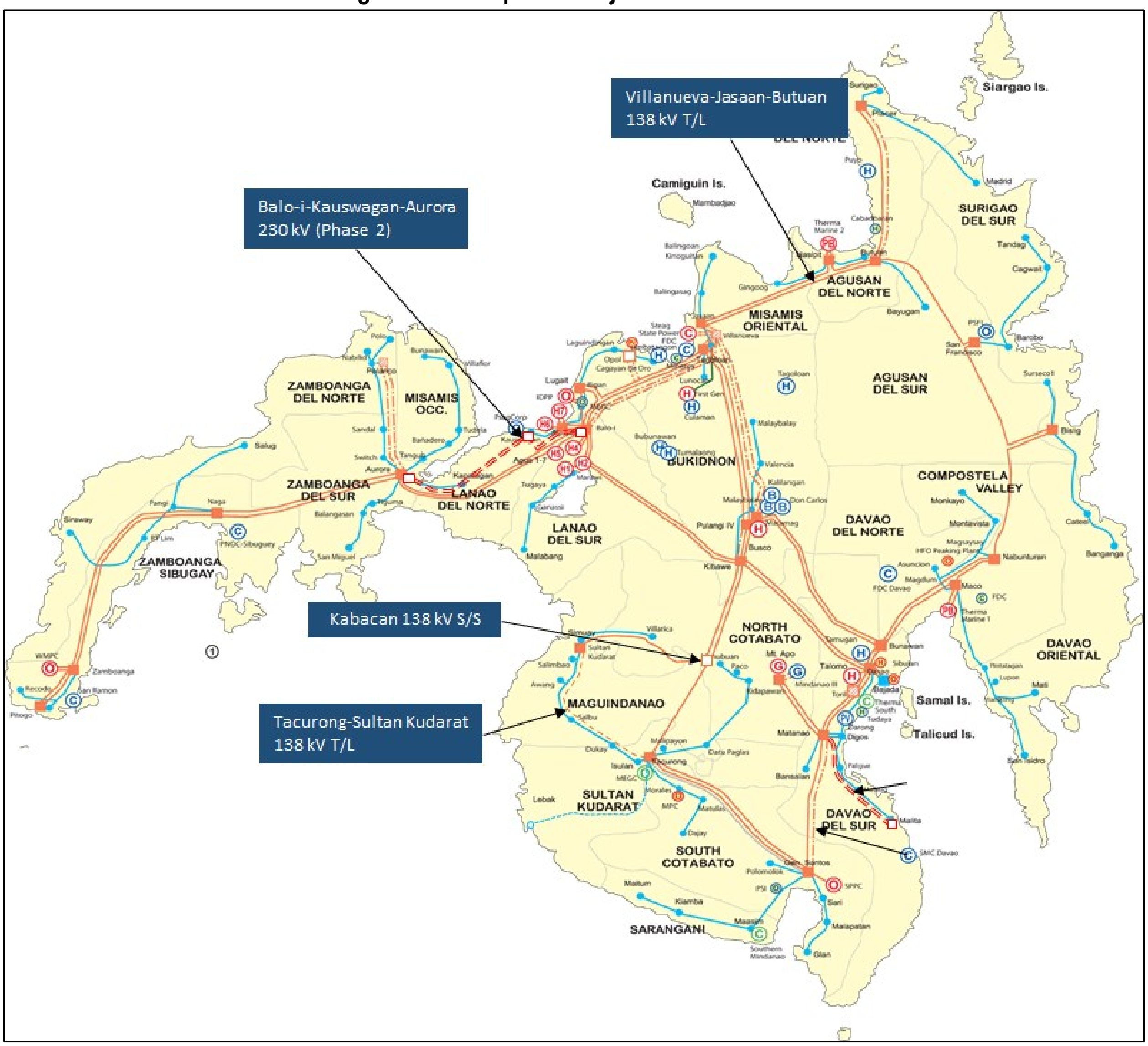
10.1 Proposed Transmission Projects for 2016-2025

Shown in Table 10.1 is the list of transmission projects planned for Mindanao Grid in the period 2016-2025 in addition to the projects already approved by the ERC.

Table 10.1: Proposed Transmission Projects for Mindanao

Project Name/Driver(s)	Province(s)	ETC
Generation Entry		
Mindanao 230 kV Transmission Backbone	Mindanao Island	Dec 2018
Balo-i-Kauswagan-Aurora 230 kV Transmission Line (Phase 2)	Lanao del Norte, Misamis Occidental, Zamboanga del Sur	Dec 2022
Load Growth		
Mindanao Substation Upgrading	Mindanao Island	Dec 2022
System Reliability		
Kabacan 138 kV Substation	Cotabato	Dec 2021
Villanueva-Jasaan-Butuan 138 kV Transmission Line	Misamis Oriental, Agusan del Norte	Dec 2021
Mindanao Substation Rehabilitation	Mindanao Island	Dec 2022
Balo-i-Tagoloan-Opol 138 kV Transmission Line	Lanao del Norte and Misamis Oriental	Dec 2025
Tacurong-Sultan Kudarat 138 kV Transmission Line	Maguindanao, Sultan Kudarat	Dec 2025

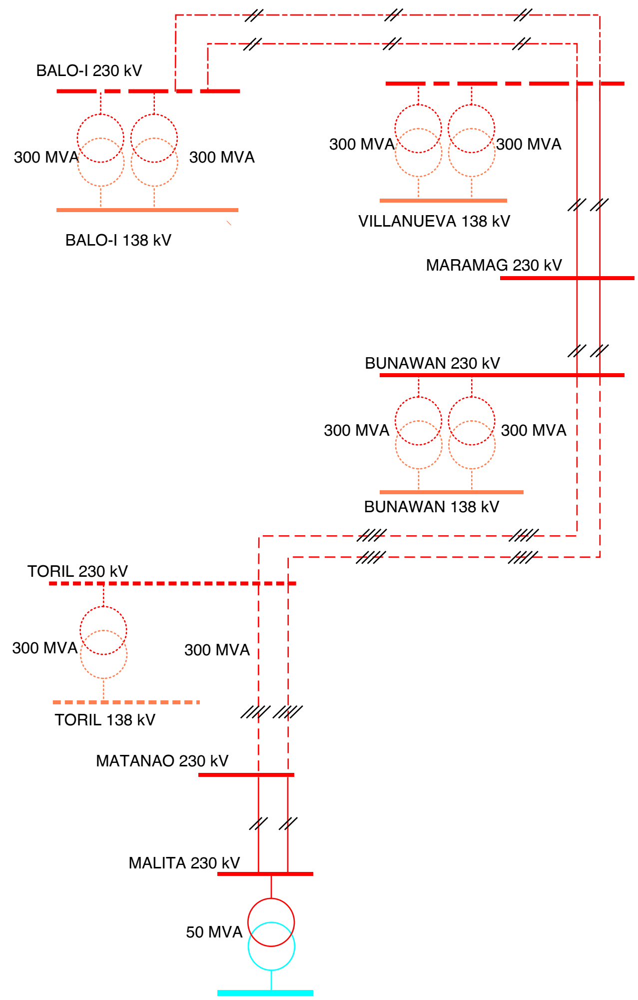
Figure 10.1: Proposed Projects for Mindanao



10.1.1 Mindanao 230 kV Transmission Backbone

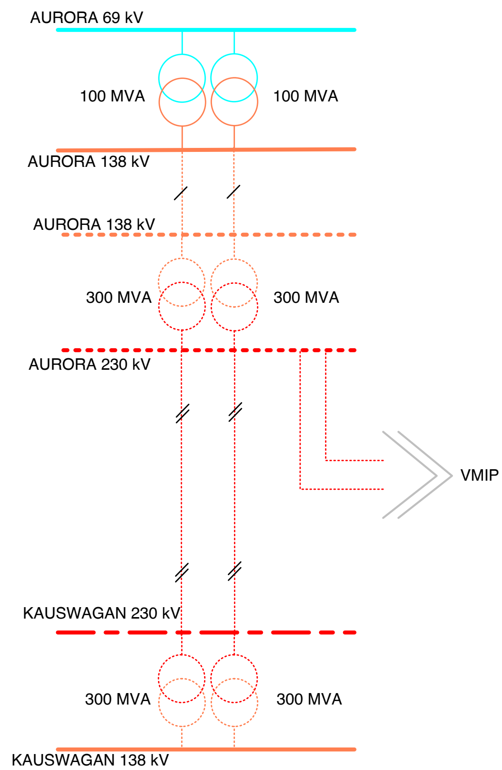
Major Project Components
▪ ***Matanao-Toril 230 kV T/L,*** ST-DC, 4-795 MCM ACSR, 34 km; ▪ ***Toril-Bunawan 230 kV T/L,*** ST-DC, 4-795 MCM ACSR, 40.2 km; ▪ ***Malita 230 kV S/S,*** 1-50 MVA 230/69 kV Power Transformer; ▪ ***Matanao 230 kV S/S,*** 2-230 kV PCB and associated equipment; ▪ ***Toril 230 kV S/S,*** 2-300 MVA 230/138 kV Power Transformer; 10-230 kV PCB, 6-138 kV PCB and associated equipment; ▪ ***Bunawan 230 kV S/S,*** 2-300 MVA 230/138 kV Power Transformer; 10-230 kV PCB, 1-69 kV PCB and associated equipment; ▪ ***Balo-i 230 kV S/S,*** 10-230 kV PCB and associated equipment; ▪ ***Villanueva 230 kV S/S,*** 2-300 MVA 230/138 kV Power Transformer; 2-35 MVAR Reactor, 12-230 kV PCB, 1-69 kV PCB and associated equipment; ▪ ***Maramag 230 kV S/S,*** 4-230 kV PCB and associated equipment.

The project will provide additional high voltage corridor for the upcoming power plants in the northern and southern parts of the island. It will strengthen the existing transmission backbone of Mindanao serving as major transmission highway delivering both renewable and conventional energy throughout the island. The project will allow full dispatch of the new large power plants increasing the transmission capacity of the backbone and eliminate the vulnerability of power supply in the island to hydropower. It has two major components: the Matanao-Toril-Bunawan 230 kV Tranmission Line and the energization of the existing Mindanao Transmission Backbone (Balo-i-Villanueva-Maramag-Bunawan) to 230 kV voltage level. Transmission line component of the project will be in place starting year 2017 while others will be completed until year 2018.



10.1.2 Balo-i-Kauswagan-Aurora 230 kV Transmission Line (Phase 2)

Major Project Components
▪ ***Aurora 230 kV S/S Expansion:*** 2-300 MVA 230/69-13.8 kV Power Transformer, 6-230 kV PCB, 4-138 kV PCB and associated equipment; ▪ ***Kauswagan 230 kV S/S Expansion:*** 2-230 kV PCB and associated equipment.



The project will ensure the reliability of power supply to the entire Zamboanga Peninsula given that majority of power is being supplied through the existing Balo-i – Aurora and Balo-i – Agus 5 – Aurora 138kV transmission lines, which are critically loaded during N-1 contingency condition. Considering the growing demand and reliability of these existing transmission lines connecting the Zamboanga Peninsula to the Mindanao Grid, it is necessary to construct the additional double-circuit 230 kV line from Kauswagan Substation to Aurora Substation.

10.1.3 Mindanao Substation Upgrading

Major Project Components

- ***Polanco 138 kV S/S,*** 1-75 MVA 138/69 kV Power Transformer, 3-138 kV PCB, 1-69 kV PCB and associated equipment;
- ***Naga 138 kV S/S,*** 1-100 MVA 138/69 kV Power Transformer, 2-69 kV PCB and associated equipment;
- ***Pitogo 138 kV S/S,*** 1-100 MVA 138/69 kV Power Transformer, 1-138 kV PCB, 1-69 kV PCB and associated equipment;
- ***Agus 6,*** 1-100 MVA 138/69 kV Power Transformer, 2-138 kV PCB and associated equipment;
- ***Maramag 138 kV S/S,*** 1-75 MVA 138/69 kV Power Transformer, 1-138 kV PCB, 1-69 kV PCB and associated equipment;
- ***Tagoloan 138 kV S/S,*** 1-100 MVA 138/69 kV Power Transformer, 3-138 kV PCB, 2-69 kV PCB and associated equipment;
- ***Opol 138 kV S/S,*** 1-75 MVA 138/69 kV Power Transformer, 4-138 kV PCB, 5-69 kV PCB and associated equipment;
- ***Butuan 138 kV S/S,*** 1-100 MVA 138/69 kV Power Transformer, 2-7.5 MVAR Shunt Capacitor, 5-138 kV PCB, 5-69 kV PCB and associated equipment;
- ***Placer 138 kV S/S,*** 1-100 MVA 138/69 kV Power Transformer, 1-7.5 MVAR Shunt Capacitor, 3-138 kV PCB, 6-69 kV PCB and associated equipment;
- ***Bislig 138 kV S/S,*** 1-50 MVA 138/69 kV Power Transformer, 4-138 kV PCB, 5-69 kV PCB and associated equipment;
- ***San Francisco 138 kV S/S,*** 1-50 MVA 138/69 kV Power Transformer, 2-7.5 MVAR Shunt Capacitor, 4-138 kV PCB, 3-69 kV PCB and associated equipment;
- ***Kidapawan 138 kV S/S,*** 1-50 MVA 138/69 kV Power Transformer, 1-138 kV PCB, 2-69 kV PCB and associated equipment;
- ***Gen. Santos 138 kV S/S,*** 1-7.5 MVAR Shunt Capacitor, 1-138 kV PCB, 8-69 kV PCB and associated equipment;
- ***Tacurong 138 kV S/S,*** 1-7.5 MVAR Shunt Capacitor, 1-138 kV PCB, 10-69 kV PCB and associated equipment

This project involves the installation of a total of 975 MVA power transformers, 52.5 MVAR capacitor banks, 19 – 138 kV power circuit breakers (PCB) and 22 – 69 kV PCB. Also included in the project are the replacement of 14 – 138 kV and 28 – 69 kV PCB.

It will enable various substations in Mindanao Grid to accommodate projected load growth and to comply with the single-outage (N-1) contingency provision prescribed under the Philippine Grid Code (PGC). The project also includes the installation of capacitor banks that can improve the voltage regulation of the network and reduce transmission system losses. Lastly, it will replace old, obsolete and underrated PCB to avoid frequent breaker failures and power interruptions.

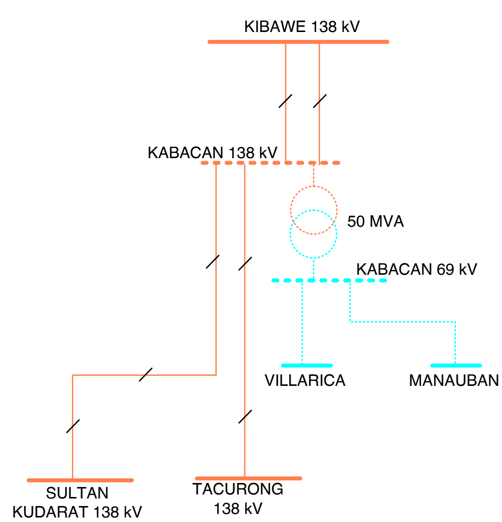
The additional power transformers, installation of capacitor banks and replacement of old, obsolete and underrated PCB, are part of the plan of NGCP to ensure adequate, reliable and quality power transmission system.

10.1.4 Kabacan 138 kV Substation

Major Project Components

- ***Kabacan 138 kV S/S,*** 50 MVA 138/69-13.8kV Power Transformer; 8-138 kV PCB, 3-69 kV PCB and associated equipment;
- ***Kabacan-Villarica 69 kV T/L,*** SC-SP/CP, 1-336.4 MCM, 2 km;
- ***Kabacan-Manauban 69 kV T/L,*** SC-SP/CP, 1-336.4 MCM, 10 km.

The new Kabacan Substation will function as a common bus for the double circuit Kibawe – Kabacan 138 kV double circuit lines, Kabacan – Sultan Kudarat 138 kV and Kabacan – Tacurong 138 kV single circuit lines. It will also serve as connection point for load end substations connected at the far end of the 69 kV transmission lines emanating from the substations of Sultan Kudarat and Kidapawan. This project will ensure the reliability and security of power supply in the area

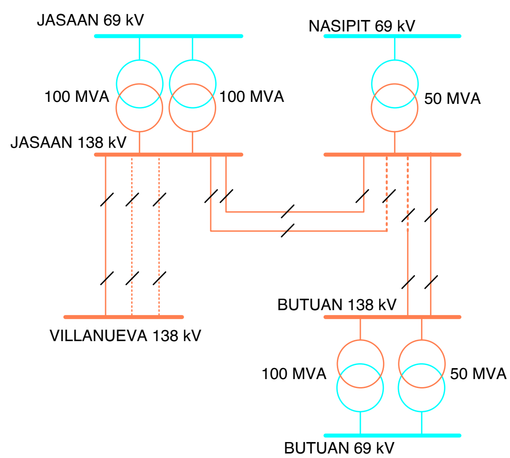


during contingencies.

The new Kabacan Substation is proposed to be situated in Cotabato which will serve as the terminal point for the Kibawe – Kabacan double-circuit line and new connection point for Sultan Kudarat – Kabacan and Tacurong – Kabacan 138 kV lines. The new substation will also cater load end substations connected at Sultan Kudarat – Midsayap 69 kV line and Kidapawan – Matalam (Manauban) 69 kV line, further connecting the Kidapawan Substation to the proposed substation. The Project, likewise, will serve as a loop connection scheme for the 69 kV lines in the vicinity giving flexibility in transmitting power to Sultan Kudarat Substation during critical incidents. Sultan Kudarat can then draw its power requirement from adjacent substations through Kabacan – Sultan Kudarat 138 kV line which offers more secured power transmission than the existing Tacurong – Cotabato – Sultan Kudarat 69 kV line.

10.1.5 Villanueva-Jasaan-Butuan 138 kV Transmission Line

Major Project Components
▪ ***Villanueva–Jasaan 138 kV T/L:*** ST-SC, 1-795 MCM ACSR, 12 km; ▪ ***Nasipit–Tower 179 138 kV T/L:*** Line 1: ST-SC, 1-795 MCM ACSR, 4 km; Line 2: ST-SC, 1-795 MCM ACSR, 4 km; ▪ ***Nasipit 138 kV S/S Expansion:*** 1-50 MVA, 138/69-13.8 kV Power Transformer, 9-138 kV PCB and associated equipment; ▪ ***Jasan 138 kV S/S Expansion:*** 2–138 kV PCB and associated equipment; ▪ ***Villanueva 138 kV S/S Expansion:*** 2-138 kV PCB and associated equipment.



The total power demand in NEMA has reached more than 130 MW and is expected to increase at a significant rate in the next 10 years. This projected increase in power demand in NEMA requires the implementation of 3rd circuit of Villanueva-Jasaan 138 kV Line to prevent overloading should there be an outage in one of the circuits. In addition, there is also a need to bus-in or divert the existing Jasaan-Butuan 138 kV transmission line to Nasipit Substation and install additional 50 MVA transformer thereat to improve system reliability as well as improve power quality in Butuan, Placer and San Francisco Substations during N-1 contingency event.

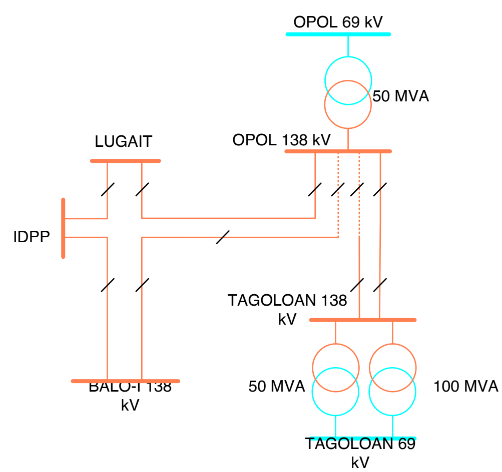
10.1.6 Mindanao Substation Rehabilitation

Major Project Components
▪ ***Aurora 138 kV S/S,*** 1-138 kV PCB, 3-69 kV PCB and associated equipment; ▪ ***Zamboanga 138 kV S/S,*** 3-138 kV PCB, 2-69 kV PCB and associated equipment; ▪ ***Balo-I 138 kV S/S,*** 13-138 kV PCB and associated equipment; ▪ ***Agus 5 S/S,*** 4-138 kV PCB and associated equipment; ▪ ***Lugait 138 kV S/S,*** 5-138 kV PCB and associated equipment; ▪ ***Pulangi 4 S/S,*** 10-138 kV PCB, 3-69 kV PCB and associated equipment; ▪ ***Nasipit 138 kV S/S,*** 4-138 kV PCB and associated equipment; ▪ ***Davao 138 kV S/S,*** 4-138 kV PCB, 6-69 kV PCB and associated equipment; ▪ ***Maco 69 kV S/S,*** 2-69 kV PCB and associated equipment; ▪ ***Nabunturan 138 kV S/S,*** 3-138 kV PCB, 5-69 kV and associated equipment; ▪ ***Sultan Kudarat 69 kV S/S,*** 4-69 kV PCB and associated equipment.

Mindanao Substation Rehabilitation Project aims to replace defective, old, obsolete and low fault level capacity PCBs in the Mindanao Grid. This involves the replacement of 47 – 138 kV and 25 – 69 kV Power Circuit Breakers (PCB) in eleven (11) NGCP substations. Implementation of project will increase the reliability of the network, reduce/prevent unserved energy, and reduce costly maintenance expenses. Lastly, the implementation of the project can improve personnel safety and decrease incidents of breaker failures.

10.1.7 Balo-i-Tagoloan-Opol 138 kV Transmission Line

Major Project Components
▪ ***Opol S/S Bus-in to Balo-i-Tagoloan 138 kV Line:*** Line 1: 138 kV, ST-DC2, 1-795 MCM ACSR, 7 km Line 2: 138 kV, ST-DC2, 1-795 MCM ACSR, 7 km; and ▪ ***Opol 138 kV S/S:*** 1–75 MVA, 138/69–13.8 kV Power Transformer, 3-138 kV PCB and associated equipment, 3-69 kV PCB and associated equipment.

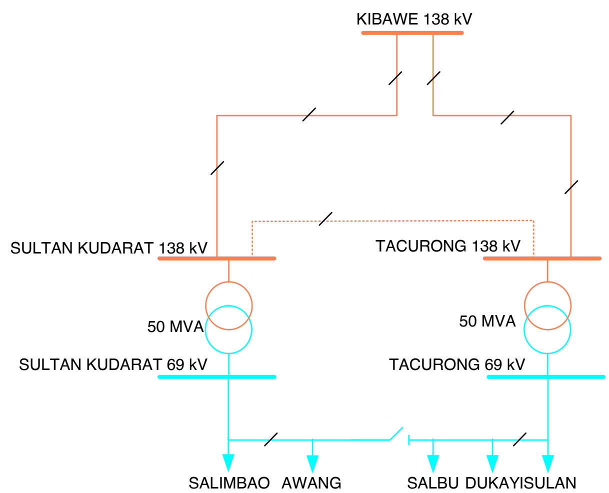


With the completion of the proposed Opol Substation, the existing Lugait – Tagoloan 138 kV line needs to be diverted through "cut-in" connection via the construction of two circuits, employing steel tower double circuit design, constructed initially with single circuit strung utilizing 1-795 MCM ACSR conductor. Tagoloan Substation is also presently connected to Balo-i Substation through the existing 138 kV ST-SC, 1-795 MCM ACSR conductor. Given the rapid growth in demand, the existing transmission system, particularly the capacity of Opol Substation, may not be able to comply with the power quality standards prescribed under the PGC during single outage (N-1) contingency condition. The project requires the Balo-i-Tagoloan 138 kV Line bus-in to Opol Substation which will address the possible low voltage that may be experienced by customers served by Opol Substation during the outage of the Opol – Tagoloan 138 kV ST-SC line. Another component is the additional 1-75 MVA transformer at Opol Substation which will comply with the N-1 contingency criterion to ensure the security and reliability of the grid during such condition.

10.1.8 Tacurong-Sultan Kudarat 138 kV Transmission Line

Major Project Components
▪ ***Tacurong-Sultan Kudarat 138 kV T/L,*** ST-SC, 1-795 MCM ACSR, 101 km; ▪ ***Tacurong 138 kV S/S,*** 2-138 kV PCB and associated equipment; ▪ ***Sultan Kudarat 138 kV S/S Expansion,*** 2-138 kV PCB and associated equipment.

The projected increase in demand in the area for the next ten years would require a more reliable power delivery system. Based on the DOE list of PSIPP (Private Sector Initiated Power Project), several generation developments in Davao and South Cotabato have intentions to connect to the grid in the next five years; thus, the need to establish a new 138 kV line with higher transfer capacity linking Tacurong and Sultan Kudarat Substations to provide an alternative power transmission corridor for Cotabato City and adjacent municipalities.



11.1 Island Interconnection

With the archipelagic nature of the Philippines, one of the challenges in improving the system reliability and reducing the reserve requirements without adding new generation is the interconnection of two or more islands by the use of an undersea cable. Major considerations in the implementation of such kind of project are the required investment and the potential generation resources in the concerned island. The power cable systems have exhibited high reliability and long life of more than 20-30 years with limited maintenance.

11.1.1 Existing Island Interconnections

As of December 2015, the Philippines has seven major undersea island interconnection systems: six High Voltage Alternating Current (HVAC) and one High Voltage Direct Current (HVDC). These are the Leyte-Luzon ± 350 kV HVDC, Leyte-Cebu 230 kV, Negros-Panay 138 kV, Cebu-Negros 138 kV, Cebu-Lapu-lapu 138 kV HVAC and the Panay-Boracay 69 kV AC Interconnection facilities. The 432-km Leyte-Luzon ± 350 kV HVDC, with a 23-km connecting Leyte Island (via Samar Island) to the Luzon Grid has been in operation since 1998. Its maximum transmission capacity is 440 MW with provision for upgrade to 880 MW.

The Leyte-Cebu interconnection is a 33-km double circuit 230 kV submarine cable, with a transfer capacity of nearly 400 MW. The first and second circuits were energized in 1997 and 2005, respectively. The double circuit Cebu-Negros Interconnection enables power sharing of maximum of 180 MW between Cebu and Negros Islands. Its first circuit of 18-km, 138 kV submarine cable was energized in 1993 while its second circuit was energized in 2007. From Negros Island, connected is the 18-km 138 kV Negros-Panay Interconnection, energized in 1990 with a rated capacity of 85 MW.

Connecting the island of Mactan to mainland Cebu is the 8.5-km 200 MW capacity cable that was energized in 2005. It is laid underneath the Cebu-Mactan Bridge. Another island interconnection is the Leyte-Bohol Interconnection, a submarine cable that allows a maximum power flow of 90 MW to the island of Bohol since 2004.

11.1.2 Benefits of Island Interconnection

The following are some of the salient benefits of island interconnections:

a) Generally, island interconnections can provide additional power supply similar to a generator having the ability to import power when required;
b) With island interconnections, the most efficient generator across both power systems is brought on to meet demand resulting in a more efficient dispatch;
c) Island interconnections also reduces power curtailment as it provides a means of exporting power when there is surplus from other island; and

d) Renewable and indigenous energy sources, such as wind, hydro and geothermal potential sites suitable for energy generation may also be taken into consideration. These are clean and sustainable sources of energy that may become attractive for development by generation proponents as a result of a wider market due to island interconnection.

Considering these salient and other intangible benefits, island interconnections become more economically attractive in the long run. However, detailed studies should be undertaken to quantify the overall benefits to the receiving island.

11.1.3 Major Project Development Considerations for Island Interconnections

The following major considerations shall be taken into account in the project development of island interconnections:

a) The depth of the seabed between two islands is always an issue in interconnecting islands. This is due to mechanical stress that the cable must be designed to withstand cable weight, sea current, bottom drag, etc. during installation and repairs;
b) The use of HVAC or HVDC transmission systems, the size and length of the cable, the existing situation of the grid, estimated load growth, environmental impact and public acceptance and the possibilities for the development of energy resources; and
c) On the operational side, single outage contingency or N-1 reliability criterion needs to be clarified further if it will be economically beneficial to the power consumers.

11.2 Transmission Backbone and Island Interconnection Projects for 2016-2025

Figure 11.1 shows the development of transmission backbones and island interconnections. While some segments of the transmission backbones are already programmed for implementation within the Fourth Regulatory Period (2016-2020), as discussed in Chapters 8, 9 and 10, other segments will still be subjected to a more thorough system analyses or even Feasibility Study for some big and more complicated backbone projects.

For Major Island Interconnections, however, no dominant projects driver is deemed appropriate to trigger its implementation. In this sense, both the Batangas-Mindoro and Visayas-Mindanao Interconnection Projects would seem to require a strategic decision, which will deeply involve both the oversight and regulatory agencies of the government, hence these island interconnection projects fall under **"Strategic Interconnection"**. NGCP is conducting related studies, e.g., economic, system and other studies to support its application to secure approval of the ERC.

Figure 11.2 shows the Existing and Future Philippine Network Topology of an interconnected grid.

11.2.1 Transmission Master Plan (TMP)

The formulation of the Transmission Master Plan (TMP) is guided by NGCP's vision to build the strongest power grid in Southeast Asia, to contribute to the social and economic development of the country and to satisfy its stakeholders' need. These are vital considerations to ensure that the country has a transmission network that can support growth and competitive electricity prices. This is done through a program that will significantly upgrade and expand the transmission backbone in order to meet the forecast demand, support the entry of new generating facilities and allow market competition.

The creation of an interconnected Philippine Grid will also be among the considerations. As the Luzon and the Visayas Grids are already interconnected, connecting the Visayas and Mindanao would create more open, liberalized and competitive market as Mindanao-based industry players can participate freely in Wholesale Electricity Spot Market.

Table 11.1 – Transmission Master Plan Proposed Projects for 2016-2030

Project Name	Provinces	ETC
Mindanao 230 kV Backbone	Mindanao Island	Dec 2018
Cebu-Negros-Panay 230 kV Backbone	Cebu, Negros Occidental, Iloilo	Aug 2020
Visayas-Mindanao Interconnection Project		Dec 2020*
Batangas-Mindoro Interconnection Project	Batangas, Oriental Mindoro amd Occidental Mindoro	Mar 2021*
Northern Luzon 230 kV Backbone Loop	Ilocos Norte, Cagayan	Jun 2024
Western Luzon 500 kV Backbone	Pangasinan, Zambales	Jun 2024
Metro Manila 500 kV Backbone Loop		

*Still subject to ERC Approval

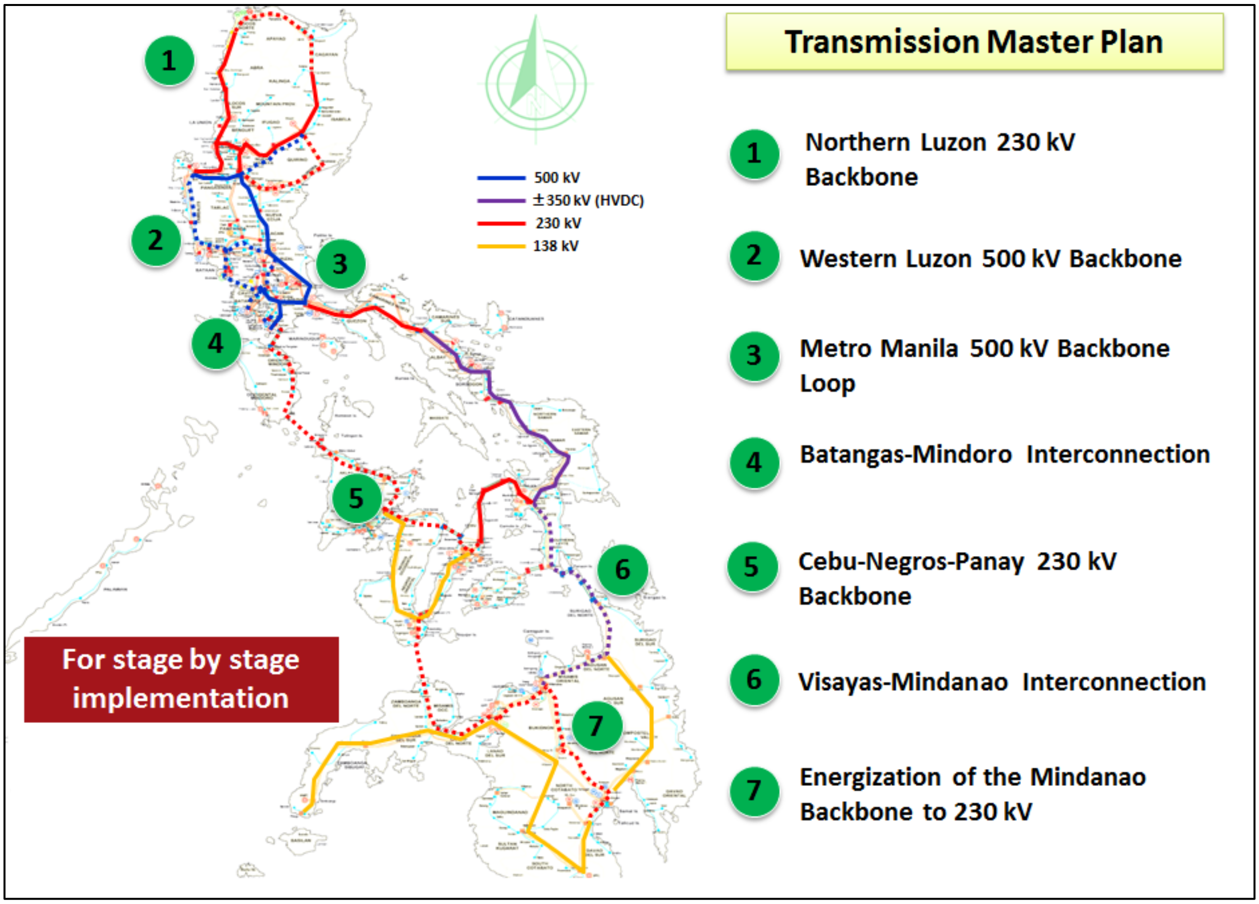


Figure 11.1 - Transmission Backbones and Island Interconnections

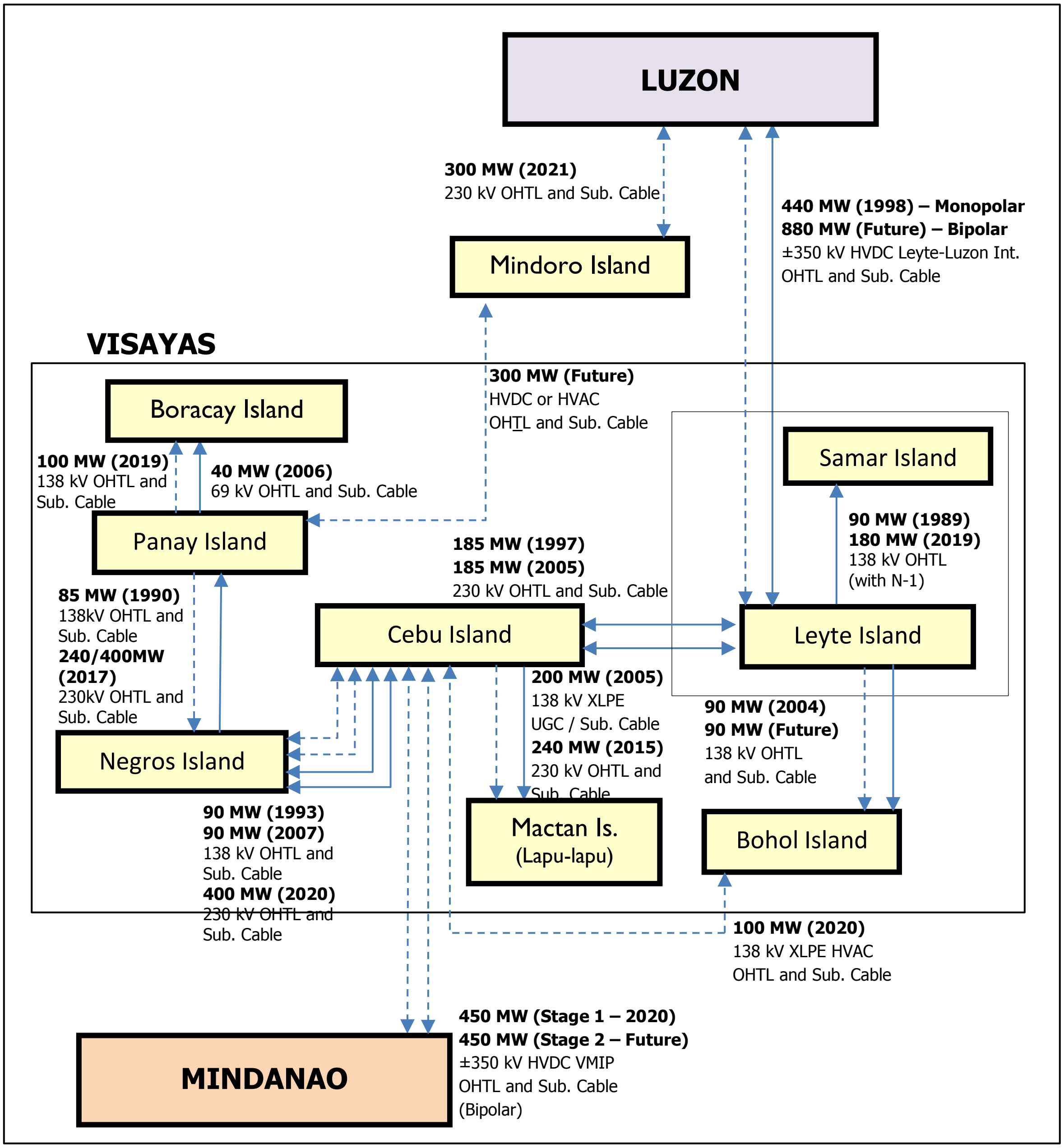


Figure 11.2 - Existing and Future Philippine Network Topology

OHTL – Overhead Transmission Line, Sub. Cable – Submarine Cable, UGC – Underground Cable and N-1 – Single Outage Contingency.

11.2.1 Batangas-Mindoro Interconnection Project (BMIP)

The power system of Mindoro Island, which is composed of 69 kV lines connected to several power plants and various load-end substations, is presently being operated by Small Power Utilities Group (SPUG) of the National Power Corporation (NPC). Power distribution to the consumers is handled by Oriental Mindoro Electric Cooperative (ORMECO) and Occidental Mindoro Electric Cooperative (OMECO). The major load center is in Calapan City in Oriental Mindoro and the total peak demand of the island in 2015 was more than 60 MW already, based on the combined total load of ORMECO and OMECO.

As the implementation of an interconnection project may take some time, further generation capacity additions within Mindoro Island would still be required to be able to sustain the short-term and medium term power supply requirements of its increasing load. The interconnection of the island with the main Luzon Grid was envisioned to provide the island the access to bulk generation sources in the main grid while at the same time providing the means to export possible excess power once the generation potentials, including RE-based plants, within the island have been developed. The improvement in reliability of supply is expected to result in better economic growth as the island could attract more investors for industrial, commercial loads and for the tourism industry.

Transmission line route investigation has been already conducted including the identification of the possible cable terminal stations (CTS) at Batangas and Mindoro side. The nearest NGCP Substation in the Luzon Grid that could serve as the connection point for the proposed interconnection project is the Batangas Substation in Barangay Mahabang Parang, Batangas City. Presently, the substation is serving Batangas II Electric Cooperative (BATELEC II), Manila Electric Company (MERALCO) and various industries.

In Mindoro side, considering that the NPC-owned Calapan 69 kV Substation is the major bulk power delivery point to Mindoro Island, it is appropriate to locate the 230 kV receiving-end substation (RES) of the proposed interconnection project adjacent to the 69 kV substation in Barangay Canubing (Simaron), Calapan City. At present, the 69 kV substation has two switch bays arranged in one-and-a-half breaker scheme composed of six 69 kV Power Circuit Breakers (PCBs) protecting two 69 kV lines, the Minolo (Mamburao) and Pinamalayan (Bansud) and two power transformers rated at 30 MVA and 20 MVA, 69/13.8 kV.

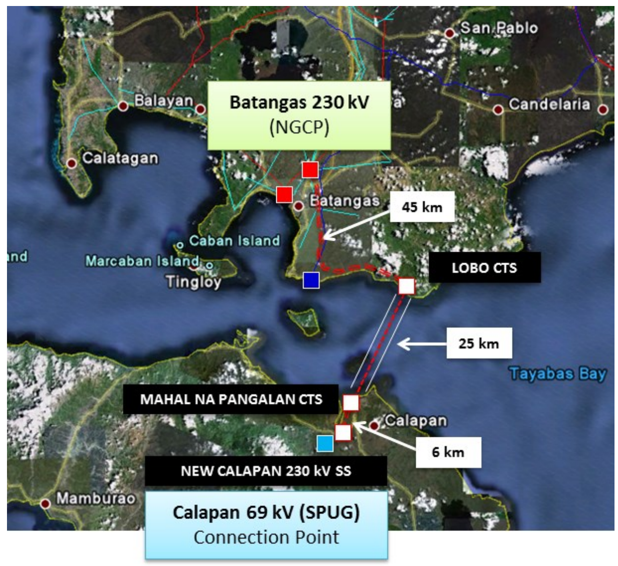
While a hydrographic survey is still needed to determine the detailed seabed profile, it was initially determined that the submarine power cables can be laid from Barangay Soloc, Lobo, Batangas City to Barangay Mahal na Pangalan, Calapan, Oriental Mindoro across the Verde Island Passage located in the Sulu-Sulawesi Seascape considered as a Marine Biodiversity Conservation Corridor as declared in Executive Order No. 578. Therefore, laying of submarine power cables shall also be coordinated with the Protected Area Management Board (PAMB), tasked to implement this executive order.

The linear distance between Lobo CTS and Mahal na Pangalan CTS is approximately 23.85 km, while the length of the submarine power cables taking into consideration the sea bottom topography is approximately 25 km. The maximum depth of water along this route is 500 meters.

The interconnection of Mindoro would only serve as the initial stage in the development of the power system in the island. Calapan would serve as the interconnection point but given the configuration of the island involving long 69 kV lines, in-land generators will still have to operate to provide voltage regulation support. In the long term, a 230 kV backbone system within the island could be developed as well as the future establishment of a loop to Panay Island thereby providing another corridor for the Luzon and Visayas link.

Major Project Components:

- Batangas–Lobo CTS 230 kV T/L, ST-DC 1-795 MCM ACSR, 45 km;
- Lobo CTS-Mahal na Pangalan CTS 230 kV Submarine Cable, 4-1000 mm^2 XLPE, 25 km;
- Mahal na Pangalan CTS-Calapan 230 kV T/L, ST-DC 1-795 MCM ACSR, 6 km;
- Batangas S/S Expansion: 1-138 kV PCB and associated equipment;
- Lobo CTS: 3-230 kV PCB, 2-30 MVAR 230 kV Shunt Reactors and associated protection equipment;
- Mahal na Pangalan CTS: 3-230 kV PCB, 2-30 MVAR 230 kV Shunt Reactors and associated protection equipment; and
- Calapan 230 kV S/S: 2-100 MVA, 230/69-13.8 kV Power Transformers, 7-230 kV PCB and 4-69 kV PCB and associated equipment and a 25 MVAR 230 kV Shunt Reactor.



11.2.2 Visayas-Mindanao Interconnection Project (VMIP)

The tangible benefits in terms of reduced investments in power generation due to the implementation of VMIP are due to the following:

a) The sharing of system reserve;
b) The lesser investment in power generation in either the Visayas or Mindanao to maintain the one day Loss of Load Probability (LOLP); and
c) The reduction of operating cost due to economic dispatch of generators.

The intangible benefits in the implementation of VMIP:

a) The benefit that is difficult to be quantified in monetary terms includes the attractiveness of VMIP to power generation investments due to the bigger market through an interconnected power network;
b) From a technical standpoint, VMIP will provide benefit to the system in terms of added supply security, improved system reliability and improvement in the quality of power supply; and

c) The optimized utilization of indigenous energy sources, such as natural gas in Luzon, geothermal in the Visayas and hydro in Mindanao. VMIP will reduce the overall generation of pollution as well as the dependency on the importation of fossils fuel, where its availability and price are sensitive to the price in the world market.

The implementation of VMIP will also complement the ultimate operation of the Wholesale Electricity Spot Market (WESM) in Mindanao. As a transition mechanism to the operation of the WESM, the Interim Mindanao Electricity Market (IMEM) commercial operations was initially launched in Davao City on September 20, 2013.

VMIP Activities by NGCP

On 02 March 2011, more than a decade after the completion of the detailed design of the Project, the DOE directed the National Grid Corporation of the Philippines (NGCP) "to lead the conduct of the study relative to the Project and include such venture in the Transmission Development Plan (TDP)." The review of the previous studies was brought by the updated assumptions of the Leyte-Mindanao Interconnection. The economic, financial and pre-engineering studies for the interconnection will involve substantial budget to complete. Inasmuch as no relevant capital expenditures (CAPEX) were allotted for this Project in the Third Regulatory Period, the NGCP filed the application for the issuance of Provisional Authority (PA) with the Energy Regulatory Commission (ERC) in March 2011.

On August 15, 2011, NGCP was granted by the ERC under Case No. 2011-037RC the PA for the implementation of Phase I of the Leyte-Mindanao Interconnection Project (LMIP), which involves the preparation of an updated Project Feasibility Study.

In 2012, NGCP engaged the services of China Electric Power Research Institute (CEPRI) to conduct the System Study to review the design and technical aspects of the interconnection based on the latest supply-demand outlook, grid structure, emerging new technologies and other key conditions.

After the completion of System Study by CEPRI, pre-engineering activities, such as transmission route survey, geologic investigations, and data gatherings, among others were immediately conducted by NGCP. Similarly, the conduct of FS on the submarine component of the interconnection project was outsourced by NGCP and conducted by Electronic and Geophysical Services Limited - Asia (EGS Asia Ltd.), a third party consultant. The hydrographic survey was conducted between the areas of Southern Leyte and Surigao Del Norte (eastern route), as originally proposed for the interconnection. As all previous studies on LMIP have been directed to use the Surigao Strait, NGCP has also considered this route for the conduct of the feasibility study.

Based on the results presented by EGS Asia Ltd. for the survey in the Eastern Route for Phase I of the LMIP, NGCP found it necessary to investigate and explore the Western Route to be able to arrive at a more prudent investment decision.

The conduct of Hydrographic Survey for the Western Route option aims to obtain the following results:

- Determine the feasible routes for the proposed submarine cable interconnection;
- Assess engineering risks along the possible cable routes;
- Identify parameters and methods for the design and implementation of the submarine cable laying; and
- Determine other factors that should be considered in the detailed design of the project.

The proposed VMIP, on the other hand, will have a capacity of 450 MW and will use bipolar HVDC system. With long-term consideration, both the proposed VMIP and the existing Luzon-Visayas Interconnection have provision for future additional 450 MW and 440 MW capacity, respectively.

Once the Visayas-Mindanao Interconnection Project is approved by the ERC, the implementation of the project can proceed and the earliest project completion is Dec 2020.

The following are the feasibility/planning and conceptual design-related activities and other information:

- Except for Converter Stations, which are already based on December 2013 conceptual design prepared by HVDC Experts from State Grid Corporation of China (SGCC), all other major project components were based on System Study completed in January 2013 by China Electric Power Research Institute (CEPRI);
- Stage 1 of the project has a capacity of 1-225 MW per pole, hence the total capacity of the conventional bipolar Converter Stations is 450 MW. While Stage 2 of the project requires an additional 1-225 MW per pole, hence the ultimate capacity of the Converter Stations is 900 MW;
- Both ±350 kV HVDC overhead lines and submarine cables will already be designed with an ultimate or maximum power transfer capacity of 900 MW;
- In a Conventional Bipolar Scheme, outage in one pole reduces the transfer capacity by half (or 50%). Unlike in an HVAC system, single outage (N-1) contingency is not considered due to sizeable amount involved (or it will not be economically viable);
- The hydrographic/marine survey for the Eastern Option involving Surigao Strait was undertaken in December 2013 to April 2014 by EGS (Asia) Inc., a Cebu-based Earth Sciences and Surveying Company with regional hub in Hong Kong for its business operations in South East Asia. EGS (Asia) Inc. has initially recommended an alternative with lower environmental impact; and

- The result of marine/hydrographic survey in the Surigao Strait for the Eastern Option revealed the following major challenges:

  a) **The existence of geophysical hazards** consisting of an underwater volcano, fault lines and unstable rock slabs that poses seismic hazards, i.e., fluidization of sediments, bulk ground displacement, strain on cable during passage of seismic wave, landslips and turbidity currents and tsunami;

  b) **Strong seabed currents** ranging from 0.58 meter per second (m/s) to 2.00 m/s. These would certainly be sufficient to move either a bare cable or cable in shells, thus surface laying is not recommended. Generally, 0.50 m/s and below can be deemed safe for surface laying. On the other hand, cable trenching is likewise not recommended due to the existence of hard rocks with Ultimate Tensile Strength (UTS) of over 60 Mega Pascals, which is beyond the rock cutting capability of available cable trenching machines; and

c) **Significant quantity of unexploded ordnance** or UXO from the Battle of Surigao Strait in 1944, which consist mainly of torpedoes and high-explosives shells likely to remain in the seabed; and

d) **Increase in the overall cost estimate** given that the recommended cable route is 67km, a distance that is longer compared to the shortest cable route option 1 which is only 30km in distance.

- With the above findings on the Eastern Option for VMIP, NGCP decided that it will be prudent to consider exploring the Western Option, which includes the area between Negros to Cebu Islands facing Mindanao (Zamboanga Del Norte and Misamis Occidental). The corresponding implementation schemes are shown in Figure 11.3a and 11.3b.

Major Project Components:

Pending the completion of both Grid Impact Study (GIS) as well as the field investigation and conceptual design for the Western Option, listed below are the initial project components, which exclude length of submarine cables, overhead lines (consist of DC, AC and electrode lines) and specific locations of Converter Stations (CS), Cable Terminal Stations (CTS) and Electrode Stations (ES):

I Land Portion

a) Overhead DC Transmission Lines:
- Visayas CS-CTS (Visayas Side) ±350 kV HVDC OHTL, Bipolar, 3-795 MCM ACSR; and
- CTS (Mindanao Side)-Mindanao CS ±350 kV HVDC OHTL, Bipolar, 3-795 MCM ACSR Condor.

b) Electrode Lines/Stations:
- Mindanao CS–Mindanao ES 20 kV OHTL (2 Lines), 2-795 MCM ACSR Condor;
- Mindanao ES; and
- Visayas CS-Visayas ES, 20 kV OHTL (2 lines), 2-795 MCM ACSR Condor.

c) Converter Stations (Conventional Bipolar):

Visayas Converter Station:
- Thyristor Valves: 2-227.5 MW, 350 kV, 750 A, water cooled, air insulated, suspended, indoor 12-pulse single phase quadruple;
- Converter Transformers: 2-225 MW, 230 kV AC/350 kV DC, single phase and three - winding;

- Oil immersed DC Smoothing Reactor; 2 groups of double-tuning passive DC filters and 2 large groups with 4 small groups AC filters;
- DC Field Equipment including DC High-Speed Switches, Metallic Return Transfer Breaker, Ground Return Transfer Switch, various DC Switches, DC Measuring equipment and wall bushings; and
- Secondary System including Operator Control, AC/DC Station Control, Pole Control, DC Protection, Station Master Clock, Fault Recording, DC Line Fault Location, AC Protection, Revenue Metering, Auxiliary System, Management Subsystems of Relay Protection and Fault Information and Telecontrol and Telecommunication Equipment.

Mindanao Converter Station:

- Thyristor Valves: 2-227.5 MW, 350 kV, 750 A, water cooled, air insulated, suspended, indoor 12-pulse single phase quadruple;
- Converter Transformers: 2-225 MW, 230 kV AC/350 kV DC, single phase and three-winding;
- Oil immersed DC Smoothing Reactor; 2 groups of double-tuning passive DC filters and 2 large groups with 4 small groups AC filters;
- DC Field Equipment including DC High-Speed Switches, Metallic Return Transfer Breaker, Ground Return Transfer Switch, various DC Switches, DC Measuring equipment and wall bushings; and
- Secondary System including Operator Control, AC/DC Station Control, Pole Control, DC Protection, Station Master Clock, Fault Recording, DC Line Fault Location, AC Protection, Revenue Metering, Auxiliary System, Management Subsystems of Relay Protection and Fault Information and Telecontrol and Telecommunication Equipment.

d) Substations:

- S/S Expansion (Visayas): 6-230 kV PCB and associated equipment;
- S/S Expansion (Mindanao): 2-300 MVA, 230/138-13.8 kV Power Transformers and accessories; and
- Other Equipment/Facilities identified based on the result of GIS, e.g., power compensating equipment, etc.
-

II Marine Portion

Visayas CTS-Mindanao CTS, ±350 kV HVDC, Bipolar, 1,500 mm^2 HVDC Mass Impregnated (MI) submarine cable.

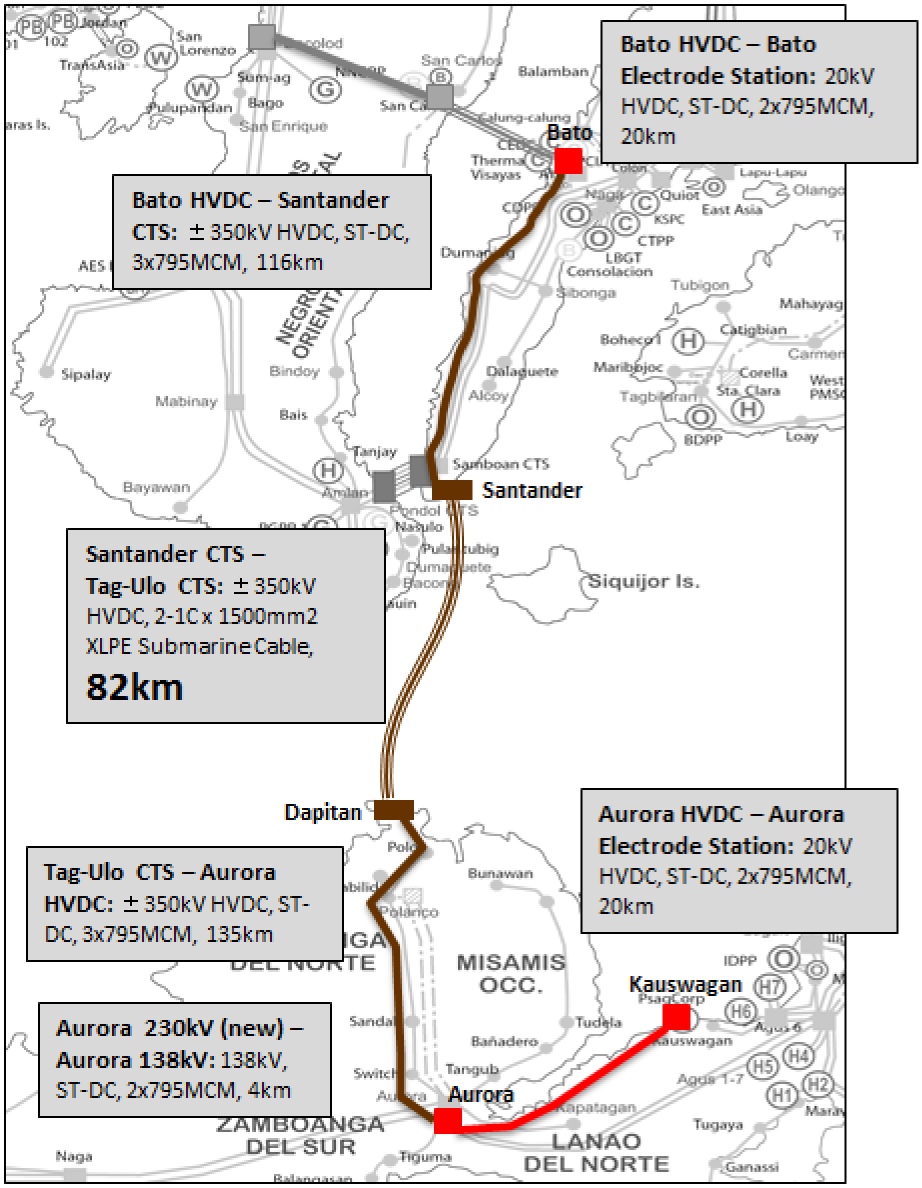


Figure 11.3a –Possible Connection on Western Route (Option 1)

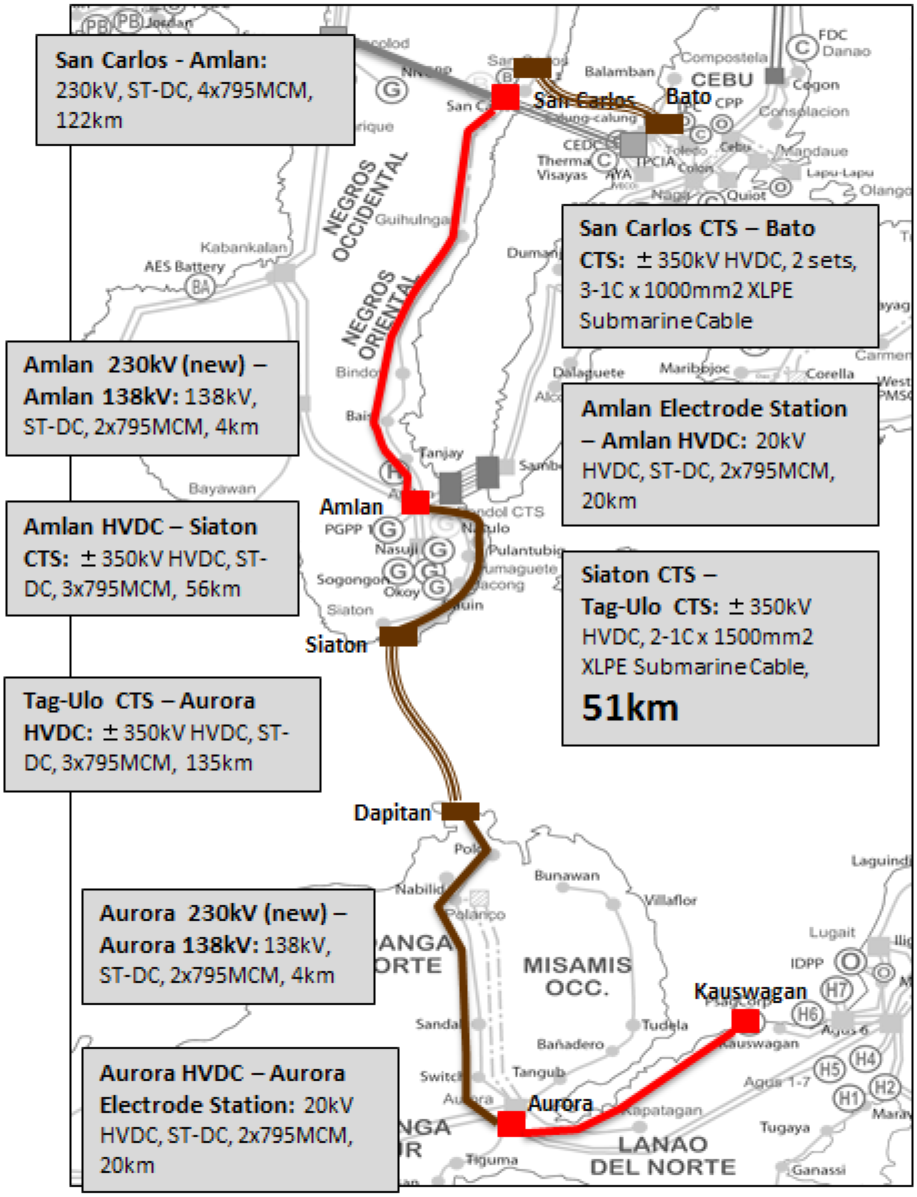


Figure 11.3b – Possible Connection on Western Route (Option 2)

Results of the Hydrographic Survey for the Western Route

The offshore survey was conducted by EGS (Asia) Inc. from 14 October 2016 to 09 November 2016. The survey involved investigations of the topography at the landing sites, the bathymetry, seabed features and shallow geology across the Dipolog Strait; and, meteorological and oceanographic measurements for the design of the cables.

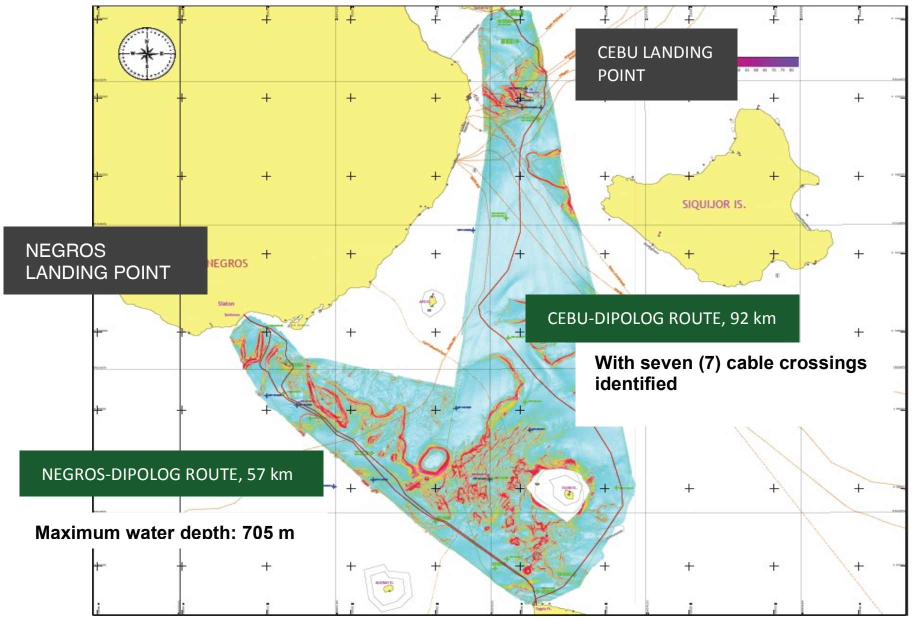


Figure 11.3c – Results of Hydrographic Survey

Summary and Recommendation

The figure below summarizes the Eastern and Western route options for VMIP with Table comparing the length of transmission facilities as well as the maximum water depth.

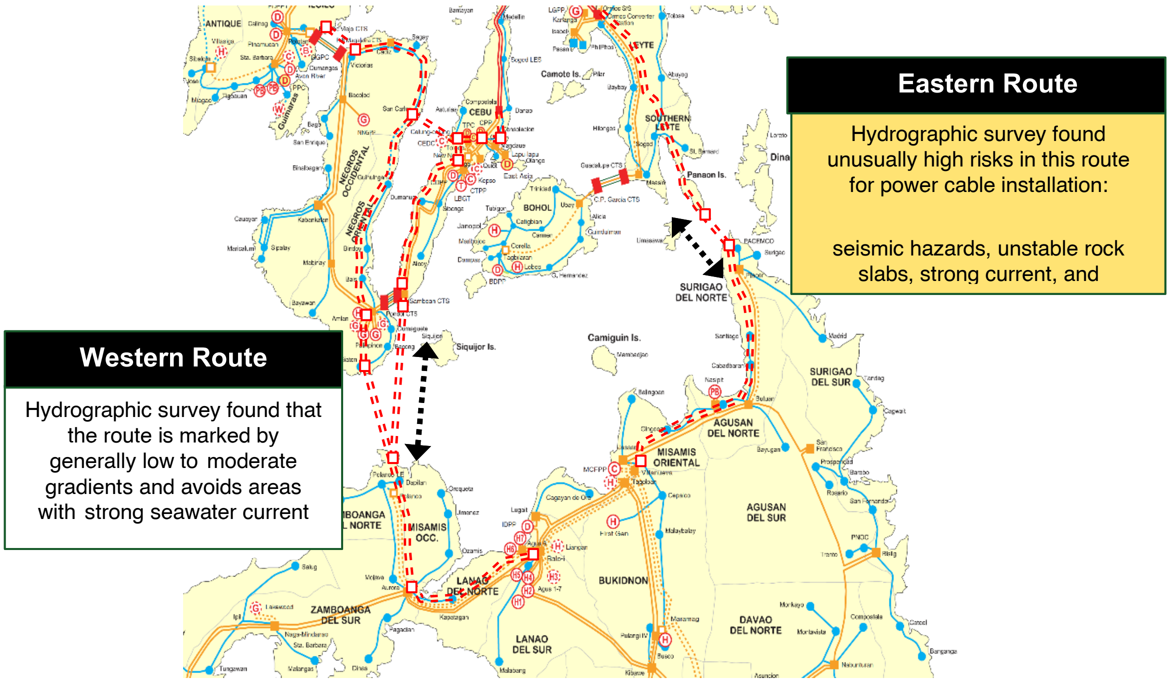


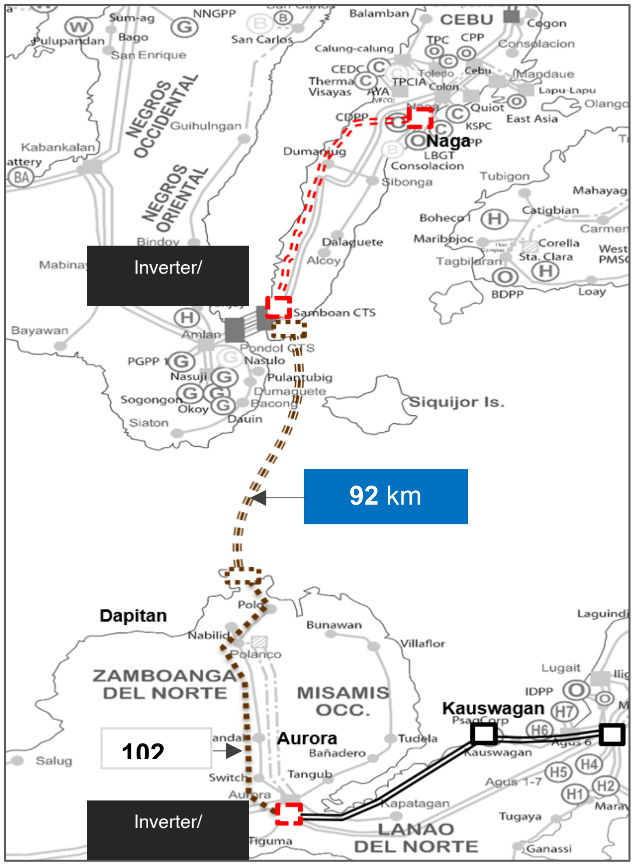
Figure 11.4 – Comparison of Western and Eastern Route

Table 11.2 Comparison of Western and Eastern Route Data

	Western Route		**Eastern Route** Southern Leyte (Cat-Iwing)-Surigao del Norte (Bilaa)
	Mindanao-Cebu Option	Mindanao-Negros Option	
Length of submarine cable (km)	**92 km**	**57 km**	**67 km**
Maximum Water Depth (m)	640 m	705 m	230 m (actual depth for cable laying)
Length of required overhead line in Visayas side	153 km (up to Magdugo)	207 km (up to San Carlos)	127 km (up to Ormoc)
Length of required overhead line in Mindanao side	221 km (up to Kauswagan)	221 km (up to Kauswagan)	285 km (up to Villanueva)
Total length of overhead line component	**374 km**	**428 km**	**412 km**

The result of the survey shows a favorable option along the Western Route. With this option, the Mindanao-Cebu route is preferred as it is marked by generally low to moderate gradients and avoids areas where strong seawater currents have exposed the rough, rocky seabed. Most seabed sediments are loose to dense sand near Santander and fine sand over highly weathered sedimentary rocks near Tagalo Point, which should not pose any problem during construction. This preferred route has an estimated length of about 92 kilometers as shown in Figure 11.5.

Figure 11.5-Recommended Western Route



11.2.3 Small Island Interconnection Projects

A significant number of islands in the country remain isolated from the main grid. The power system in the island is being operated and managed by the Small Power Utilities Group (SPUG) of the National Power Corporation. Summarized in Table 11.3 below are the potential small island interconnections indicating the length of the required facilities and the peak load in the island:

Table 11.3 – Potential Small Island Interconnections

Island	Interconnection Point (Town)	Length (kms)		2015 Peak Demand (MW)	2040 Peak Demand (MW)
		Submarine	Overhead		
LUZON					
Palawan	San Jose	252	173	43.7	261.42
Masbate	San Jacinto	16	16	15.51	37.04
Catanduanes	Presentacion	32	17	9.13	33.74
Tablas	San Jose	61	36	6.14	26.96
Marinduque	General Luna	23	11	8.57	23.71
Busuanga	San Jose	84	52	3.93	16.96
Ticao	Abuyog	20	35	1.71	2.58
Lubang	Calaca	54	20	0.73	1.54
VISAYAS					
Siquijor	Bacong	20	24	4.56	16.58
Bantayan	Medellin	21	24	4.5	12.56
Camotes	Isabel	18	8	3	11.83
Semirara	San Jose	33	0		
MINDANAO					
Tawi-Tawi	Pagatpat	84	60	4.92	31.93
Basilan	Pitogo	27	12	8.3	29.04
Sulu	Taberlongan	100	34	7.87	20.11
Samal	Lasang	9	21	5.96	14.81
Dinagat	Canlanipa	30	15	3.06	13.22
Siargao	Cagdiano	13	7	4.29	11.28
Camiguin	Esperanza	30	37	4.02	8.95
Siasi	Parang	43	32	0.66	1.84

It should be noted that further project assessments are required for the small island interconnections listed above.

Appendix 1 – Prospective Power Plants

Table A1.1 – List of Prospective Power Plants

Proposed Generation Facility	Capacity (MW)
LUZON	
Man-Asok Agno Mini-hydropower Project	3
EWCL Interim Connection	400
Maris Hydro Power Project	10
Jobin Solar Plant	20
Jobin Wind Farm	50
Pantabangan PSPP	600
Wawa Pumped Storage Hydropower Project	500
Bataan Coal Fired Kepco-Hanjin	300
Calatagan Solar Plant	50
NLREC Wind Farm Expansion	69
EDC Burgos Solar Plant	30
Tarlac Solar Plant	50
Shell Gas Turbine Power Plant Project	20
UPPC Cogeneration Power Plant	30
NGPT Mariveles Solar Plant	20
Pasuquin Solar Power Project	100
VISAYAS	
Silay Solar Power Project	20
Negros PH Felisa Solar	50
Montesol Solar Power Plant	15.3
First Toledo Solar Power Plant	60
San Carlos Sun Solar Power Plant	48.6
SACASOL Solar Power Plant	27.2
PASAR Diesel Power Plant	42
Manapla Solar Power Plant	40.5
Biliran Solar Farm	25
Solexar Solar Power Plant Project	28.26
Constellation Wind Power Project	45
Cosmo Solar Power Plant	5.6
SPC Coal Power Plant	300
PDC 1 & 2 Diesel Power Plant	92
MINDANAO	
Eastern Petroleum Corporation Biomass Power Plant	23.5
Astroenergy Solar Power Project	20
ARK Green Dynamic Resources Solar Power Plant	60
KEGI Diesel Power Plant	7.8
Tagoloan Solar Power Plant	40

Appendix 2 – ASEAN Power Grid (APG)

Realizing the importance of building a regional power grid among ASEAN member countries through cross-border transmission links, the Heads of ASEAN Power Utilities/Authorities (HAPUA) initiated the conduct of ASEAN Interconnection Master Plan Study (AIMS). It is envisioned that the establishment of the ASEAN Power Grid would allow pooling of the energy resources of the member countries and that the diversity in demand patterns and time zones would provide opportunities for power sharing and greater optimization of generation capacity. Moreover, this undertaking is also expected to promote sharing of experiences and close power cooperation in the region.

As shown in Figure 11.6, the Philippine Grid will form part of System C and the identified interconnection is the Philippine-Sabah Interconnection Project. The line will traverse within the islands of Palawan and Mindoro and the proposed interconnection point is at Ilijan 500 kV Substation in the Luzon Grid. In AIMS-II completed in 2010, this proposed ±500 kV HVDC interconnection is at 500 MW capacity and the identified earliest commercial operation year is 2020. It should be noted, however, that this more than 800-km interconnection project will still require further feasibility study. Also, the harmonization of the operational and regulatory framework, tariff structure, as well as mechanism for pool rules among member countries will still require further discussions.

Through Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area or BIMP-EAGA, which is a sub-regional economic cooperation initiative, discussions are already being undertaken to facilitate the interconnection projects for the region. A feasibility study is now ongoing to further explore the possibility of Philippine interconnection but with consideration to both via Palawan and via Mindanao (Borneo-Mindanao) options. For the interconnection via Mindanao, it is important that the Visayas-Mindanao Interconnection is in place in order to unify first the Philippine Grid and at the same time, to strengthen the Mindanao power system.
In addition to the geographical and technical challenges for the interconnection, the differences in the electric power industry structure may also pose challenges in this government-to-government cooperation. The Philippines has a restructured electric power industry already while neighboring countries have remained vertically-integrated with state-owned power generation, transmission and even including distribution sectors.

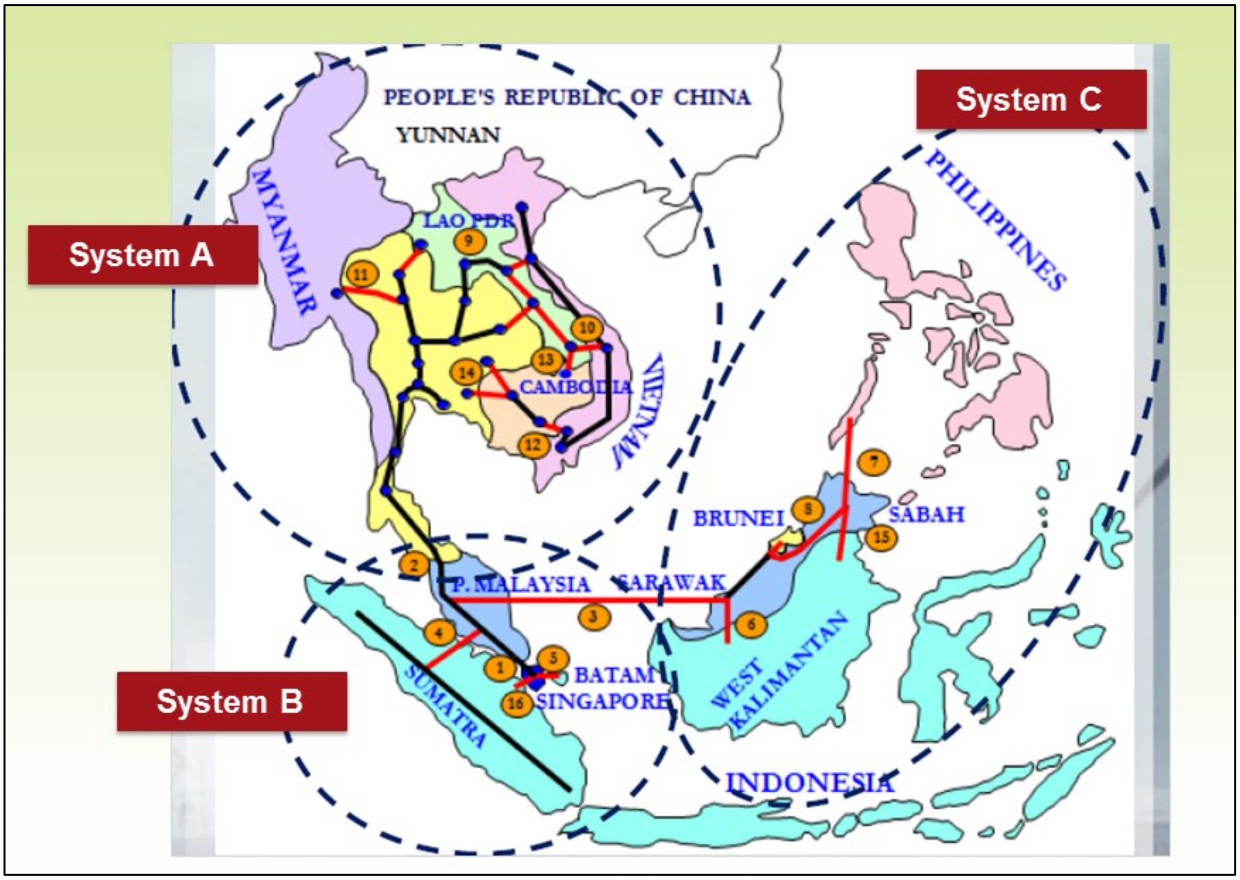


Figure A2 - The ASEAN Power Grid

Appendix 3 – Other Renewable Energy Potential[6]

USAID Biomass Resource Assessment - Luzon

Table A3.1 Theoretical Total MW Potential

Provinces	Rice Hull (2012)	Rice Straw (2012)	Coco Husk (2011)	Coco Shell (2011)	Coco Frond (2011)	CornCob (2012)	Corn Stalk (2012)	Bagasse (2011)	Trash (2011)	Total
Albay	5.40	21.40	27.10	12.30	5.90	5.20	61.80		0.00	139.10
Aurora	2.40	9.40	34.70	15.70	7.50	1.90	22.70		0.00	94.30
Batangas	1.10	4.50	21.20	9.60	4.60	1.40	16.50		0.50	59.30
Cagayan	22.80	90.80	5.50	2.50	1.20	38.70	464.50		0.10	626.10
Isabela	31.70	126.20	2.60	1.20	0.60	108.40	1,299.40		0.00	1,570.00
Masbate	4.00	16.00	48.10	21.80	10.40	3.10	37.30		0.0	140.80
Nueva Ecija	41.30	164.6	0.10	0.10	0.00	1.70	20.80		0.00	228.70
Palawan	7.00	27.80	48.70	22.10	10.60	1.60	19.20		0.00	136.80
Pampanga	10.10	40.30	0.00	0.00	0.00	4.40	52.70	0.10	0.10	107.70
Pangasinan	27.50	109.70	4.50	2.10	1.00	25.50	306.40		0.00	476.70
Quezon	4.20	16.70	187.60	85.00	40.70	3.30	39.50		0.00	377.00

USAID Biomass Resource Assessment – Visayas

Table A3.2 Calculated Biomass Energy derived from Production Data (2011) with Total Potential Energy in megawatt-hour units for Provinces in the Visayas

	Rice Hull	Rice Straw	Corn Cobs	Corn Stalk	Corn Leaves&Hu	Bagasse	Cane Trash	CocoHusk	CocoShell	Chicken	Hog	Solid Waste	**Total MW**	Ranking
Aklan	0.95	2.82	0.02	0.06	0.07			6.18	3.33	3.84	1.46	1.88	20.63	
Antique	2.63	7.81	0.05	0.13	0.14	0.58	0.44	3.77	2.03	3.86	0.67	1.96	24.07	
Capiz	1.52	4.52	0.05	0.12	0.14	6.36	4.88	5.06	2.73	8.07	0.57	4.45	38.47	
Guimaras	0.21	0.63	0.06	0.15	0.17			1.33	0.72	2.03	0.63	0.57	6.51	
Iloilo	6.93	20.56	2.76	7.03	7.95	13.16	10.10	3.17	1.71	25.16	20.33	10.72	129.59	4
Negros Occidental	4.76	14.12	4.12	10.50	11.87	141.20	108.38	6.17	3.33	25.40	12.81	15.02	357.67	1
Bohol	1.86	5.51	1.24	3.15	3.57			8.86	4.78	9.65	11.76	7.79	58.16	
Cebu	0.23	0.67	9.91	25.24	28.55	5.48	4.21	5.35	2.88	28.61	41.55	15.45	168.12	2
Negros Oriental	0.82	2.44	6.63	16.89	19.11	20.85	16.01	9.68	5.22	7.66	6.95	7.81	120.08	5
Siquijor	0.04	0.12	0.63	1.61	1.83			0.59	0.32	1.79	0.10	0.33	7.36	
Biliran	0.95	2.81	0.05	0.13	0.15			3.27	1.76	0.46	0.04	0.57	10.20	
Eastern Samar	0.23	0.67	0.03	0.07	0.08	0.00	0.00	15.35	8.27	0.70	0.14	1.54	27.08	
Leyte	5.32	15.78	4.78	12.18	13.78	5.41	4.15	37.99	20.47	7.74	0.46	10.91	138.96	3
Northern Samar	0.22	0.64	1.05	2.68	3.03			18.86	10.17	1.94	0.93	2.09	41.61	
Southern Leyte	1.18	3.49	0.69	1.77	2.00	0.00	0.00	16.34	8.81	1.50	0.05	4.40	40.24	
Western Samar	0.25	0.73	0.84	2.15	2.43	0.00	0.00	7.05	3.80	1.18	0.38	1.49	20.29	

[6] All data presented in Appendix 3 are sourced from DOE.

Table A3.3 HYDROPOWER SITES OFFERED FOR OCSP

No.	Island	Name of Project	Location	Max Output (kW)	Annual Energy Generation (MWh)	Type
1	Bohol	Upper Manaba	Garcia-Hernandez, Bohol	1,000	6,094	Run of River
2	Bohol	Balite	Baggao, Cagayan	1,000	6,997	Run of River
3	Bohol	Lower Manaba	Garcia-Hernandez, Bohol	800	4,826	Run of River
4	Bohol	Odiong	Jagna, Bohol	500	2,759	Run of River
5	Mindoro	Sinambalan No. 1	Abra de Ilog, Occidental Mindoro	3,000	17,946	Run of River
6	Mindoro	Pagbahan No. 1	Sta. Cruz, Occ. Mind	6,000	31,946	Run of River
7	Negros	Binalbagan No. 1	Moises Padilla, Neg. Occidental	13,000	64,506	Pondage
8	Negros	Binalbagan No. 2	Moises Padilla, Neg. Occidental	5,000	35,546	Run of River
9	Negros	Binalbagan No. 3	Moises Padilla, Neg. Occidental	4,000	27,934	Run of River
10	Negros	Lag-il No. 1	Binalbagan, Negros Occidental	1,000	8,677	Run of River
11	Negros	Lag-il No. 2	Binalbagan, Negros Occidental	2,000	13,750	Run of River
12	Negros	Pangiplan	Himamaylan, Neg. Occidental	1,000	8,407	Run of River
13	Negros	Hilabangan No. 3	Himamaylan and Kabankalan, Negros Occidental	4,000	29,360	Run of River
15	Negros	Calatong No. 1	Sipalay, Negros Occidental	1,000	8,801	Run of River
16	Negros	Calatong No. 2	Cauayan, Negros Occidental	2,000	11,747	Run of River
17	Negros	Binulug	Sipalay, Negros Occidental	3,000	21,932	Run of River
18	Negros	Mona-ol	Bana-ol, Negros Oriental	900	6,768	Run of River
19	Negros	Cauitan	Santa Catalina, Neg. Oriental	1,000	11,207	Run of River
20	Negros	Canauay	Zamboanguita, Neg. Oriental	600	4,255	Run of River
21	Negros	Himogaan	Calatrava, Negros Occidental	2,000	13,169	Run of River
22	Negros	Guinoba-an No. 1	La Libertad, Negros Oriental	4,000	33,167	Run of River
23	Negros	Pacuan	La Libertad, Negros Oriental	4,000	31,174	Run of River
24	Negros	Guinoba-an No. 2	La Libertad, Negros Oriental	3,000	27,157	Run of River
25	Negros	San Jose	La Libertad, Negros Oriental	600	4,310	Run of River
26	Negros	Talaptap	Bindoy, Negros Oriental	1,000	9,664	Run of River
27	Negros	Hinotongan	Sibulan, Negros Oriental	600	4,286	Run of River
30	Panay	Dugayan	Libertad, Antique	1,000	6,949	Run of River
31	Panay	Bulanao No. 1	Libertad, Antique	1,000	6,561	Run of River
32	Panay	Tibiao No. 2	Tibiao, Antique	2,000	9,191	Run of River
33	Panay	Ulian No. 2	Lambunao, Iloilo	1,000	7,482	Run of River
34	Luzon	Solsona	Solsona, Ilocos Norte	3,000	11,121	Run of River
35	Luzon	Madongan 1	Nueva Era, Ilocos Norte	4,000	15,457	Run of River
36	Luzon	Madongan 2	Nueva Era, Ilocos Norte	5,000	19,375	Run of River
37	Luzon	Nailiman 2	Nagtipunan, Quirino	3,000	16,230	Run of River
38	Luzon	Dabubu No. 2	Maddela, Quirino	7,000	39,280	Run of River
39	Luzon	Dibuluan No. 2	Maddela, Quirino	3,000	17,750	Run of River
40	Luzon	Maplas	Ilagan, Isabela	4,000	17,608	Run of River
41	Luzon	Tuguegarao 2	Peñablaca, Cagayan	3,000	26,358	Run of River
42	Luzon	Natulud 1	Peñablaca, Cagayan	2,000	40,153	Run of River
43	Luzon	Natulud 2	Peñablaca, Cagayan	3,000	110,978	Reservoir
44	Luzon	Pered 1	Peñablaca, Cagayan	3,000	21,797	Run of River
45	Luzon	Immurung	Baggao, Cagayan	1,000	20,549	Run of River
46	Luzon	Tabo-an 2	Baggao, Cagayan	1,000	11,171	Run of River
47	Luzon	Dikatayan	San Pablo, Isabela	5,000	19,149	Run of River

Table A3.4 Sites under Wind Resource Assessment Project (WRAP)

1	Brgy. Malasin, San Jose City, Nueva Ecija
2	Brgy. Fatima, Pantabangan, Nueva Ecija
3	Brgy. Ibis, Bagac, Bataan
4	Puro, Magsingal, Ilocos Sur
5	East Poblacion, Pantabangan, Nueva Ecija
6	Malacapas, Dasol, Pangasinan
7	Cabusao, Camarines Sur
8	Happy Valley, San Isidro, Northern Samar
9	Mahawan, Kananga, Leyte
10	Poblacion Norte, Culasi, Antique

Note: Listed sites are subject for detailed analysis to determine its viability

Table A3.5 POTENTIAL GEOTHERMAL PROJECTS WITH OUT RESC

LINE NO.	REGION	PROVINCE	CITY MUNICIPALITY	PROJECT NAME	COMPANY NAME	PROPONENT	PROJECT STATUS*	SUB-CATEGORY	PROPOSED CAPACITY 2016-2030
2	CAR	Benguet		Acupan-Itogon Geothermal Power Project			Pending Service Contract	Base-load	20
3	CAR	Ifugao		Buguias-Tinoc Geothermal Power Project			Pending Service Contract	Base-load	60
5	CAR	Mt. Province		Mainit-Sadanga Geothermal Power Project			Pending Service Contract	Base-load	80
17	IV-A	Batangas	Tingloy	Maricaban Island Geothermal Power Project			Pending Service Contract	Base-load	-
33	VIII	Southern Leyte		Southern Leyte			Pending Service Contract	Base-load	40
35	VIII	Biliran		Biliran 2	Biliran Geothermal Inc.	Biliran Geothermal Inc.	Pending Service Contract	Base-load	-
39	X	Lanao del Norte		Sapad-Salvador Geothermal Prospect			Pending Service Contract	Base-load	30
40	XI	Compostela Valley		Amacan Geothermal Prospect			Pending Service Contract	Base-load	40
41	XI	Davao Occidental		Balut Island Geothermal Prospect			Pending Service Contract	Base-load	23
45	XII	South Cotabato		Mt. Parker Geothermal Prospect			Pending Service Contract	Base-load	60
46	XII	South Cotabato		Mt. Matutum Geothermal Prospect			Pending Service Contract	Base-load	20
47	XIII	Surigao del Norte		Mainit Geothermal Prospect			Pending Service Contract	Base-load	30
									1,371

NOTE:

1. The row with a " Yellow mark" indicates geothermal projects that the Geothermal Energy Management Division have identified with potential and can be offered for investment. Suggested to include "Potential Project" that has no pending RE Service Contract application
2. TBD - To be determined
GEMD has insufficient data to estimate the potential capacity of a service contracts with TBD.
These areas are still conducting geological, geochemical and geophysical studies.

Table A3.6 AWARDED HYDROPOWER PROJECTS

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
Luzon	CAR	Benguet	Tuba	Abdao	AV Garcia Power Systems Corp.	2.00
Luzon	CAR	Benguet	Buguias	Man-asok	Benguet Electric Cooperative, Inc.	3.00
Luzon	IVB	Oriental Mindoro	Baco	Dulangan	PNOC - Renewables Corp.	8.25
Luzon	V	Camarines Sur	Buhi	Barit Irrigation Discharge	NASCENT Technologies Corp.	0.40
Luzon	III	Nueva Ecija	Gabaldon	Dupinga	Constellation Energy Corporation	3.00
Luzon	V	Catanduanes	San Miguel	Kapipian	Sunwest Water & Electric Company, Inc.	2.40
Luzon	III	Aurora	Dingalan	Davildavilan	PTC Energy, Inc.	1.00
Luzon	II	Cagayan	Peñablanca	Pinacanauan River	Sunwest Water & Electric Company, Inc.	6.00
Luzon	CAR	Mt. Province	Bauko	Ampassit	Kadipo Bauko Hydro Power Corp.	1.20
Luzon	CAR	Ifugao	Kiangan	Asin	Kiangan Mini Hydro Corporation	7.04
Luzon	IVB	Oriental Mindoro	San Teodoro	Inabasan	Ormin Power, Inc	10.00
Luzon	II	Nueva Vizcaya	Bambang	Matuno	Epower Technologies Corp.	8.00
Luzon	CAR	Ifugao	Lagawe	Ibulao	Hydrocore, Inc.	4.50
Luzon	IVB	Oriental Mindoro	Naujan	Catuiran	Catuiran Hydro Power Corp.	8.00
Luzon	IVB	Oriental Mindoro	Naujan	Catuiran (Upper Cascade)	Philnew Hydro Power Corp	8.00
Luzon	CAR	Ifugao	Tinoc	Tinoc 1	Quadriver Energy Corporation	3.00
Luzon	CAR	Ifugao	Tinoc	Tinoc 2	Quadriver Energy Corporation	6.50
Luzon	CAR	Ifugao	Tinoc	Tinoc 3	Quadriver Energy Corporation	5.00
Luzon	CAR	Ifugao	Tinoc	Tinoc 4	Philnew Hydro Power Corp	6.00
Luzon	II	Isabela	Tumauini	Tumauini (Upper Cascade)	Philnew Hydro Power Corp	14.00
Luzon	II	Isabela	Tumauini	Tumauini (Lower Cascade)	Quadriver Energy Corporation	7.80
Luzon	II	Quirino	Cabugao	Diduyon	Green Energy Management (GEM) & Holdings, Inc.	320.00
Luzon	CAR	Apayao	Cabarroguis & Nagtipunan	Gened 1	Pan Pacific Renewable Power Philippine Corp.	600.00
Luzon	II	Cagayan	Gonzaga	Baua 1	Pan Pacific Renewable Power Philippine Corp.	4.44
Luzon	CAR	Kalinga	Tinglayan	Tinglayan	Pan Pacific Renewable Power Philippine Corp.	4.32
Luzon	I	Ilocos Sur	Alilem	Alilem HEP	Philnewriver Power Corp.	16.20
Luzon	I	Ilocos Sur	Sugpon	Danac HEP	Philnewriver Power Corp.	3.00
Luzon	I	Ilocos Sur	Quirino	Quirino HEP	Philnewriver Power Corp.	11.50
Luzon	CAR	Ifugao	Tinoc	Tinoc 5 (Lower Luhong) HEP	Philnewriver Power Corp.	6.90
Luzon	CAR	Ifugao	Tinoc	Tinoc 6 (Wangwang) HEP	Philnewriver Power Corp.	8.00
Luzon	II	Isabela	San Mariano & San Guillermo	Ilaguen	Isabela Power Corp.	19.00
Luzon	CAR	Mt. Province	Tadian	Dicapan	Asiapac Green Renewable Energy Corporation	3.00
Luzon	CAR	Mt. Province	Natonin	Lower Siffu	Asiapac Green Renewable Energy Corporation	8.00
Luzon	CAR	Mt. Province	Natonin	Upper Siffu	Asiapac Green Renewable Energy Corporation	8.00
Luzon	III	Nueva Ecija	General Tinio	Balintingon HEP	First Gen Luzon Power Corporation	30.00

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
Luzon	III	Nueva Ecija	Pantabangan	Pantabangan (Pump Storage) HEP	First Gen Prime Energy Corporation	300.00
Luzon	CAR	Benguet	La Trinidad	Bineng 1-2B Combination	Hedcor, Inc.	19.00
Luzon	IVB	Palawan	Narra	Batang-Batang	Langongan Power Corporation	3.50
Luzon	CAR	Mt. Province	Bauko	Boga	Kadipo Bauko Hydro Power Corp.	1.00
Luzon	CAR	Mt. Province	Bauko	Enodey 1A	Kadipo Bauko Hydro Power Corp.	1.80
Luzon	IVA	Laguna & Quezon	Pangil & Real & Mauban	Siniloan	Sierra Madre Water Corporation	35.00
Luzon	II	Isabela & Quirino	San Agustin & Maddela	Dabubu	Greenpower Resources Corporation	4.50
Luzon	II	Isabela	San Agustin	Dibuluan	Greenpower Resources Corporation	5.50
Luzon	II	Isabela	San Mariano	Disabungan	Greenpower Resources Corporation	5.50
Luzon	II	Nueva Vizcaya	Ambaguio	Matuno 1	Smith Bell Mini-Hydro Corp.	7.40
Luzon	II	Nueva Vizcaya	Bambang	Matuno 2	Smith Bell Mini-Hydro Corp.	7.90
Luzon	CAR	Mt. Province	Bauko	Enodey-Abit 1	Kadipo Bauko Hydropower Corp.	2.00
Luzon	CAR	Mt. Province	Natonin	Malecom	Southeast Asia Renewable Power Corporation	0.80
Luzon	CAR	Mt. Province	Natonin	Malig	Southeast Asia Renewable Power Corporation	1.10
Luzon	III	Bataan	Mariveles	Mariveles	Southeast Asia Renewable Power Corporation	1.10
Luzon	CAR	Mt. Province	Natonin	Pantor	Southeast Asia Renewable Power Corporation	1.20
Luzon	I	La Union	Tubao	Tubao	Tubao Mini Hydro-Electric Corporation	1.50
Luzon	IVA	Quezon	Lucban	Maapon	Renesons Energy Corporation	2.60
Luzon	II	Nueva Vizcaya	Alfonso Castañeda	Mangayngay	United Hydro Power Builders	1.60
Luzon	CAR	Benguet	Tuba	Kanggas	Goldlink Global Energy Corporation	3.00
Luzon	CAR	Benguet	Tuba	Tadiangan	Goldlink Global Energy Corporation	4.70
Luzon	CAR	Mt. Province	Bauko	Enodey-Abit 2	Kadipo Bauko Hydropower Corp.	1.20
Luzon	CAR	Mt. Province	Bauko	Enodey-Abit 3	Kadipo Bauko Hydropower Corp.	2.00
Luzon	CAR	Ifugao	Kiangan	Ibulao 2	Enerhighlands Corporation	8.80
Luzon	CAR	Ifugao	Kiangan	Hungduan	Kiangan Mini Hydro Corporation	4.04
Luzon	CAR	Ifugao	Lamut	Lamut	Enerhighlands Corporation	6.00
Luzon	IVB	Oriental Mindoro	San Teodoro	Linao Cawayan Phase 2 (Tail-End)	Mindoro Grid Corporation	1.00
Luzon	II	Nueva Vizcaya	Kasibu	Didipio 1	AT Dinum Company	2.10
Luzon	II	Nueva Vizcaya	Kasibu & Nagtipunan	Didipio 2	Alimit Hydro Corp.	9.40
Luzon	II	Isabela	Nagtipunan	Ilaguen 2	Isabela Power Corporation	14.00
Luzon	II	Isabela	Echague	Ilaguen 3	Isabela Power Corporation	11.00
Luzon	II	Isabela	Echague	Ilaguen 4	Isabela Power Corporation	10.00
Luzon	CAR	Mt. Province	Besao	Besao 1	BIMAKA Renewable Energy Development Corporation (BREDCO)	5.00
Luzon	CAR	Mt. Province	Besao	Besao 2	BIMAKA Renewable Energy Development Corporation (BREDCO)	7.00
Luzon	CAR	Mt. Province	Besao	Besao 3	BIMAKA Renewable Energy Development Corporation (BREDCO)	4.50
Luzon	CAR	Mt. Province	Besao	Besao 1A	BIMAKA Renewable Energy Development Corporation (BREDCO)	2.60
Luzon	CAR	Mt. Province	Besao	Besao 1B	BIMAKA Renewable Energy Development Corporation (BREDCO)	1.70
Luzon	CAR	Mt. Province	Besao	Besao 2A	BIMAKA Renewable Energy Development Corporation (BREDCO)	1.50

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
Luzon	CAR	Abra	Tubo	Amtuagan	Sta. Clara Power Corp.	8.50
Luzon	CAR	Abra	Manabo	Three Rivers	Sta. Clara Power Corp.	10.00
Luzon	CAR	Abra	Lagayan	Tineg	Sta. Clara Power Corp.	16.00
Luzon	CAR	Abra	Tubo	Gayaman (Tubo)	Sta. Clara Power Corp.	8.50
Luzon	I	Ilocos Sur	San Emilio	Matibuey	Sta. Clara Power Corp.	16.00
Luzon	IVA	Quezon	Mauban	Calmenue	Sta. Clara Power Corp.	2.00
Luzon	CAR	Ifugao	Kiangan	Ibulao 1	Kiangan Mini Hydro Corporation	6.75
Luzon	CAR	Benguet	Kibungan	Kibungan	Kibungan Hydropower Corporation	1,000.00
Luzon	II	Nueva Vizcaya	Dupax del Norte and Alfonso Castañeda	Casignan	JRV Renewable Energy Corporation	5.00
Luzon	IVA	Quezon	Real	Kinanliman	Municipality of Real, Quezon	1.60
Luzon	I	La Union	Bagulin	Baroro 1	Team (Philippines) Renewable Energy Corporation	1.00
Luzon	I	La Union	Bagulin	Baroro 2	Team (Philippines) Renewable Energy Corporation	3.00
Luzon	I	La Union	Bagulin	Baroro 3	Team (Philippines) Renewable Energy Corporation	1.50
Luzon	CAR	Benguet	Kapangan and Kibungan	Kapangan	Cordillera Hydro Electric Power Corporation	60.00
Luzon	CAR	Benguet	Buguias & Kabayan	Kabayan 1	Hedcor Benguet, Inc.	20.00
Luzon	CAR	Benguet	Kabayan	Kabayan 2	Hedcor Kabayan, Inc.	52.00
Luzon	II	Isabela	Ramon	Maris Main Canal 1	SN Aboitiz Power - Magat, Inc.	6.00
Luzon	CAR	Ifugao	Ramon	Maris Main Canal 2	SN Aboitiz Power - Magat, Inc.	1.75
Luzon	IVB	Palawan	Alfonso Lista	Bulalakao 1 North River	Alternergy Viento Partners Corporation	0.34
Luzon	IVB	Palawan	El Nido	Bulalakao 2 South River	Alternergy Viento Partners Corporation	0.44
Luzon	II	Quirino	Cabarroguis	Addalam	Quirino Resources Development Corp.	26.00
Luzon	IVB	Oriental Mindoro	Naujan	Mag-asawang Tubig B	Philippine Hybrid Energy Systems, Inc.	1.00
Luzon	IVA	Rizal	Rodriguez	Wawa Pumped Storage 1	Olympia Violago Water & Power, Inc.	500.00
Luzon	IVA	Rizal	Rodriguez	Wawa Pumped Storage 3	Olympia Violago Water & Power, Inc.	50.00
Luzon	IVA	Rizal	Rodriguez	Wawa Pumped Storage 2	Olympia Violago Water & Power, Inc.	100.00
Luzon	III	Nueva Ecija	San Jose	SDC	PNOC-Renewables Corporation	0.50
Luzon	IVB	Oriental Mindoro	Sibagat	Bongabong	S&B Power Corporation	2.60
Luzon	CAR	Kalinga		Chico	San Lorenzo Ruiz Piat Energy & Water, Inc.	150.00
Luzon	III	Nueva Ecija	Bongabon	Calaanan	Hydrokinetic Corp.	2.00
Luzon	II	Nueva Vizcaya	Dupax del Sur	Abaca	JRV Renewable Energy Corporation	3.20
Luzon	II	Isabela	Cabagan	Balasig 1	Greenpower Resources Corporation	9.00
Luzon	II	Isabela	Balasig	Balasig 2	Greenpower Resources Corporation	7.00
Luzon	IV-A	Laguna	Majayjay	Majayjay	Majayjay Hydropower Company, Inc.	2.20
Luzon	V	Camarines Norte	Mercedes	Colasi	Colasi Mini Hydro Electric Power Plant Corporation	0.96
Luzon	II	Quirino	Aglipay	Addalam	Quirino Power Energy Corporation	3.80
Luzon	IVA	Quezon	Real	Labayat River (Upper Cascade)	Repower Energy Development Corporation	3.00
Luzon	IVA	Quezon	Real	Piapi River	Repower Energy Development Corporation	3.30

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
Luzon	IVA	Quezon	Real	Labayat River (Lower Cascade)	Repower Energy Development Corporation	1.40
Luzon	IVA	Quezon	Real	Tignoan River (Upper Cascade)	Repower Energy Development Corporation	1.50
Luzon	IVA	Quezon	Real	Lalawinan	Repower Energy Development Corporation	3.00
Luzon	IVA	Quezon	Real	Tibag	Repower Energy Development Corporation	4.40
Luzon	CAR	Benguet	Bokod & Kabayan	Kabayan-Bokod	Hedcor Benguet, Inc.	27.00
Luzon	CAR	Kalinga	Balbalan	Biyao	Biyao Hydro Power Corporation	0.80
Luzon	III	Tarlac	Mayantoc	Camiling 1	Northgreen Energy Corporation	5.40
Luzon	III	Aurora	San Luis	Diteki	PTC Energy, Inc.	1.67
Luzon	III	Aurora	Dinalungan	Talaytay	PTC Energy, Inc.	1.45
Luzon	IVA	Quezon	Mauban	(Laguio) Laginbayan Malaki 2	Enervantage Supplier's Co., Inc.	3.10
Luzon	V	Sorsogon	Sorsogon	Cawayan 2	Sunwest Water and Electric Co., Inc.	0.99
Luzon	IVB	Oriental Mindoro	Bansud & Gloria	Bansud	Sunwest Water and Electric Co., Inc.	1.50
Luzon	CAR	Benguet		Cattubo II	Green Indigenous Environment Development Corporation	3.00
Luzon	CAR	Benguet	Atok	Cattubo I	Green Indigenous Environment Development Corporation	2.00
Luzon	I	La Union	Atok	Bagulin I	Green Indigenous Environment Development Corporation	9.00
Luzon	IVA	Quezon	Real	Tignoan	Aurora All Asia Energy Corporation	20.00
Luzon	II	Nueva Vizcaya	Alfonso Castañeda	Denip	JRV Renewable Energy Corporation	2.30
Luzon	CAR	Mt. Province	Bontoc	Talubin	Mountain Province Electric Cooperative, Inc.	4.90
Luzon	II	Isabela	Ilagan	Ilagan	Trans-Asia Oil and Energy Development Corp,	10.00
Luzon	IVA	Rizal	Pililla	Pililia Pumped Storage	Trans-Asia Oil and Energy Development Corp,	300.00
Luzon	III	Zambales	Masinloc	Coto 1	Coto Hydro Corp.	6.50
Luzon	III	Zambales	Masinloc	Coto 2	Coto Hydro Corp.	2.80
Luzon	II	Quirino	Nagtipunan	Gawagan 1	Gawagan Hydro Power Corp.	4.30
Luzon	II	Quirino	Nagtipunan	Gawagan 2	Gawagan Hydro Power Corp.	2.60
Luzon	II	Quirino	Nagtipunan	Geblem 1	Gawagan Hydro Power Corp.	0.70
Luzon	CAR	Ifugao	Lagawe	Alimit	SN Aboitiz Power - Ifugao, Inc.	100.00
Luzon	CAR	Ifugao	Lagawe & Mayoyao	Alimit-Pumped Storage	SN Aboitiz Power - Ifugao, Inc.	240.00
Luzon	CAR	Ifugao	Ilagan	Olilicon	SN Aboitiz Power - Ifugao, Inc.	10.00
Luzon	II	Isabela	Lagawe & Mayoyao	Abuan River 1	Greenpower Resources Corporation	10.80
Luzon	IV-B	Palawan	Narra	Bato-Bato (Kaliwa) HEP	AQA Global Power Inc.	12.00
Luzon	IV-B	Palawan	Busuanga	Busuanga River 1 HEP	AQA Global Power Inc.	8.00
Luzon	IV-B	Palawan	Rizal	Culasian River HEP	AQA Global Power Inc.	10.00
Luzon	IV-B	Palawan	Narra	Estrella River HEP	AQA Global Power Inc.	8.00
Luzon	IV-B	Palawan	Puerto Princesa	Inaguan River HEP	AQA Global Power Inc.	12.00
Luzon	IV-B	Palawan	Narra	Malasgao (Kaliwa) HEP	AQA Global Power Inc.	10.00
Luzon	IV-B	Palawan	Bataraza	Marangas River	AQA Global Power Inc.	12.00
Luzon	IV-B	Palawan	Brooke's Point	Sologon River HEP	AQA Global Power Inc.	12.00
Luzon	V	Camarines Sur	Buhi	Barit 2	People's Energy Services Inc.	0.60

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
Luzon	III	Nueva Ecija	Pantabangan	Diaman	United Hydro Power Builders	1.80
Luzon	CAR	Benguet	Kabayan	Eddet Adaoay 1	United Hydro Power Builders	1.00
Luzon	CAR	Benguet	Kabayan	Eddet Adaoay 2	United Hydro Power Builders	1.80
Luzon	IVB	Oriental Mindoro	Baco	San Ignacio	Alpaparay Resort & Development Corporation	0.50
Luzon	IVB	Oriental Mindoro	San Teodoro	Alag Tributary 1	Constellation Energy Corporation	2.80
Luzon	IVB	Oriental Mindoro	San Teodoro	Alag Tributary 2	Constellation Energy Corporation	2.80
Luzon	IVA	Cavite	Indang & Maragondon	Indang	Energywise Corporation	1.50
Luzon	IVA	Quezon	Mauban	Mauban	Aurora All Asia Energy Corporation	10.00
Luzon	CAR	Benguet	Tublay & La Trinidad	Tublay 1	AT Dinum Company	0.90
Luzon	III	Nueva Ecija	General Tinio	Rio Chico	LGU of Gen. Tinio	2.00
Luzon	III	Tarlac	Mayantoc	Camiling River 3	Northgreen Energy Corporation	3.40
Luzon	CAR	Kalinga	Tabuk	Chico River	San Lorenzo Ruiz Builders & Developers Group, Inc.	45.00
Luzon	II	Isabela	Cordon	Magat F	PhilCarbon Inc.	0.60
Luzon	IVA	Quezon	Mauban	Laguio (Laginbayan) Malaki 1	Enervantage Supplier's Co., Inc.	1.60
Luzon	I	La Union	Naguilian	Naguilian	Naguilian Mini-Hydro Electric Corporation	6.10
Luzon	IVB	Oriental Mindoro	San Teodoro & Puerto Gallera	Inabasan Phase II	Ormin Power, Inc.	10.00
Luzon	II	Nueva Vizcaya	Kasibu	Namanaan	AT Dinum Company	0.60
Luzon	II	Nueva Vizcaya	Kasibu	Edralin	AT Dinum Company	1.20
Luzon	IVA	Laguna	Majayjay	Upper Botocan River	Aurora All Asia Energy Corporation	8.64
Luzon	CAR	Benguet	Itogon	San Roque Upper East Pump Storage	Strategic Power Development Corp.	600.00
Luzon	CAR	Benguet	Itogon	San Roque West Pump Storage	Strategic Power Development Corp.	400.00
Luzon	IVB	Quezon	General Nakar	Kanan B-1	Energy World Kanan River, Inc.	150.00
Luzon	II	Quirino	Nagtipunan	Dakgan 1	Asiapacific Renewables Corporation	9.00
Luzon	II	Quirino	Nagtipunan	Dakgan 2	Asiapacific Renewables Corporation	12.00
Luzon	CAR	Benguet	Bakun & Mankayan	Mankayan 1	Hedcor, Inc.	12.70
Luzon	IVB	Palawan	Puerto Princesa	Langogan	Langongan Power Corporation	6.80
Luzon	CAR	Mt. Province	Bauko	Lower Chico	Kadipo Bauko Hydro Power Corp.	3.40
Luzon	III	Nueva Ecija / Aurora	Gabaldon / San Luis	Lingod River	United Hydro Power Builders	2.50
Luzon	IVA	Quezon	General Nakar	Umiray 1	Laguna Hydroenergy Corporation	6.00
Luzon	II	Isabela	San Pablo	San Pablo	Greenpower Resources Corporation	8.00
Luzon	III	Nueva Ecija	Pantabangan	Sampaloc	San Lorenzo Ruiz Builders & Developers Group, Inc.	14
Luzon	IVA	Laguna	Majayjay & Magdalena	Balanac (Middle)	Repower Energy Development Corporation	5.00
Luzon	II	Quirino	Nagtipunan	Dagkan	United Hydro Power Builders	142
Luzon	CAR	Benguet	Tublay	Tublay 2	AT Dinum Company	6.00
Luzon	CAR & I	Benguet & Ilocos Sur	Bakun & Cervantes	Mankayan 2	Hedcor, Inc.	20.30
Luzon	II	Quirino	Maddela	Dabubu 2	Greenpower Resources Corporation	4.30
Luzon	IVA	Quezon	General Nakar	Umiray Site 2 River	Laguna Hydroenergy Corporation	3.90
Luzon	II	Quirino	Maddela	Dibuluan 2	Greenpower Resources Corporation	3.2
Luzon	IVA	Quezon	General Nakar	Umiray Site 4 River	Laguna Hydroenergy Corporation	2.80
Luzon	CAR	Mt. Province	Bauko	Upper Chico	Kadipo Bauko Hydro Power Corp.	2.10

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
Luzon	CAR	Kalinga	Pasil	Pasil B	I-Magat Renewable Energy Corporation	14.00
Luzon	CAR	Kalinga	Pasil	Pasil C	I-Magat Renewable Energy Corporation	11.00
Luzon	II	Isabela	San Pablo	San Pablo Site 2	Greenpower Resources Corporation	3.00
Luzon	II	Isabela	San Pablo	San Pablo Site 3	Greenpower Resources Corporation	4.90
Luzon	II	Isabela	Ilagan	Abuan 2	Greenpower Resources Corporation	8.10
Luzon	CAR	Benguet	Tublay	Tublay 3	AT Dinum Company	1.00
Luzon		Zambales	Masinloc	Coto 3	AT Dinum Company	2.20
Luzon	CAR	Apayao	Conner	Nabuangan River	Strategic Power Development Corp.	10.00
Luzon		Bulacan	Norzagaray	Angat Run-of-River	Strategic Power Development Corp.	10.00
Luzon	III	Aurora	Dingalan	Dingalan Pumped-Storage	Strategic Power Development Corp.	500.00
Luzon	CAR	Abra	Tineg & Lagayan	Binongan-Tineg	First Gen Mindanao Hydro Power Corp.	175.00
Luzon	CAR	Benguet	Kibungan	Kibungan Pumped-Storage	Coheco Badeo Corporation	500.00
Luzon	I	Ilocos Norte	Dumalneg	Bulo 2	Phildane Resources Corporation	5.00
Luzon	III	Pangasinan	San Quintin	Dipalo	Power Beacon Renewable Solutions, Inc.	2.50
Luzon	I	Ilocos Sur	Suyo	Suyo 2	Satrap Power Corporation	3.00
Luzon		Benguet	Itogon	San Roque Lower East Pumped-Storage	Strategic Power Development Corp.	400.00
Visayas	VI	Aklan	Madalag	Timbaban	Oriental Energy and Power Generation Corporation	18.00
Visayas	VI	Negros Occidental	Kabankalan	Hilabangan (Upper Cascade)	Century Peak Energy Corporation	4.80
Visayas	VI	Negros Occidental	Kabankalan	Hilabangan (Lower Cascade)	Century Peak Energy Corporation	3.00
Visayas	VI	Iloilo	Igbaras	Igbulo (Bais)	Century Peak Energy Corporation	5.10
Visayas	VI	Antique	San Remigio	Maninila (Lower Cascade)	Century Peak Energy Corporation	4.50
Visayas	VI	Antique	San Remigio	Maninila (Upper Cascade)	Century Peak Energy Corporation	3.10
Visayas	VI	Antique	San Remigio	Sibalom (Upper Cascade)	Century Peak Energy Corporation	4.20
Visayas	VI	Antique	San Remigio	Sibalom (Middle Cascade)	Century Peak Energy Corporation	4.00
Visayas	VI	Antique	San Remigio	Sibalom (LowerCascade)	Century Peak Energy Corporation	3.30
Visayas	VII	Negros Oriental	La Libertad	Pacuan-Guinobaan	PNOC - Renewables Corp.	13.80
Visayas	VII	Cebu	Badian	Basak II	Rapids Innoenergy, Inc.	0.50
Visayas	VI	Negros Occidental	Silay City	Malugo	Vivant-Malogo Hydropower, Inc.	6.00
Visayas	VI	Antique	Sebaste	Caro-an	Antique Electric Cooperative, Inc.	0.84
Visayas	VI	Antique	Sebaste	Ipayo	Antique Electric Cooperative, Inc.	1.30
Visayas	VI	Antique	Bugasong	Villasiga	Sunwest Water & Electric Company, Inc. 2	8.00
Visayas	VI	Aklan	Libacao	Main Aklan	Sunwest Water & Electric Company, Inc.	15.00
Visayas	VII	Negros Oriental	Amlan	Amlan (Plant A)	Natural Power Sources Intergration,Inc.	3.20
Visayas	VII	Negros Oriental	Amlan	Amlan (Plant B)	Natural Power Sources Intergration,Inc.	1.50
Visayas	VII	Negros Oriental	Amlan	Amlan (Plant C)	Natural Power Sources Intergration,Inc.	0.80

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
Visayas	VII	Bohol	Danao	Cantakoy	Quadriver Energy Corporation	8.00
Visayas	VIII	Leyte	Kananga	Bao	Leyte V Electric Cooperative, Inc (LEYECO V)	1.50
Visayas	VIII	Western Samar	Calbiga & Pinabacdao	Calbiga	Meadowland Developers, Inc.	15.00
Visayas	VIII	Leyte	Inopacan	Caminto River	Leyte IV Electric Cooperative, Inc.	0.50
Visayas	VI	Negros Occidental	San Carlos City	Bago 1	Alsons Energy Development Corporation	4.00
Visayas	VI	Negros Occidental	San Carlos City & Murcia	Bago 2	Alsons Energy Development Corporation	10.00
Visayas	VI	Aklan	Malay	Aklan Pumped-Storage	Strategic Power Development Corp.	300.00
Visayas	VI	Antique	Bugasong	Villasiga 2	Sunwest Water and Electric Co., Inc.	9.40
Visayas	VI	Negros Occidental	Victorias and Cadiz	Malogo Phase 2	Vivant-Malogo Hydropower, Inc.	5.00
Visayas	VI	Negros Occidental	Silay & E. B Magalona	Malogo Phase 3	Vivant-Malogo Hydropower, Inc.	2.00
Visayas	VI	Negros Occidental	Sagay City	Lower Himogaan	LGU of Sagay	4.00
Visayas	VI	Negros Occidental	San Carlos City	Bago Prosperidad 2	Bago River Hydro Power Corporation	3.50
Visayas	VI	Negros Occidental	San Carlos City	Initihan	Bago River Hydro Power Corporation	3.50
Visayas	VIII	Eastern Samar	Lawaan	Pumped Storage Bolusao	San Lorenzo Ruiz Samar Energy and Water, Inc.	300.00
Visayas	VIII	Eastern Samar	Lawaan	Run-of-River Bolusao	San Lorenzo Ruiz Samar Energy and Water, Inc.	12.00
Visayas	VI	Negros Occidental	Bago & Murcia	Bago 4	Alsons Energy Development Corporation	11.00
Visayas	VII	Cebu	Argao	Argao	Universal Hydrotechnologies, Inc.	0.80
Visayas	VII	Negros Oriental	Siaton	Canaway 1	Orbysy Holdings, Inc.	1.60
Visayas	VII	Negros Oriental	Siaton	Canaway 2	Orbysy Holdings, Inc.	1.40
Visayas	V	Camarines Sur	Goa & Tigaon	Ranggas	Clean and Green Energy Solutions, Inc.	1.50
Visayas	VIII	Leyte	Jaro & Pastrana	Binaha-an River	Engineering & Development Corporation of the Philippines	2.20
Visayas	VII	Siquijor	Lazi	Senona	AQA Global Power Inc.	3.20
Visayas	VII	Siquijor	Lazi	Gabangan	AQA Global Power Inc.	4.14
Visayas	VII	Cebu	Alegria	Compostela	T.A.G Mineral Resources, Inc.	0.50
Visayas	VII	Bohol	Loboc	Loboc (Expansion)	Sta. Clara Power Corp.	1.2
Visayas	VIII	Eastern Samar	Maslog	Maslog	Iraya Energy Corporation	40.00
Visayas	VIII	Eastern Samar	Maslog	Upper Maslog	Iraya Energy Corporation	9.00
Visayas	VII	Negros Occidental	Isabela	Limalima-Sacop Phase 1	888 Blue Energy Corporation	2.00
Visayas	VII	Negros Occidental	Isabela	Limalima-Sacop Phase 2	888 Blue Energy Corporation	8.00
Visayas	VIII	Western Samar	Calbayog City	Bugtong Falls	Clean and Green Energy Solutions, Inc.	1.80
Visayas	VIII	Eastern Samar	Maydolong	Buhid	Vivant Energy Corp.	20.20
Visayas	VII	Negros Oriental	Mabinay	Ilog	Trans-Asia Oil and Energy Development Corp,	21.60
Mindanao	X	Bukidnon	Baungon and Libona	Bubunawan	FGEN Bubunawan Hydro Corporation	23.00
Mindanao	XIII	Agusan del Norte	Cabadbaran	Cabadbaran	FGEN Cabadbaran Hydro Corporation	9.75
Mindanao	XIII	Agusan del Norte	Jabonga	Puyo	FGEN Puyo Hydro Corporation	30.00

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
Mindanao	X	Bukidnon	Impasugong and Sumilao	Tagoloan	FGEN Tagoloan Hydro Corporation	39.00
Mindanao	X/ARMM	Lanao del Norte/Lanao del Sur	Pantar & Baloi/Saguiaran	Agus III	Maranao Energy Corp.	225.00
Mindanao	X	Bukidnon	Manolo Fortich	Culaman	Oriental Energy and Power Generation Corporation	10.00
Mindanao	IX	Zamboanga City	Zamboanga City	Pasonanca	PhilCarbon Inc.	0.05
Mindanao	IX	Zamboanga City	Zamboanga City	Pasonanca (Upstream)	PhilCarbon Inc.	1.00
Mindanao	X	Misamis Occidental	Clarin	Clarin	Philnew Hydro Power Corp	6.20
Mindanao	X	Cagayan de Oro	Claveria	Mat-I 1	Philnew Hydro Power Corp	4.85
Mindanao	X	Misamis Occidental	Cagayan de Oro City	Limbatangon HEP	Turbines Resource & Development Corp.	9.00
Mindanao	XII	Sultan Kudarat	Isulan	Kabulnan 2 HEP	Philnewriver Power Corp.	110.00
Mindanao	X	Bukidnon	Malitbog	Malitbog HEP	Philnewriver Power Corp.	5.00
Mindanao	X	Bukidnon	Manolo Fortich	Mangima HEP	Philnewriver Power Corp.	10.00
Mindanao	X	Misamis Oriental	Claveria	Mat-i 2 HEP	Philnewriver Power Corp.	1.60
Mindanao	X	Misamis Oriental	Claveria	Mat-i 3 HEP	Philnewriver Power Corp.	3.25
Mindanao	X	Bukidnon	Malitbog	Silo-o HEP	Philnewriver Power Corp.	4.50
Mindanao	XII	North Cotabato	Alamada	Alamada HEP	Euro Hydro Power (Asia) Holdings, Inc.	2.84
Mindanao	X	Lanao del Norte	Iligan City	Bayug HEP	Euro Hydro Power (Asia) Holdings, Inc.	1.00
Mindanao	XI	Compostela Valley	New Bataan	New Bataan HEP	Euro Hydro Power (Asia) Holdings, Inc.	2.40
Mindanao	X	Lanao del Norte	Kolambogan	Titunod HEP	Euro Hydro Power (Asia) Holdings, Inc.	1.00
Mindanao	XIII	Agusan del Norte	Santiago	Asiga	Asiga Green Energy Corporation	8.00
Mindanao	XIII	Agusan del Norte	Butuan City	Taguibo 1	Equi-Parco Construction Co.	2.00
Mindanao	XIII	Agusan del Norte	Butuan City	Taguibo 2	Equi-Parco Construction Co.	2.00
Mindanao	XII	Sarangani	Maasim	Siguil 1	Alsons Energy Development Corporation	8.70
Mindanao	XII	Sarangani	Maasim	Siguil 2	Alsons Energy Development Corporation	3.20
Mindanao	XII	Sarangani	Maasim	Siguil 3	Alsons Energy Development Corporation	4.80
Mindanao	IX	Zamboanga del Norte	Leon Postigo	Polandoc Hydroelectric Power Project	Euro Hydro Power (Asia) Holdings, Inc.	2.00
Mindanao	X	Bukidnon	Valencia	Upper Manupali	Bukidnon II Electric Cooperative, Inc.	4.40
Mindanao	X	Misamis Oriental	Jasaan	Lower Cabulig	Mindanao Energy Systems, Inc.	10.00
Mindanao	XIII	Surigao del Sur	Carrascal and Cantilan	Carac-an	Hydro Link Projects Corporation	25.00
Mindanao	XIII	Agusan del Norte	Jabonga	Lake Mainit	Agusan Power Corporation	25.00
Mindanao	XII	Sarangani	Maitum	Kalaong 1	Alsons Energy Development Corporation	12.00
Mindanao	XII	Sarangani	Maitum	Kalaong 2	Alsons Energy Development Corporation	6.00
Mindanao	XI	Davao Del Sur	Digos City	Ruparan	Davao de Sur Electric Cooperative, Inc.	5.00
Mindanao	IX	Zamboanga del Norte	Mutia	Dapitan River (Upper)	Euro Hydro Power (Asia) Holdings, Inc.	3.60

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
Mindanao	IX	Zamboanga del Norte	Mutia	Dapitan River (Middle)	Euro Hydro Power (Asia) Holdings, Inc.	3.60
Mindanao	XI	Davao Oriental	Caraga	Caraga 4	LGS Renewable Energies Corporation	35
Mindanao	X	Bukidnon	Malaybalay	Middle Canayan	Sta. Clara Power Corp.	3.00
Mindanao	XI	Compostela Valley	Maco	Upper Maco	Sta. Clara Power Corp.	4.00
Mindanao	XI	Compostela Valley	Maco	Mt. Leonard	Sta. Clara Power Corp.	2.00
Mindanao	XI	Compostela Valley	Maco	Tagum R	Sta. Clara Power Corp.	4.00
Mindanao	XI	Compostela Valley	Maco	Hijo River I	Sta. Clara Power Corp.	3.00
Mindanao	XI	Compostela Valley	Maco	Hijo River II	Sta. Clara Power Corp.	3.00
Mindanao	XIII	Agusan del Norte	Butuan City	Bugsukan	Global Sibagat Hydro Power Corp.	5.00
Mindanao	XIII	Agusan Del Sur	Sibagat	Managong	Global Sibagat Hydropower Corporation	6.00
Mindanao	XIII	Agusan del Sur	Sibagat	Wawa	Global Sibagat Hydropower Corporation	13.00
Mindanao	XIII	Agusan del Sur	Bongabong	Wawa 1	Equi-Parco Construction Co.	7.70
Mindanao	XIII	Agusan del Sur	Sibagat	Wawa 2	Equi-Parco Construction Co.	7.00
Mindanao	XIII	Agusan del Sur	Sibagat	Wawa 3	Equi-Parco Construction Co.	5.60
Mindanao	X	Bukidnon	Impasugong	Gakaon	LGU of Impasugong	2.23
Mindanao	X	Lanao del Norte	Bacolod	Liangan	Liangan Power Corporation	11.90
Mindanao	XI	Davao City		Davao	San Lorenzo Ruiz Olympia Energy & Water, Inc.	140.00
Mindanao	XIII	Surigao del Sur	Cantilan	Lower Carac-an	Meadowland Developers, Inc.	5.00
Mindanao	XII	South Cotabato	Lake Sebu	Lanon (Lam-alu)	Euro Hydro Power (Asia) Holdings, Inc.	9.00
Mindanao	X	Bukidnon		Pulanai River	Repower Energy Development Corporation	10.60
Mindanao	X	Bukidnon	Cabanglasan	Katipunan River	Repower Energy Development Corporation	6.20
Mindanao	X	Bukidnon	Malaybalay	Sawaga	Repower Energy Development Corporation	2.00
Mindanao	X	Bukidnon	Dancagan	Kitaotao 1	Hedcor Bukidnon, Inc.	70.00
Mindanao	X	Bukidnon	Kalilangan & Wao	Maladugao River (Lower Cascade)	Bukidnon Maladugao Hydro Power Corp.	15.70
Mindanao	X	Bukidnon	Wao	Maladugao River (Upper Cascade)	UPHC Bukidnon Hydro Power I Corp.	8.40
Mindanao	XII	South Cotabato	Lake Sebu	Takbo	South Cotabato I Electric Cooperative, Inc.	15.00
Mindanao	XI	Davao del Sur	Malita	Malita	LGU of Malita, Davao del Sur	2.50
Mindanao	X	Misamis Oriental	Gingoog City	Odiongan River A	JE Hydropower Ventures, Inc.	0.25
Mindanao	IX	Zamboanga del Sur	Dumingag & Midsalip	Sindangan 4	Alsons Energy Development Corporation	8.00
Mindanao	XI	Davao Oriental	Lupon	Sumlog 1	Alsons Energy Development Corporation	8.00
Mindanao	XI	Davao Oriental	Lupon & Mati	Sumlog 2	Alsons Energy Development Corporation	15.00
Mindanao	XII	Sarangani	Maitum	Kalaong 3	Alsons Energy Development Corporation	4.00
Mindanao	XII	North Cotabato	Magpet	Magpet 1	Universal Hydrotechnologies, Inc.	9.80
Mindanao	XII	North Cotabato	Magpet	Magpet 2	Universal Hydrotechnologies, Inc.	1.30
Mindanao	XII	North Cotabato	Makilala	Makilala-1	Universal Hydrotechnologies, Inc.	2.00

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
Mindanao	XI	Davao Oriental	Caraga	Manorigao	LGS Renewable Energies Corporation	17.00
Mindanao	X	Bukidnon	Valencia	Manupali	Matic Hydropower Corporation	9.00
Mindanao	XI	Davao Oriental	Manay	Casauman	Global Sibagat Hydro Power Corp.	34.00
Mindanao	X	Bukidnon	Maramag	Maramag	First Bukidnon Electric Cooperative, Inc. transferred to Maramag Mini-Hydro Corporation	1.40
Mindanao	XI	Davao del Sur	Goa & Tigaon	Guma	Euro Hydro Power (Asia) Holdings, Inc.	1.70
Mindanao	ARMM	Lanao del Sur	Malabang & Tubaran	Maitling River HEP	AQA Global Power Inc.	50.00
Mindanao	ARMM	Lanao del Sur	Malabang	Matadi River HEP	AQA Global Power Inc.	27.00
Mindanao	ARMM	Lanao del Sur	Pualas & Ganassi	Lake Dapao HEP	AQA Global Power Inc.	50.00
Mindanao	ARMM	Lanao del Sur	Malabang	Baras River HEP	AQA Global Power Inc.	30.00
Mindanao	XI	Davao Oriental	Baganga	Cateel	Global Sibagat Hydro Power Corp.	16.00
Mindanao	X	Lanao del Norte	Iligan City	Lower Bayug	Euro Hydro Power (Asia) Holdings, Inc.	4.00
Mindanao	X	Lanao del Norte	Iligan City	Upper Bayug	Euro Hydro Power (Asia) Holdings, Inc.	3.30
Mindanao	IX	Zamboanga del Sur	Bayog	Bayog	Global Sibagat Hydro Power Corp.	6.00
Mindanao	XI	Davao Oriental	Baganga	Baganga River	Global Sibagat Hydro Power Corp.	11.00
Mindanao	XI	Davao Oriental	Governor Generoso	Osmena	LGS Renewable Energies Corporation	2.00
Mindanao	X	Lanao del Norte	Iligan City	Bulanog-Batang	Bukidnon Hydro Energy Corporation	150.00
Mindanao	IX	Zamboanga City		Patalon	Everhydro Corporation	0.50
Mindanao	IX	Zamboanga City		Alimpaya	Everhydro Corporation	1.20
Mindanao	IX	Zamboanga City		Tagpangi	Everhydro Corporation	0.50
Mindanao	IX	Zamboanga City		Ayala	Everhydro Corporation	1.00
Mindanao	IX	Zamboanga del Sur	Zamboanga City	Saaz	Meadowland Developers, Inc.	1.00
Mindanao	XI	Davao Oriental	Governor Generoso	Tibanban	LGS Renewable Energies Corporation	2
Mindanao	X	Misamis Occidental	Calamba	Langaran	Kaltimex Langaran Hydro Inc.	3.60
Mindanao	X	Bukidnon	Impasugong	Atugan 1 River	Gerphil Renewable Energy, Inc.	2.40
Mindanao	X	Lanao del Norte	Iligan City	Agus VIII Modular	Fu-Tai Philippines, Inc.	12.00
Mindanao	X	Bukidnon	Maramag	Pulangui IV	Repower Energy Development Corporation	10.00
Mindanao	X	Misamis Occidental	Cagayan de Oro City	Umalag 1	Meadowland Developers, Inc.	1.80
Mindanao	X	Bukidnon	Impasugong	Atugan 4	Gerphil Renewable Energy, Inc.	3.50
Mindanao	XIII	Surigao del Sur	San Miguel	Sagbayan	Surigao del Sur II Electric Cooperative, Inc.	0.64
Mindanao	X	Bukidnon	Santiago	Manolo Fortich 1	Hedcor Bukidnon, Inc.	43.40
Mindanao	X	Bukidnon	Santiago	Manolo Fortich 2	Hedcor Bukidnon, Inc.	25.40
Mindanao	X	Bukidnon	Libona	Umalag 2	Meadowland Developers, Inc.	2.50
Mindanao	XIII	Surigao del Sur	San Miguel	Carromata	Surigao del Sur II Electric Cooperative, Inc.	5.60
Mindanao	XI	Davao del Sur	Davao City	Tamugan	Hedcor, Inc.	11.50
Mindanao	XI		Davao City	Apo Agua	Apo Agua Infrastructura, Inc.	2.20
Mindanao	X	Lanao del Norte	Iligan City	Cagayan 1N	First Gen Mindanao Hydro Power Corp.	160.00
Mindanao	XI	Davao Oriental	Baganga	Cateel	First Gen Mindanao Hydro Power Corp.	17.50
						10,476.62

Table A3.7 AWARDED BIOMASS PROJECTS

ISLAND / GRID	REGION	PROVINCE	CITY / MUNICIPALITY	PROJECT NAME	COMPANY NAME	POTENTIAL CAPACITY (MW)
Luzon	IV-A	Rizal	Rodriguez	14.8 MW Montalban Landfill Methane Recovery and Power Generation Facility	Montalban Methane Power Corporation	6.475
Luzon	III	Nueva Ecija	San Jose City	24 MW San Jose City Rice Husk-Fired Biomass Power Plant Project	San Jose City I Power Corporation	12.00
Luzon	I	La Union	Rosario	1 MW Pepsi Biomass Power Plant Project	Sure PEP, Inc.	1.00
Luzon	NCR	Metro Manila	Quezon City	1.5 MW Payatas Landfill Methane Recovery and Power Generation Facility	Pangea Green Energy Philippines, Inc.	0.624
Luzon	III	Aurora	Dilasag	2.5 MW EMS Woody Biomass Power Plant Project	EcoMarketSolutions, Inc.	2.50
Luzon	IV-B	Orriental Mindoro	Bongabong	0.4 MW VMA Rice Husk-Fired Biomass Power Plant Project	V. M. Agbayani Rice Mill	0.40
Luzon	V	Camarines Sur	Pili	5 MW BBEC Rice Husk-Fired Biomass Power Plant Project	Bicol Biomass Energy Corporation	5.00
Luzon	IV-A	Batangas	Lian	8.8 MW Biogas Power Plant Project	AseaGas Corporation	8.80
Luzon	III	Tarlac	Tarlac City	2 MW ACNPC WTE Biomass Power Plant Project	Asian Carbon Neutral Power Corporation	2.00
Luzon	III	Nueva Ecija	Llanera	12 MW G2REC Napier Grass-Fired Biomass Power Plant Project	Grass Gold Renewable Energy Corporation	12.00
Luzon	IV-A	Quezon	Polillo	1.5 MW Coconut Waste-Fired Biomass Power Plant Project	Renesons Energy Polillo, Inc.	1.50
Luzon	II	Cagayan	Lal-lo	24 MW Biomass Power Plant Project	Natures Renewable Energy Development Corporation	24.00
Luzon	I	Ilocos Sur	Santa	10 MW Biomass Power Plant Project	SATRAP Power Corporation	10.00
Luzon	II	Isabela	Aurora,	5MW Biomass Power Plant Project	Isabela La Suerte Rice Mill Corporation	5.00
Luzon	V	Camarines Sur	Naga City	20MW Waste-to-Energy Power Plant Project	CJ Global Green Energy Philippines Corporation	20.00
Visayas	NIR	Negros Occidental	Victorias City	63 MW VMCI Bagasse-Fired Cogeneration Power Plant	Victorias Milling Company Inc.	29.00
Visayas	NIR	Negros Occidental	San Carlos City	20 MW SCBPI Multi-Feedstock Power Plant Project	San Carlos Biopower Inc.	20.00
Visayas	NIR	Negros Occidental	Silay City	28.58 MW HPCo Bagasse Cogeneration Power Plant Project	Hawaiian-Philippine Company	20.58
Visayas	NIR	Negros Occidental	Himamaylan City	12 MW Multi-Feedstock Biomass Power Plant Project	Megawatt Clean Energy, Inc.	12.00
Visayas				25MW Cane Trash-fired Biomass Power Plant Project	South Negros Biopower, Inc.	25.00
Visayas		Negros Oriental	Bais City	25MW Cogeneration Power Plant Project	Central Azucarera de Bais	25.00

ISLAND / GRID	REGION	PROVINCE	CITY / MUNICIPALITY	PROJECT NAME	COMPANY NAME	POTENTIAL CAPACITY (MW)
Visayas	NIR	Negros Occidental		48.5 MW Cogen Project	BISCOM	48.50
Mindanao	X	Bukidnon	Malaybalay	10 MW Malaybalay Multi Feedstock Biomass Power Plant Project	Malaybalay BioEnergy Corporation	10.00
Mindanao	ARMM	Maguindanao	Sultan Kudarat	15 MW LPC Rice Husk-Fired Biomass Power Plant Project	Lamsan Power Corporation	15.00
Mindanao	CARAGA	Agusan del Norte	Buenavista	23.5 MW Woody Biomass Power Plant Project	CARAGA Renewable Energy Corporation	23.50
Mindanao	ARMM	Maguindanao	Buluan	3.5 GEEC MW Biomass Cogeneration System	Green Earth Enersource Corporation	3.50
Mindanao	X	Bukidnon	Manolo Fortich	12 MW Napier Grass-Fired Biomass Power Plant Project	Manolo Fortich Renewable Energy Corporation	12.00
Mindanao	ARMM	Maguindanao	Sultan Kudarat	5.5 MW Biomass Power Plant Project	Lamsan Power Corporation	5.50
						360.879

Table A3.8 AWARDED OCEAN ENERGY PROJECTS

ISLAND / GRID	REGION	PROVINCE	CITY / MUNICIPALITY	PROJECT NAME	COMPANY NAME	POTENTIAL CAPACITY (MW)
LUZON	**III**	Zambales	**Cabangan**	Cabangan Ocean Thermal Energy Conversion (OTEC)	**Bell Pirie Power Corporation**	5.00
	V	Sorsogon	**Southeast side of Municipality of Matnog**	San Bernardino Strait Between Bicol Peninsula and Samar Leyte Corridor (2 sites) - Area 1OP (Tidal In-Stream Energy Conversion TISEC Project)	**H & WB Corporation**	5.00
LUZON Sum						**10.00**
VISAYAS	**VIII**	Northern Samar	**San Bernardino Strait**	TISEC-Project Site (Areas 4&5)	**Poseidon Renewable Energy Corporation**	
			Capul Pass, Dalupiri Island, San Antonio	TISEC-Project Site (Area 6)	**Poseidon Renewable Energy Corporation**	
			East side of Municipality of Capul and West side of Municipality of San Antonio	San Bernardino Strait Between Bicol Peninsula and Samar Leyte Corridor (2 sites) - Area 2OP	**H & WB Corporation**	5.00
			East side of Municipality of San Antonio and West side of Municipalities of San Isidro and Victoria	San Bernardino Strait Between Bicol Peninsula and Samar Leyte Corridor (2 sites) - Area 3OP	**H & WB Corporation**	5.00
VISAYAS Sum						**10.00**
MINDANAO	**CARAGA**	Surigao del Norte	**Surigao City**	Gaboc Channel Ocean Energy	**Adnama power Resources, Inc.**	6.00
MINDANAO Sum						**6.00**
Grand Total						**26.00**

Table A3.9 AWARDED GEOTHERMAL PROJECTS

ISLAND / GRID	REGION	PROVINCE	PROJECT NAME	COMPANY NAME	POTENTIAL CAPACITY (MW)
LUZON	**CAR**	Abra	**Sal-lapadan-Boliney-Bucloc-Tubo Geothermal Power Project**	Pan Pacific Power Phils. Corp.	
		Benguet / Nueva Ecija	**Daklan Geothermal Project**	Clean Rock Renewable Energy Resources Corporation	60.00
		Kalinga	**Kalinga Geothermal Project**	Aragorn Power and Energy Corporation	120.00
		Ifugao, Benguet, Mountain Province	**East Mankayan Geothermal Power Project**	Basic Energy Corp.	
	I	Ilocos Sur / Mt. Province / Benguet	**Cervantes Geothermal Power Project**	Pan Pacific Power Phils. Corp.	
	II	Cagayan	**Cagua-Baua Geothermal Power Project**	Pan Pacific Power Phils. Corp.	45.00
	III	Bataan	**Mariveles Geothermal Power Project**	Basic Energy Corp.	
			Mt. Natib Geothermal Project	Clean Rock Renewable Energy Resources Corporation	40.00
		Zambales, Pampanga	**Negron-Cuadrado Geothermal Power Project**	Negron Cuadrado Geothermal Inc.	
	IV-A	Batangas	**San Juan Geothermal Power Project**	San Juan Geothermal Power Inc.	20.00
		Laguna/Batangas	**Makban Geothermal Power Project**	Philippine Geothermal Production Company, Inc.	
		Laguna / Quezon / Batangas	**Tiaong Geothermal Power Project**	Tiaong Geothermal Power Corp.	
		Laguna	**Mt. Puting Lupa Geothermal Project**	Filtech Energy Drilling Corp.	
		Tayabas / Laguna	**Tayabas - Lucban Geothermal Power Project**	Tayabas Geothermal Power Inc.	
		Rizal	**Talim Geothermal Power Project**	Alco Steam Energy Corp.	
	IV-B	Oriental Mindoro	**Montelago Geothermal Project**	Mindoro Geothermal Power Corp.	40.00
	V	Albay	**Tiwi Geothermal Power Project**	Philippine Geothermal Production Company, Inc.	
		Quezon / Camarines Norte & Sur	**Mt. Labo Geothermal Project**	Energy Development Corporation	65.00
		Sorsogon	**Southern Bicol Geothermal Project**	SKI Construction Group Inc.	40.00

ISLAND / GRID	REGION	PROVINCE	PROJECT NAME	COMPANY NAME	POTENTIAL CAPACITY (MW)
			West Bulusan Geothermal Power Project	Basic Energy Corp.	
		Sorsogon / Albay	**Bacon-Manito Geothermal Production Field**	Energy Development Corporation	
		Camarines Sur, Albay	**Iriga Geothermal Power Project**	Basic Energy Corp.	
LUZON Sum					**430.00**
VISAYAS	**VI**	Negros Occidental	**Northern Negros Geothermal Production Field**	Energy Development Corporation	
			Mandalagan Geothermal Prospect	Energy Development Corporation	20.00
	VIII	Biliran	**Biliran Geothermal Project**	Biliran Geothermal Incorporated	50.00
VISAYAS Sum					**70.00**
MINDANAO	**IX**	Zamboanga del Sur / Zamboanga del Norte / Zamboanga Sibugay	**Lakewood Geothermal Prospect**	Energy Development Corporation	40.00
	IX / X	Misamis Occidental / Zamboanga del Norte / Zamboanga del Sur	**Ampiro Geothermal Power Project**	Energy Development Corporation	30.00
	X	Misamis Oriental / Bukidnon	**Balatukan-Balingasag Geothermal Prospect**	Energy Development Corporation	20.00
	XI	Davao del Sur	**Mt. Sibulan-Kapatagan Geothermal Power Project**	Mount Apo Geopower, Inc.	
	XI / XII	North Cotabato / Davao del Sur	**Mt. Zion Geothermal Power Project**	Energy Development Corporation	20.00
			Mt. Zion 2 Geothermal Power Project	Energy Development Corporation	
		North Cotabato and Davao del Sur	**Mt. Talomo-Tico Geothermal Power Project**	Mount Apo Geopower, Inc.	
MINDANAO Sum					**110.00**
Grand Total					**610.00**

Appendix 4 – Changes from 2013 TDP to 2014 – 2015 TDP

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
Luzon Projects			
Luzon Voltage Improvement I -Doña Imelda S/S*	**ETC: 2014**	**ETC: Feb 2016**	Reflecting actual completion of the project.
Luzon Substation Expansion III -Batangas S/S* -Bay S/S*	**ETC: 2014**	**ETC: Mar 2016**	Reflecting actual completion of the project.
Bacnotan Tap-Bacnotan 230 kV T/L*			New project under 2014-2015 TDP (This is an ERC approved project originally under O&M capex).
Luzon Substation Reliability I -San Esteban S/S* -Botolan -Labo S/S	**ETC: 2014**	**ETC: May 2016**	Reflecting actual completion of the project.
Balingueo (Sta. Barbara) 230 kV S/S*	**No ETC** (Transmission project for accelerated Implementation)	**ETC: June 2016**	Reflecting actual completion of the project.
Dasmariñas EHV Substation	**ETC: 2014**	**ETC: July 2016**	Reflecting actual completion of the project.
Luzon Substation Expansion IV	**Muntinlupa S/S** **Nagsaag S/S** **Bayombong S/S** **Limay S/S** **Tuguegarao S/S** **Santiago S/S** **Daraga S/S**	**Muntinlupa S/S** 1-300 MVA 230/115 kV transformer **Nagsaag EHV S/S** 1-100 MVA 230/69 kV transformer **Bayombong S/S** 1-75 MVA 230/69 kV transformer **Limay S/S** 1-100 MVA 230/69 kV transformer **Tuguegarao S/S** 1-100 MVA 230/69 kV transformer **Santiago S/S** 2-100 MVA 230/69 kV transformer **Daraga S/S:** 1-100 MVA 230/69 kV transformer	Nagsaag and Limay project components were under the LSEP-5 in 2013 TDP. Bayombong project component was under the LSRP project in 2013 TDP. Labrador project was deferred in lieu of the Balingueo project (recently completed last June 2016).

* - Completed/ Energized

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
	Labrador S/S	**Gumaca S/S:** 1-50 MVA 230/69 kV transformer	
Luzon PCB Replacement	**ETC: 2014**	**ETC: Dec 2016**	Reflecting actual completion of the project.
Santiago-Tuguegarao 230 kV Line 2	**ETC: 2014**	**ETC: Dec 2016**	Reflecting actual completion of the project.
San Jose-Angat 115 kV Line Upgrading	**ETC: 2015**	**ETC: June 2017**	Due to updates in actual implementation status.
San Jose-Quezon 230 kV Line 3	**ETC: 2015**	**ETC: Dec 2017**	Due to updates in actual implementation status.
Bataan-Cavite Transmission Line FS	**No ETC**	**ETC: Dec 2017**	Due to updates in actual implementation status.
Hermosa-Floridablanca 69 kV T/L	**ETC: 2018**	**ETC: Mar 2018**	Due to updates in actual implementation status.
Tuguegarao-Lal-lo (Magapit) 230 kV T/L	**ETC: 2017**	**ETC: Oct 2018**	Due to updates in actual implementation status
Western 500 kV Backbone (Stage 1)	**ETC: 2017**	**ETC: Dec 2018**	Due to updates in actual implementation status.
Eastern Albay 69 kV Line Stage 2	**ETC: 2016**	**ETC: (Stage 2) June 2019**	Originally packaged together with Stage 1 under 2013 TDP.
Ambuklao-Binga 230kV T/L Upgrading	**ETC: 2015**	**ETC: Dec 2019**	Due to updates in actual implementation status.
Binga-San Manuel 230 kV T/L Stage 1 & 2	**ETC: (Stage 1) 2014** **ETC: (Stage 2) 2015**	**ETC: Dec 2019**	Due to updates in actual implementation status.
New Antipolo 230 kV Substation	**ETC: 2015**	**ETC: Dec 2019**	Due to updates in actual implementation status.
Calaca-Dasmariñas 500 kV Transmission Line	**ETC: 2018**	**ETC: Dec 2019**	Due to updates in actual implementation status.
Pagbilao 500 kV Substation	**Pagbilao 500 kV S/S** 3-750 MVA, 500/230 kV Power Transformer, 8-500 kV PCB and 8-230 kV PCB **Tayabas 500 kV S/S Expansion** 4-230 kV PCB	**Pagbilao 500 kV S/S** 3-1000 MVA, 500/230 kV Power Transformers, 8-500 kV PCBs and 11-230 kV PCB **Tayabas 500 kV S/S Expansion** 3-500 kV PCB and 1-230 kV PCB **Swinging of Naga-Tayabas EHV Line at Tayabas SS** ST-DC, 4-795 MCM ACSR, 0.5 km	Uprating of the transformer capacity considers anticipating future generation development in the area. Update on the project components and transmission line swinging already based on the recent site development plan and detailed engineering design.

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
	Naga-Tayabas 230 kV T/L Extension ST-DC, 4-795 MCM ACSR, 1 km **Pagbilao–Tayabas 500 kV T/L** ST-DC, 4-795 MCM ACSR, 17 km.	**Naga-Tayabas Line Extension to Pagbilao EHV SS** ST-DC, 4-795 MCM ACSR, 0.5 km **Pagbilao-Tayabas Line Extension to Pagbilao EHV SS** 230 kV, ST-DC, 4-795 MCM ACSR, 2.75 km **Pagbilao-Tayabas connection to Naga-Tayabas,** 230 kV, ST-DC, 4-795 MCM ACSR, 2.75 km.	
Hermosa-San Jose 500 kV Transmission Line	**ETC: 2020** **Hermosa-San Jose 500 kV T/L** ST-DC, 6-795 MCM ACSR/AS, 83 km **New Hermosa 500 kV S/S** 2-750 500/230-13.8 kV Power Transformer, 10-500 kV PCB and 10-230 kV PCB **New Hermosa 500 kV S/S** 1-90 MVAR 500 kV Reactor **San Jose S/S Expansion** 4-230 kV PCB	**ETC: May 2018** **Hermosa-San Jose 500 kV T/L** ST-DC, 4-410 mm^2 TACSR/AS, 82.41 km **New Hermosa-Old Hermosa Tie Line** SP-DC, 4-795 MCM ACSR, 0.5 km **New Hermosa 500 kV S/S** 2-750 500/230-13.8 kV Power Transformer, 10-500 kV PCB and 12-230 kV PCB **New Hermosa 500 kV S/S** 2-60 MVAR 500 kV Shunt Reactors, 1-90 MVAR 500 kV Line Reactor and 2-100 MVAR, 230 kV Capacitor Banks **Old Hermosa 230 kV S/S** 2-230 kV PCB and 9-69 kV PCB	Considers using the existing tower design while maintaining the same transfer capacity. Updates on the project components were already based on the recent site development plan and detailed engineering design.
Bataan 230 kV Grid Reinforcement		**ETC: December 2018**	New Project under 2014-2015 TDP
Bolo 5th Bank	**ETC: 2018** **Bolo 500 kV S/S Expansion** 1-600 MVA, 500/230 kV Power Transformer, 3-500 kV PCB, and 2-230 kV PCB	**ETC: June 2019** **Bolo Substation Expansion** 1x600 MVA 500/230 kV Transformer and 3-500 kV PCB	Due to updates in the timeline and status of the generation capacity additions that trigger the implementation of the project.

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
Mariveles-Hermosa 500 kV Transmission Line		**ETC: November 2019**	Previously named as Cabcaben-Hermosa 500 kV Transmission Line
Northern Luzon 230 kV Loop		**ETC: June 2024**	Conceptualization of this project is included in the 2013 TDP.
Sta Maria / Ibaan 500 kV Substation		**ETC: October 2024**	New Project under 2014-2015 TDP
Liberty-Nagsaag 230 kV Transmission Line	**ETC: 2020** **Liberty 230 kV S/S** 1-50 MVA 230/69 kV Power Transformer	**ETC: December 2024** **Liberty 230 kV S/S** 1-100 MVA 230/69 kV Power Transformer	Due to updates in load forecast and actual implementation status.
La Trinidad-Sagada 230 kV Transmission Line	**ETC: 2019**	**ETC: December 2024**	Due to updates in load forecast and actual implementation status.
Pagbilao-Tayabas 500 kV Transmission Line		**ETC: December 2024**	New Project under 2014-2015 TDP
Santiago-Nagsaag 500 kV Transmission Line		**ETC: December 2024**	New Project under 2014-2015 TDP
Clark-Mabiga 69 kV Transmission Line	**Clark-Mabiga 69 kV T/L** 1-795 MCM ACSR, ST-DC, 6 km	**Clark-Mabiga 69 kV T/L** 1-410mm^2 TACSR/AS, SP-DC, 6 km **Clark 230 kV S/S (Expansion)** 1-300 MVA 230/69-13.8 kV Power Transformer, 1-230 kV PCB and 3-69 kV PCB	Due to updates in load forecast.
North Luzon Substation Upgrading Project – Stage 1 / Stage 2		**ETC: December 2018/ June 2022**	New Project under 2014-2015 TDP
Calamba 230 kV Substation	**ETC: 2016** **Calamba 230 kV S/S** 2-300 MVA, 230/115-13.8 kV Power Transformers to be implemented by MERALCO, 10-230 kV PCB and associated equipment; and 230 kV T/L, ST-DC, 4-795 MCM ACSR, 1.5 km	**ETC: March 2019** **Calamba 230 kV S/S** 2-300 MVA, 230/115-13.8 kV Power Transformers to be implemented by MERALCO, 10-230 kV PCB and associated equipment and 230 kV T/L, SP-DC, 2-610 mm^2 TACSR/AS, 1.5km	Due to updates in actual implementation status Updates on the project components were already based on the recent site development plan and detailed engineering design.
Manila (Navotas) 230 kV Substation	**Manila 230 kV S/S** 2-300 MVA, 230/115-13.8 kV Power Transformer, 2-50 MVAR, 115 kV Capacitor Banks, 6-230 kV PCB (GIS) and 9-115 kV PCB (GIS)	**Manila 230 kV S/S** 2-300 MVA, 230/115-13.8 kV Power Transformers and Accessories, 9-230 kV PCBs (GIS) and 15-115 kV PCBs (GIS)	Updates on the project components were already based on the recent site development plan and detailed engineering design.

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
Mexico-San Simon 69 kV Transmission Line	**ETC: 2016** **Mexico-San Simon 69 kV T/L** ST/SP-DC, 410 mm^2 TACSR, 8.0 km **Mexico S/S Expansion** 2-69 kV PCB and associated equipment	**ETC: June 2020** **Mexico-San Simon 69 kV T/L** ST/SP-DC, 1-410 mm^2 TACSR, 6.9 km **Mexico 69 kV S/S Expansion** 9-69 kV PCB and associated equipment	Due to updates in load forecast and actual implementation status.
Tanauan 230 kV Substation		**ETC: June 2020**	New Project under 2014-2015 TDP
Pasay 230 kV Substation	**ETC: 2019** **Pasay 230 kV S/S** 2-300 MVA, 230/115-13.8 kV Power Transformer, 2-50 MVAR, 115 kV Capacitor Banks, 6-230 kV PCB (GIS) and 9-115 kV PCB (GIS) **Las Piñas-Pasay 230 kV T/L** SP-DC, 4-795 MCM ACSR/AS, 21 km	**ETC: July 2020** **Pasay 230 kV S/S** 5-230 kV PCBs (GIS) and associated equipment **Las Piñas-Pasay 230 kV T/L** 230 kV, 2-795 MCM ACSR/AS, SP-DC, 4.2 km 230 kV 2-1C-2,000 mm^2 XLPE, UG-DC, 3.9 km	Due to updates in load forecast and actual implementation status. Updates on the project components were already based on the recent site development plan and detailed engineering design.
Taguig 500 kV Substation	**ETC: 2018** **Baras (Antipolo)-Taguig 500 kV T/L (initially energized at 230 kV)** 4-795 MCM ACSR/AS, ST-DC, 7.3 km, and 4-795 MCM ACSR/AS, SP-SC, 2-16 km **Baras (Antipolo) S/S Expansion** 4-230 kV PCB and associated equipment **Taguig 230 kV S/S cut-in to Muntinlupa-Paco 230 kV T/L** 2-410 mm^2 TACSR, SP-SC, 2-2.4 km **Taguig 230 kV S/S** 2-50 MVAR, 230 kV Capacitor Banks and 10-230 kV PCB and associated equipment	**ETC: November 2020** **Taguig 500 kV S/S** 2-1,000 MVA, 500/230-13.8 kV Power Transformers and Accessories, 1-90 MVAR, 500 kV Shunt Reactor and Accessories, 3-100 MVAR, 230 kV Capacitor Banks and Accessories, 8-500 kV PCBs (GIS), 10-230 kV PCBs (GIS), and Associated Equipment **Taguig cut-in to San Jose-Tayabas 500 kV T/L** 500 kV, ST-DC, 4-795 MCM ACSR, 37 km **Taguig bus-in to Muntinlupa-Paco 230 kV T/L** 230 kV, SP-DC1, 2-410 mm^2 TACSR, 2-2.4 km	Due to updates in load forecast and actual implementation status. Updates on the project components were already based on the recent site development plan and detailed engineering design.
South Luzon Substation Upgrading Project – Stage 1 / Stage 2		**ETC: December 2021/June 2022**	New Project under 2014-2015 TDP

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
Marilao 500 kV Substation		**ETC: June 2023**	New Project under 2014-2015 TDP
Porac 230 kV Substation	**ETC: 2022** **Hermosa-Clark 230 kV T/L** ST/SP-DC, 795 MCM ACSR/AS, 53.8 km **Hermosa S/S Expansion** 4-230 kV PCB and associated equipment **Clark S/S Expansion** 4-230 kV PCB and associated equipment.	**ETC: December 2024** **Porac 230 kV S/S** 1-300 MVA 230/69 kV transformer, 5-230 kV PCB, 9-69 kV PCB and associated equipment **Hermosa-Porac-Clark** 4-795 MCM ACSR, ST-DC, 54-km **Hermosa 230 kV S/S (Expansion)** 4-230 kV PCB and associated equipment **Clark 230 kV S/S (Expansion)** 4-230 kV PCB and associated equipment.	Due to updates in load forecast and actual implementation status.
Magalang 230 kV Substation	**ETC: 2020** **Magalang 230 kV S/S (New)** 1-100 MVA, 230/69-13.8 kV Power Transformer, 9-230 kV PCB, 11-69 kV PCB and associated equipment. **Extension from the bus-in point (Concepcion side) to Magalang Substation** 230 kV, ST-DC, 2-410 mm^2 TACSR, 0.1 km **Extension from the bus-in point (Mexico side) to Magalang Substation** 230 kV, ST-DC, 2-410 mm^2 TACSR, 0.1 km	**ETC: June 2025** **Magalang 230 kV S/S** 1-300 MVA 230/69 kV Power Transformer, 8-230 kV PCB, and 230 kV, ST-DC, 2-410 mm^2 TACSR, 5 km.	Due to updates in load forecast and actual implementation status.
Relocation of Steel Poles along Hermosa-Duhat 230 kV Transmission Line		**ETC: December 2018**	New Project under 2014-2015 TDP
La Trinidad-Calot 69 kV Transmission Line	**ETC: 2018** **La Trinidad–Calot 69 kV T/L** Double Circuit 1-795 MCM ACSR, 17 km	**ETC: June 2019** **La Trinidad–Calot 69 kV T/L** SP/ST-DC, 1-795 MCM ACSR/AS, 21 km **69 kV Line Tapping Points,** 5-72.5 kV, 3-way Air Break	Due to updates in load forecast and actual implementation status.

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
		Switch **La Trinidad 69 kV S/S Expansion** 1-69 kV PCB and Associated Equipment	
Tiwi Substation Upgrading Project	**ETC: 2018** **Tiwi 230 kV S/S** 1-50 MVA, 230/69-13.8 kV Power Transformer, 8-230 kV PCB, and 2-69 kV PCB	**ETC: July 2019** **Tiwi A 230 kV S/S** 4-230 kV PCB **Tiwi C 230 kV S/S** 1-50 MVA, 230/69-13.8 kV Power Transformer, 15-230 kV PCB and 3-69 kV PCB	Due to updates in load forecast and actual implementation status.
Pinili 115 kV Substation		**ETC: December 2019**	New Project under 2014-2015 TDP Previously conceptualized as Currimao Substation Expansion. Change in the location of the substation was brought about by the intention of Ilocos Sur Electric Cooperative and Abra Electric Cooperative to connect their additional 69 kV line to the said substation.
Navotas-Pasay 230 kV Transmission Line		**ETC: July 2020**	Conceptualization of this project is included in the 2013 TDP
Taguig-Taytay 230 kV Transmission Line		**ETC: October 2020**	New Project under 2014-2015 TDP
Balayan 69 kV Switching Station		**ETC: June 2021**	New Project under 2014-2015 TDP
San Manuel-Nagsaag 230 kV Transmission Line	**ETC: 2018** **Nagsaag-San Manuel 230 kV T/L** SP-DC, 2-410 mm^2 TACSR, 1.0 km **Nagsaag S/S Expansion** 6-230 kV PCB and associated equipment	**ETC: December 2021** **San Manuel-Nagsaag 230 kV Tie-Line Upgrading** SP-DC, 2-410 mm^2 TACSR, 0.6 km **Binga Line Extension** 230 kV, SP-DC, 2-795 MCM ACSR, 0.6 km	Due to updates in load forecast and actual implementation status.

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
	Binga-San Manuel 230 kV T/L Extension SP/ST-DC, 2-795 MCM ACSR, 4 km **San Manuel S/S Expansion** 2-230 kV PCB and associated equipment	**Nagsaag 500 kV S/S (Expansion)** 3-200 MVA, 500/230-13.8 kV Power Transformers and Accessories, 2-500 kV PCB and Associated Equipment and 8-230 kV PCB and Associated Equipment **San Manuel 230 kV S/S (Expansion)** 3-230 kV PCB and Associated Equipment	
Dasmariñas-Las Piñas 230 kV Transmission Line		**ETC: December 2023**	New Project under 2014-2015 TDP
Manila(Navotas)-Dona Imelda 230 kV Transmission Line		**ETC: December 2023**	New Project under 2014-2015 TDP
Mexico-Clark 69 kV Transmission Line Upgrading		**ETC: April 2024**	New Project under 2014-2015 TDP
Minuyan 115 kV Switching Station		**ETC: April 2024**	New Project under 2014-2015 TDP
Western 500 kV Backbone – Stage 2		**ETC: June 2024**	New Project under 2014-2015 TDP
Baras 500 kV Switching Station	**ETC: 2019** **Antipolo-San Jose 500 kV Line Extension** 500 kV, ST-DC, 4-795 MCM ACSR, 9 km **Antipolo-Tayabas 500 kV Line Extension** 500 kV, ST-DC, 4-795 MCM ACSR, 8.5 km **Antipolo 500 kV S/S** 10-500 kV PCB, 3-230 kV PCB and associated equipment, 7-250 MVA, 500/230 kV Power Transformers and 1-100 MVAR, 230 kV Shunt Reactor	**ETC: December 2024** **Baras 500 kV S/S** 10-500 kV PCBs and associated equipment	Due to updates in load forecast and actual implementation status.
Alaminos 500 kV Switching Station	**ETC: 2019** **Antipolo-San Jose 500 kV Line Extension** 500 kV, ST-DC, 4-795 MCM ACSR, 9 km	**ETC: 2024** **Alaminos 500 kV S/S** 12-500 kV PCB, 2-30 MVAR 500 kV Shunt Reactor and associated	Due to updates in load forecast and actual implementation status.

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
	Antipolo-Tayabas 500 kV Line Extension 500 kV, ST-DC, 4-795 MCM ACSR, 8.5 km **Antipolo 500 kV S/S** 10-500 kV PCB, 3-230 kV PCB and associated equipment, 7-250 MVA, 500/230 kV Power Transformers and 1-100 MVAR, 230 kV Shunt Reactor	equipment.	
Silang-Taguig 500 kV Transmission Line		**ETC: December 2024**	New Project under 2014-2015 TDP
Calaca-Salong 230 kV Transmission Line 2		**ETC: March 2025**	New Project under 2014-2015 TDP
Liberty-Cabanatuan-San Rafael-Mexico 230 kV Transmission Line Upgrading		**ETC: June 2025**	New Project under 2014-2015 TDP
Luzon Voltage Improvement Project 3 – Stage 1 / Stage 2	**ETC: 2018** **Laoag 230 kV S/S** 2-25 MVAR, 230 kV Shunt Reactors **San Esteban 230 kV S/S** 2-25 MVAR, 230 kV Shunt Reactors **Tuguegarao 230 kV S/S** 1-25 MVAR Capacitor Bank and 1-25 MVAR, 230 kV Shunt Reactor **Botolan 230 kV S/S** 1-25 MVAR 230 kV Shunt Reactor **Mexico 230 kV S/S** 1-100 MVAR 230 kV Capacitor Bank **San Jose 230 kV S/S** 1-100 MVAR 230 kV Capacitor Bank **Bantay 115 kV S/S** 1-7.5 MVAR, 115 kV Capacitor Bank **Itogon Load-end 69 kV S/S** 1-7.5 MVAR, 69 kV Capacitor Bank	**ETC: January 2018/ June 2022** **STAGE 1** **Laoag 230 kV S/S** 1-35 MVAR & 1-25 MVAR 230 kV Shunt Reactors and Accessories, 2-25 MVAR 230 kV Capacitor Banks and Accessories **Cabanatuan 230 kV S/S** 2-50 MVAR, 230 kV Capacitor Banks and Accessories **Nagsaag 500 kV S/S** 1-90 MVAR, 500 kV Shunt Reactor and Accessories **Tuguegarao 230 kV S/S** 1-25 MVAR Capacitor Bank and Accessories and 1-25 MVAR, 230 kV Shunt Reactor and Accessories **Baler Load-End 69 kV S/S** 3-2.5 MVAR, 69 kV Capacitor Bank and Accessories	Due to updates in load forecast and actual implementation status.

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
	Pantabangan Load-end 69 kV S/S 2-5 MVAR, 69 kV Capacitor Banks **Nagsaag 500 kV S/S** 1-90 MVAR, 500 kV Shunt Reactor.	**Pantabangan Load-end 69 kV S/S** 1-5 MVAR, 69 kV Capacitor Bank and Accessories **Umingan Load-end 69 kV S/S** 3-5 MVAR 69 kV Capacitor Bank and Accessories **Paniqui Load-end 69 kV S/S** 3-5 MVAR 69 kV Capacitor Bank **Bantay 115 kV S/S** 1-7.5 MVAR, 115 kV Capacitor Bank and Accessories **<u>STAGE 2</u>** **San Esteban 230 kV S/S** 2-25 MVAR, 230 kV Capacitor Banks and Accessories **Botolan 230 kV S/S** 1-25 MVAR 230 kV Shunt Reactor and Accessories **Mexico 230 kV S/S** 1-100 MVAR 230 kV Capacitor Bank and Accessories **San Jose 230 kV S/S** 1-100 MVAR 230 kV Capacitor Bank and Accessories **Itogon Load-end 69 kV S/S** 1-7.5 MVAR, 69 kV Capacitor Bank and Accessories **Antipolo 230 kV S/S** 2-100 MVAR, 230 kV Capacitor Banks and Accessories **Bayambang Load-end 69 kV S/S** 3-5 MVAR 69 kV Capacitor Bank and Accessories	

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
Luzon Voltage Improvement Project 4 – Stage 1 / Stage 2	**ETC: 2018** **Ligao Switching Station** 3-5 MVAR, 69 kV Capacitor Banks **Balogo Switching Station** 3-5 MVAR, 69 kV Capacitor Banks **Tigaon Switching Station** 2-5 MVAR, 69 kV Capacitor Banks **Antipolo 230 kV S/S** 2-100 MVAR, 230 kV Capacitor Banks, 1-100 MVAR, 230 kV Shunt Reactor **Biñan 230 kV S/S** 2-100 MVAR, 230 kV Capacitor Banks **Dasmariñas 230 kV S/S** 2-100 MVAR, 230kV Capacitor Banks	**ETC: December 2019/ June 2022** **STAGE 1** **Ligao Switching Station,** 3-5 MVAR, 69 kV Capacitor Banks and Accessories **Iriga Load-end 69 kV S/S** 2-5 MVAR, 69 kV Capacitor Banks and Accessories **STAGE 2** **Biñan 230 kV S/S** 2-100 MVAR, 230 kV Capacitor Banks and Accessories **Dasmariñas 230 kV S/S** 2-100 MVAR, 230kV Capacitor Banks and Accessories **Mabini Load-end 69 kV S/S** 3-7.5 MVAR, 69 kV Capacitor Banks and Accessories **Cuenca Load-end 69 kV S/S** 3-7.5 MVAR, 69 kV Capacitor Banks and Accessories **Taysan Load-end 69 kV S/S** 3-7.5 MVAR, 69 kV Capacitor Banks and Accessories **San Juan Load-end 69 kV S/S** 3-5 MVAR, 69 kV Capacitor Banks and Accessories **Lagonoy Load-end 69 kV S/S** 3-5 MVAR, 69 kV Capacitor Banks and Accessories	Due to updates in load forecast and actual implementation status.

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
Visayas Projects			
CNP 230 kV Backbone Project - Stage 2 (Cebu Substation 230 kV Upgrading)	**ETC: 2017** **Cebu 230 kV S/S** 2-300 MVA 230/138 KV Power Transformers and 1-138 kV PCB	**ETC: Dec 2018** **Cebu 230 kV S/S** 3-300 MVA 230/138 KV Power Transformers and 3-138 kV PCB	Change of components was for N-1 contingency.
Cebu – Negros – Panay 230 kV Backbone (Stage 1)	**ETC: 2016** **Barotac Viejo S/S Expansion** 6-138 kV PCB	**ETC: Dec 2017** **Barotac Viejo S/S Expansion** 5-138 kV PCB	Substation reconfiguration was due to ERC approval of Eastern Panay Transmission Project
E.B. Magalona – Cadiz 138 kV T/L	**E.B. Magalona – Cadiz 138 kV T/L**		Not included in the 2014-2015 TDP because it can be addressed by CNP 3
Umapad 230 kV Substation Project	**ETC :2017** **Umapad 230 kV S/S** 4-138 kV PCB, 4-69 kV PCB	**ETC : Jun 2023** **Umapad 230 kV S/S** 7-230 kV PCB, 5-69 kV PCB	Due to updates in actual implementation status.
Laray 230 kV Substation Project	**SRP 138 kV Substation** **ETC : 2018** **SRP 230 kV S/S** 2-300 MVA 230/69-13.8 kV Power Transformers, 5-230 kV PCB (GIS) and 4-69 kV PCB (GIS) and associated equipment **SRP S/S cut-in to the proposed Bato-Cebu 230 kV Line 1** ST/SP-DC, 2-410 mm2 TACSR/4-795 MCM ACSR, 22 km	**Laray 230 kV Substation Project** **ETC : Nov 2020** **Laray 230 kV S/S (New)** 2-150 MVA 230/69-13.8 kV Power Transformers, 6-230 kV PCB (GIS), 5-69 kV PCB (GIS) and associated equipment **Naga-Laray 230 kV T/L** ST/SP-DC, 2-610 mm2 TACSR, 4-795 MCM ACSR, 22 km.	SRP was changed to Laray due to Transmission line ROW difficulty. Transformer capacity was reduced as per coordination with VECO. Change in connection scheme from cut-it to direct to Magdugo was for future purposes.
Nabas-Caticlan-Boracay Transmission Project	**ETC : 2018** **Nabas-Caticlan 138 kV T/L** ST-DC1, 1-795 MCM ACSR, 22 km **Caticlan 138 kV S/S** 2-50 MVA, 138/69-13.8 kV Power Transformers, 5-138 kV PCB and 4-69 kV PCB and associated equipment **Nabas S/S Expansion** 1-138 kV and associated equipment	**ETC : Mar 2021** **Boracay 138 kV S/S (New)** 1-100 MVA 138/69/13.2 kV Power Transformer, 2-50 MVA 69/13.2 kV Power Transformer, 1-138 kV PCB, 4-69 kV PCB and associated equipment **Caticlan-Boracay Power Cable** XLPE Submarine Cable System of 100 MW capacity at 138 kV, 2 km **Boracay-Manocmanoc Power Cable** XLPE Underground Cable	During the coordination meeting with Akelco, it was agreed upon that NGCP's scope to change up to Boracay. Load is located in Boracay.

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
		of 50 MW capacity at 69 kV, 1km **Caticlan CTS (New)** Cable Sealing End **Nabas-Caticlan 138 kV T/L** Combination of ST/SP-DC, 1-795 MCM ACSR, 14 km and Underground Cable System of 100 MW capacity at 138 kV, 8 km **Nabas 138 kV S/S** 4-138 kV PCB and associated equipment **Unidos CTS (New)** Cable Sealing End	
Amlan - Dumaguete 138 kV Transmission Line Project	**ETC : 2018** **Dumaguete 138 kV S/S (New)** 2-50 MVA, 138/69-13.8 kV Power Transformers, 6-138 kV PCB and 4-69 kV PCB and associated equipment **Amlan 138 kV S/S** 4-138 kV PCB and associated equipment.	**ETC : June 2023** **Dumaguete 138 kV S/S** 1-50 MVA, 138/69-13.8 kV Power Transformers PCB and 3-69 kV PCB and associated equipment **Amlan 138 S/S Expansion** 2-138 kV PCB and associated equipment.	Due to updates in actual implementation status
Babatngon-Palo 138 kV Transmission Line Project	**ETC : 2018** **Babatngon-Campetic 138 kV T/L** ST-DC, 1-795 MCM ACSR, 20 km **Campetic 138 kV S/S** 1-50 MVA 138/69-13.8 kV Power Transformer and 4-138 kV PCB and associated equipment **Sagkahan-Campetic 69 kV T/L** ST-DC, 1-336.4 MCM, 1 km **Campetic-Campetic 69 kV T/L** ST-DC, 1-336.4 MCM, 1 km	**ETC : Dec 2022** **Babatngon-Palo 138 kV T/L** ST-DC, 1-795 MCM ACSR, 20 km **Palo 138 kV S/S (New)** 2-50 MVA 138/69-13.8 kV Power Transformer and 6-138 kV PCB, 8-69 kV PCB and associated equipment **Babatngon 138 kV S/S** 3-138 kV PCB associated equipment.	Babatngon – Campetic was changed to Babatngon –Palo due to change in location because the junction that connects the lines is located in Palo.

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
Visayas Substation Upgrading Project (VSUP)	**Panay Substations Upgrading Project** ETC : 2018 **Cebu Substation Upgrading Project** ETC : 2019 **Samar Substation Upgrading Project** ETC : 2019 **Bohol Substations Upgrading Project** ETC : 2020 **Negros Substations Upgrading Project** ETC : 2019 **Leyte Substation Upgrading Project** ETC : 2018	**Visayas Substation Upgrading Project (VSUP)** ETC : Dec 2021	Visayas Substation upgrading is divided into two due to prioritization issues.
Leyte – Bohol Line 2 (2022)	**Leyte – Bohol Line 2**		Not included in the 2014-2015 TDP but included as an option in the Cebu-Bohol Interconnection project.
Upgrading of Ormoc / Tongonan - Isabel 138 kV Transmission Line Upgrading of Panitan - Nabas 138 kV Transmission Line	**Permanent Restoration of Panitan-Nabas and Ormoc-Isabel 138 kV lines** **ETC : 2016** **Panitan – Nabas 138 kV** 134 Steel tower Structures **Ormoc – Isabell 138 kV** 71 Steel tower Structures	**Upgrading of Ormoc / Tongonan - Isabel 138 kV Transmission Line** **ETC : May 2017** **Panitan – Nabas 138 kV** 128 Steel tower Structures **Upgrading of Panitan - Nabas 138 kV Transmission Line** **ETC : Apr 2017** **Ormoc – Isabell 138 kV** 72 Steel tower Structures	The original project was split into two different projects.
Kabankalan Substation Reliability Improvement Project	**ETC : 2018**	**ETC : Jun 2024**	Due to updates in actual implementation status
Naga (Visayas) Substation Upgrading Project	**Naga 138 kV Substation Upgrading** **ETC : 2018** Supply and installation of 2-100 MVA, 138/69-13.8 kV Power Transformers, 18-138 kV PCB and 9-69 kV PCB including associated equipment; and Includes dismantling and gradual replacement of existing equipment.	**Naga (Visayas) Substation Upgrading Project** **ETC : Mar 2019** **Naga 138 kV S/S** 6-138 kV PCB and associated equipment.	Other components moved to Colon Substation upgrading (Remaining Works)

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
Reconfiguration of Babatngon - Sta. Rita 138 kV Transmission Corridor	**Babatngon – Sta. Rita 138 kV T/L Upgrading** **ETC : 2019** **Babatngon-Wright 138 kV T/L (portion along San Juanico Strait)** 138 kV T/L, ST-DC, 2-795 MCM ACSR, 1.8 km **Babatngon-Sta. Rita 69 kV T/L** 1-336.4 MCM ACSR, 11.6 km, 1-69 kV PCB and associated equipment (installation and hauling from Sta. Rita)	**Reconfiguration of Babatngon - Sta. Rita 138 kV Transmission Corridor** **ETC : Dec 2024** **Babatngon-Paranas 138 kV T/L (portion along San Juanico Strait)** ST-DC, 2-795 MCM ACSR, 1.8 km **Sta. Rita 138 kV S/S** 2-50 MVA 138/69-13.8 kV Power Transformer, 10-138 kV PCB, 4-69kV PCB and associated equipment	Babatngon –Wright was changed to Babatngon-Paranas due to SEIL.
Cebu-Bohol Interconnection Project	**Cebu-Bohol 138 kV Interconnection Project** New 138 kV switching stations and cable terminal stations at Sibonga, Cebu and in Loon, Bohol 138 kV Submarine Cable from Sibonga, Cebu to Loon, Bohol; and A 138 kV overhead transmission line from Loon towards Corella S/S and Ubay S/S.	**Cebu-Bohol Interconnection Project** **ETC : Dec 2020** **Sibonga 138 kV S/S (New)** 1-50MVA, 138/69 kV Transformer, 13-138 kV PCB and associated equipment, 3-40 MVAR Reactor, 3-69 kV PCB and associated equipment **Corella 138 kV S/S** 3-138 kV PCB and associated equipment **Sibonga CTS-Corella CTS** Single circuit submarine cable system of 200 MW capacity at 138 kV, 30km **Loon CTS-Corella S/S** ST-DC, 1-795 MCM, 17 km.	More detailed components in the 2014-2015 TDP.
Visayas Voltage Improvement Project	**Visayas Voltage Improvement 1** **Corella 138 kV S/S** 3-7.5 MVAR, 138 kV Capacitor Banks **Catarman LES** 1-7.5 MVAR, 69 kV Capacitor Bank **Caticlan LES** 4-5 MVAR, 69 kV Capacitor Banks	**Visayas Voltage Improvement Project** **Compostela 138 kV S/S** 2-20 MVAR, 138 kV Capacitor Banks **Cebu 138 kV S/S** 2-20 MVAR, 138 kV Capacitor Banks **Corella 138 kV S/S** 3-5 MVAR, 138 kV Capacitor Banks	Corella's Capacitor was changed from 3-7.5 MVAR to 3-5 MVAR because it is already sufficient. Caticlan's capacitor bank was transferred to Nabas-Caticlan-Boracay Transmission Project.

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
Maasin-Javier 138 kV Transmission Line Project	**ETC : 2019** **Maasin-Javier 138 kV T/L** ST-DC, 1-795 MCM ACSR, 105 km **Javier 138 kV S/S** 2-50 MVA 138/69-13.8 kV Power Transformer, 7-138 kV PCB and associated equipment	**ETC : Jun 2025** **Maasin-Javier 138 kV T/L** ST-DC, 1-795 MCM ACSR, 105 km **Maasin 138 kV S/S** 3-138 kV PCB and associated equipment **Javier 138 kV S/S (New)** 2-50 MVA 138/69-13.8 kV Power Transformer, 6-138 kV PCB, 5-69kV PCB and associated equipment	Due to updates in actual implementation status.
Tagbilaran 69 kV Substation Project	**ETC : 2020**	**ETC : Dec 2017**	Due to updates in actual implementation status
Bacolod - San Enrique 69 kV T/L Reclassification	**Bacolod - San Enrique 69 kV T/L Reclassification**		Not included in the 2014-2015 TDP
Cadiz – San Carlos 69 kV T/L Reclassification	**Cadiz – San Carlos 69 kV T/L Reclassification**		Not included in the 2014-2015 TDP because it can be already addressed by CNP 3.
Calong-Calong-Toledo-Colon 138 kV T/L	**Calung-Calung-Colon 138 kV T/L** **ETC : 2014**	**Calong-Calong-Toledo-Colon 138 kV T/L** **ETC : Aug 2016**	Due to updates in actual implementation status
Southern Panay Backbone	**ETC: 2014**	**ETC: Jun 2016**	Due to updates in actual implementation status
Colon-Cebu T/L	**Colon-Cebu 138 kV T/L** **ETC: 2014**	**Colon-Cebu T/L** **ETC: Jul 2016**	Due to updates in actual implementation status
Culasi-San Jose 69 kV T/L	**Culasi-Sibalom 69 kV T/L** **ETC : 2014** **San Jose S/S Expansion** 2-69 kV Air Break Switch	**Culasi-San Jose 69 kV T/L** **ETC : Jul 2016** **San Jose S/S Expansion** 1-69 kV Air Break Switch	Due to updates in actual implementation status
Ormoc-Maasin 138kV T/L	**ETC : 2014**	**ETC : Aug 2016**	Due to updates in actual implementation status
Ormoc-Babatngon 138 kV T/L	**ETC : 2014**	**ETC : Oct 2016**	Due to updates in actual implementation status
Sta.Rita-Quinapundan 69 kV T/L	**ETC : 2014** **Sta. Rita S/S – Quinapundan S/S** 69 kV T/L, ST-SC, 1-336.4 MCM, 97 km	**ETC : Jun 2016** **Sta. Rita S/S – Quinapundan S/S** 69 kV T/L, ST-SC, 1-336.4 MCM, 103 km	Due to updates in actual implementation status

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
Visayas Substation Reliability II	**ETC : 2014** Sta Rita (50 MVA from Ormoc S/S)	**ETC : Sep 2017** Removed Sta Rita Rita (50 MVA from Ormoc S/S)	Due to updates in actual implementation status
Cebu-Lapu-lapu T/L	**ETC : 2015** **<u>Overhead Transmission Line</u>** **Cebu S/S – Umapad CTS** 230 kV, ST/SP-DC, 2-795 MCM ACSR, 9 km (initially energized at 138 kV) **<u>Underground and Submarine Cable</u>** **Umapad CTS – Mandaue Cable Joint (CJ)** 138 kV, SC, three single-core 1,000 mm2 XLPE underground cable, 0.3 km **Mandaue CJ – Lapulapu CJ** 138 kV, SC, two bundle of three-core 500 mm2 XLPE submarine cable, 0.5 km **Lapulapu CJ – Lapulapu S/S** 138 kV, SC, three single-core 1,000 mm2 XLPE underground cable, 0.1 km	**ETC : Dec 2018** **<u>Substation Components</u>** **Lapu-lapu 138 kV S/S** 1-138 kV GIS Switchbay. **<u>Transmission Components</u>** **Cebu-Umapad 230 kV T/L** ST/SP-DC, 2-795 MCM ACSR, 9 km **Umapad-Mandaue CJ 138 kV T/L** SC, 3-1C 1,000mm^2 XLPE underground cables, 0.3 km **Lapu-lapu CJ-Lapu-lapu 138 kV T/L** SC, 3-1C 1,000mm^2 XLPE underground cables, 0.1km **<u>Submarine Cable Components</u>** **Mandaue-Lapu-lapu CJ 138 kV T/L** SC, 2-3C 500mm^2 XLPE Submarine Cables, 0.5km **Umapad CTS** Cable Sealing End Structures, 3-138 kV Disconnect Switches	Due to updates in actual implementation status
CNP 230 kV Backbone Project - Stage 3 (Negros-Cebu Interconnection)			Conceptualization of this project is included in the 2013 TDP
Sta. Barbara-Dingle 138 kV Line 3 Project			New project under 2014 – 2015 TDP
New Naga (Colon) Substation Project (Remaining Works)			New project under 2014 – 2015 TDP
Palo-Javier 138 kV T/L Project			New project under 2014 – 2015 TDP

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
Visayas Substation Upgrading Project - 2			New project under 2014 – 2015 TDP
Panitan-Nabas 138 kV Transmission Line 2 Project			New project under 2014 – 2015 TDP
Visayas Substation Upgrading Project - 1			New project under 2014 – 2015 TDP
Barotac Viejo – Natividad 69kV Transmission Line			New project under 2014 – 2015 TDP
Mindanao Projects			
Mindanao Substation Reliability I	**ETC: 2014** **Bunawan S/S** 1-50 MVA Transformer **Lugait S/S** 1-75 MVA Transformer	**ETC: March 2016** **Bunawan S/S** **Lugait S/S**	Transformer transferred to "Maramag – Bunawan 230kV Transmission Project" Transformer intended for Lugait substation was installed in Opol Substation instead.
Agus 6 Switchyard Upgrading / Rehabilitation	**ETC: 2015**	**ETC: Dec 2016**	Due to updates in actual implementation status
Malita-Matanao-Bunawan 230 kV T/L (Phase 1 and 2)	**ETC: 2018**	**ETC: Mar 2016 (Phase 1)**	Reflecting actual completion of the project. Changed name to Culaman-Matanao 230 kV T/L
Matanao-Gen. Santos 138 kV T/L	**ETC: 2014**	**ETC: Mar 2016**	Reflecting actual completion of the project.
Maramag-Kibawe 138 kV T/L Project	**ETC: 2014**	**ETC: Apr 2016**	Reflecting actual completion of the project.
Opol 138 kV S/S	**ETC: 2015**	**ETC: Jun 2016**	Reflecting actual completion of the project.
Sultan Kudarat (Nuling) Capacitor Project	**ETC: 2014**	**ETC: Dec 2016**	Due to updates in actual implementation status
Balo-i-Kauswagan-Aurora 230 kV T/L (Phase 1)	**ETC: 2017**	**ETC: Aug 2017**	Due to updates in actual implementation status

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
Balo-i-Kauswagan-Aurora 230 kV T/L (Phase 2)	**ETC: 2019**	**ETC: Dec 2022**	Due to updates in actual implementation status
Balo-i-Tagoloan-Opol 138 kV Transmission Line	**ETC: 2020**	**ETC: Dec 2025**	Due to updates in actual implementation status
Tacurong-Sultan Kudarat 138 kV T/L	**ETC: 2018**	**ETC: 2025**	Due to updates in actual implementation status
Villanueva-Jasaan-Butuan 138 kV T/L	**ETC: 2018**	**ETC: 2021**	Due to updates in actual implementation status
Mindanao Substation Upgrading Project (MSUP)	**CARAGA Substations Upgrading** **ETC: 2018** **Butuan S/S** 2-138 kV PCB and associated equipment; **Placer S/S** 2-138 kV PCB and associated equipment and 2-7.5 MVAR 69 kV Capacitor Banks; **San Francisco S/S** 2-138 kV PCB and associated equipment; **Bislig S/S** 2-138 kV PCB and associated equipment	**MSUP** **ETC: Dec 2022** **Butuan S/S:** 2-7.5 MVAR Shunt Capacitor, 5-138 kV PCB, 5-69 kV PCB and associated equipment **Placer S/S:** 1-7.5 MVAR Shunt Capacitor, 3-138 kV PCB, 5-69 kV PCB and associated equipment **San Francisco S/S:** 2-7.5 MVAR Shunt Capacitor, 4-138 kV PCB, 3-69 kV PCB and associated equipment **Bislig S/S:** 4-138 kV PCB, 5-69 kV PCB and associated equipment	Repackaging of projects
	Central Mindanao Substations Upgrading **ETC: 2018** **Tagoloan S/S** 4-138 kV PCB, 1-69 kV PCB and associated equipment; **Maramag S/S** 2-138 kV PCB and associated equipment;	**MSUP** **ETC: 2022** **Tagoloan S/S** 4-138 kV PCB, 1-69 kV PCB and associated equipment; **Maramag S/S** 1-138 kV PCB, 1-69 kV PCB and associated equipment;	Repackaging of projects

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
	Zamboanga Peninsula Substations Upgrading **ETC: 2018** **Polanco S/S** 2–138kV PCB including associated equipment **Pitogo S/S** 2–138 kV PCB and associated equipment **Zamboanga S/S** 2-138 kV PCB and associated equipment **Naga Mindanao S/S** 2-138 kV PCB and associated equipment	**MSUP** **ETC: 2022** **Polanco S/S** 3-138 kV PCB, 1-69 kV PCB and associated equipment **Pitogo S/S** 1-138 kV PCB, 1-69kVPCB and associated equipment **Zamboanga S/S** 3-138 kV PCB, 2-69 kV PCB and associated equipment **Naga Mindanao S/S** 2-69kV PCB and associated equipment	Repackaging of projects
	Davao Region Substations Upgrading **ETC: 2022** **Kidapawan S/S** 2-138 kV PCB and associated equipment **Davao S/S** 2-138 kV PCB and associated equipment	**MSUP** **ETC: 2022** **Kidapawan S/S** 1-138 kV PCB, 2-69 kV PCB and associated equipment **Davao S/S** 4-138 kV PCB, 6-69 kV PCB and associated equipment	Repackaging of projects
	Mindanao Power Circuit Breaker Replacement **Tacurong S/S** 1-138 kV PCB, 8-69 kV PCB and associated equipment	**MSUP** **Tacurong S/S** 1-7.5 MVAR, 2-138 kV PCB, 10-69 kV PCB and associated equipment	Repackaging of projects
Mindanao Substation Rehabilitation Project (MSRP)	**Mindanao Power Circuit Breaker Replacement** **ETC:** **Agus 1 and 2 S/Y** 4-138 kV PCB and associated equipment **Agus 5 S/Y** 6-138 kV PCB and associated equipment **Aurora S/S** 2-138 kV PCB, 3-69 kV PCB and associated equipment	**MSRP** **ETC: Dec 2022** **Agus 1 and 2 S/Y** **Agus 5 S/Y** 4-138 kV PCB and associated equipment **Aurora S/S** 1-138 kV PCB	Repackaging of projects Agus 1 is removed from the project

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
	Balo-I S/S 7-138 kV PCB, 1-69 kV PCB and associated equipment	**Balo-I S/S** 13-138 kV PCB and associated equipment	
	Bislig S/S 3-138 kV PCB, 4-69 kV PCB and associated equipment	**Bislig S/S**	Moved to MSUP
	Bunawan S/S 1-69 kV PCB and associated equipment	**Bunawan S/S** 6-138 kV PCB and associated equipment	Orginally included in Matanao-Toril Bunawan
	Butuan S/S 5-138 kV PCB, 3-69 kV PCB and associated equipment	**Butuan S/S**	Moved to MSUP
	Davao S/S 8-138 kV PCB, 2-69 kV PCB and associated equipment	**Davao S/S** 4-138 kV PCB, 6-69 kV PCB and associated equipment	
	General Santos S/S 1-138 kV PCB, 4-69 kV PCB and associated equipment	**General Santos S/S**	Moved to MSUP
	Lugait S/S 1-138 kV PCB and associated equipment	**Lugait S/S** 5-138 kV PCB and associated equipment	
	Maco S/S 2-69 kV PCB and associated equipment	**Maco S/S**	Moved to MSUP
	Maramag S/S 9-138 kV PCB and associated equipment	**Pulangi S/S** 10-138 kV PCB, , 3-69 kV PCB and associated equipment	
	Nabunturan S/S 3-138 kV PCB, 1-69 kV PCB and associated equipment	**Nabunturan S/S** 5-69 kV PCB and associated equipment	
	Naga S/S 3-69 kV PCB and associated equipment	**Naga S/S** 1-69 kV PCB and associated equipment	
	Nasipit S/S 1-138 kV PCB and associated equipment	**Nasipit S/S** 4-138 kV PCB and associated equipment	

Project Name	2013 TDP	2014 – 2015 TDP	Remarks
	Placer S/S 1-138 kV PCB and associated equipment **Sultan Kudarat S/S** 1-69 kV PCB and associated equipment **Tacurong S/S** 1-138 kV PCB, 8-69 kV PCB and associated equipment **Zamboanga S/S** 2-138 kV PCB and associated equipment	**Placer S/S** 1-138 kV PCB and associated equipment **Sultan Kudarat S/S** 4-69 kV PCB and associated equipment **Tacurong S/S** **Zamboanga S/S** 3-138 kV PCB and associated equipment	Moved to MSUP
Kabacan 138 kV S/S		**ETC: 2021**	New project under 2014 - 2015 TDP
Tacurong-Sultan Kudarat 138 kV TL	**ETC: 2018**	**ETC: 2025**	Due to updates in actual implementation status
Tacurong-Kalamansig	**ETC: 2020** 69kV T/L: 80 km 1-69 kV PCB	**ETC: 2019** 69kV T/L: 100 km 3-69 kV PCB	Due to updates in actual implementation status
Toril 138 kV S/S Phase 2		**ETC: 2017**	New Project under 2014-2015 TDP
Aurora-Polanco 138 kV T/L	**ETC: 2014**	**ETC: 2018**	Due to updates in actual implementation status
Agus 2 S/Y Upgrading/Rehabilitation	**ETC: 2017** 2-138 kV PCB and associated equipment	**ETC: 2018** 10-138 kV PCB and associated equipment;	Due to updates in actual implementation status
Mindanao 230 kV backbone Project	**Balo-i-Villanueva-Maramag-Bunawan 230 kV Energization** **Malita – Matanao – Bunawan 230 kV Transmission Line**	**Mindanao 230 kV backbone Project** ETC: Dec 2018	Repackaged into 1 project

Appendix 5 – Abbreviations and Acronyms

Development Plans:

DDP	Distribution Development Plan
NREP	National Renewable Energy Program
PDP	Power Development Program
PEP	Philippine Energy Plan
TDP	Transmission Development Plan
TMP	Transmission Master Plan

Electric Cooperatives:

ABRECO	Abra Electric Cooperative
AEC	Angeles Electric Cooperative
AKELCO	Aklan Electric Cooperative
ALECO	Albay Electric Cooperative
ANECO	Agusan del Sur Electric Cooperative
AURELCO	Aurora Electric Cooperative
BATELEC	Batangas Electirc Cooperative
BILECO	Biliran Electric Cooperative
BENECO	Benguet Electric Cooperative
BUSECO	Bukidnon Electric Cooperative
CAPELCO	Capiz Electric Cooperative
CASURECO	Camarines Sur Electric Cooperative
CENECO	Central Negros Electric Cooperative
CENPELCO	Central Electric Cooperative
DANECO	Davao del Norte Electric Cooperative
DECORP	Dagupan Electric Cooperative
DORECO	Davao Oriental Electric Cooperative
DORELCO	Don Orestes Romuladez Elect Cooperative
FIBECO	First Bukidnon Electric Cooperative
GUIMELCO	Guimaras Electric Cooperative
ILECO	Iloilo Electric Cooperative
INEC	Ilocos Norte Electric Cooperative
ISECO	Ilocos Sur Electric Cooperative
ISELCO	Isabela Electric Cooperative
LANECO	Lanao Electric Cooperative
LEYECO	Leyte Electric Cooperative
MAGELCO	Maguindanao Electric Cooperative
MOPRECO	Mountain Province Electric Cooperative
MORESCO	Misamis Oriental Electric Cooperative
NEECO	Nueva Ecija Electric Cooperative
NOCECO	Negros Occidental Electric Cooperative

NORECO	Negros Oriental Electric Cooperative
NORSAMELCO	Northern Samar Electric Cooperative
OMECO	Occidental Mindoro Electric Cooperative
ORMECO	Oriental Mindoro Electric Cooperative
PANELCO	Pangasinan Electric Cooperative
PELCO	Pampanga Electric Cooperative
SAMELCO	Samar Electric Cooperative
SIARELCO	Siargao Electric Cooperative
SOCOTECO	South Cotabato Electric Cooperative, Inc.
SOLECO	Southern Leyte Electric Cooperative
SORECO	Sorsogon Electric Cooperative
SUKELCO	Sultan Kudarat Electric Cooperative
SURSECO	Surigao del Sur Electric Cooperative
SURNECO	Surigao del Norte Electric Cooperative
VRESCO	VMC Rural Electric Cooperative
ZAMCELCO	Zamboanga City Electric Cooperative
ZAMSURECO	Zamboanga del Sur Electric Cooperative
ZANECO	Zamboanga del Norte Electric Cooperative

Electricity Market:

IMEM	Interim Mindanao Electricity Market
PEMC	Philippine Electricity Market Corporation
WESM	Wholesale Electricity Spot Market

Government Oversight/Regulatory Agencies:

ERC	Energy Regulatory Commission
DOE	Department of Energy
GMC	Grid Management Committee
NEDA	National Economic & Development Authority
NPC	National Power Corporation
PSALM	Power Sector Assets & Liabilities Management
TRANSCO	National Transmission Corporation
SPUG	Small Power Utilities Group

Legal, Environmental and Other Requirements:

CCAP	Climate Change Action Plan
CCC	Climate Change Commission
EPIRA	Electric Power Industry Reform Act
IMS	Integrated Management System
OSHAS	Occupational Health & Safety

PGC	Philippine Grid Code
QMS	Quality Management System
RE Law	Renewable Energy Law

Other Companies and Service Providers:

CEPRI	China Elecric Power Research Institute
SACC	State Grid Corporation of China

Power Generating Companies:

CEDC	Cebu Energy Development Corporation
GN Power	General Nakar Power
FGHPC	First Gen Hydro Power Corporation
KEPCO	Korea Electric Power Corporation
KSPC	KEPCO SPC Power Corporation
MAEC	Mirae Asia Power Corporation
PCPC	Palm Concepcion Power Corporation
PEDC	Panay Energy Development Corporation
QPPL	Quezon Power Philippines Limited
RP Energy	Redondo Peninsula Energy
SMCPC	San Miguel Consolidated Power Corporation
TAREC	Trans-Asia Renewable Energy Corporation

Power Plants:

CCPP	Combined Cycle Power Plant
CFPP	Coal-Fired Power Plant
DPP	Diesel Power Plant
GPP	Geothermal Power Plant
HEPP	Hydro Electric Power Plant
LNG	Liquified Natural Gas
NGPP	Natural Gas Power Plant
RE	Renewable Energy
Solar PV	Solar Photovoltaic

Private Distribution Utilities:

CEPALCO	Cagayan Electric Power & Light Company
CEDC	Clark Electric Development Corporation
COLIGHT	Cotabato Light and Power Company
DLPC	Davao Light and Power Corporation

MERALCO	Manila Electric Company
SFELAPCO	San Fernando Electric Light and Power Company

Regions/Areas:

CBD	Central Business District
NCR	National Capital Region
NCMA	North Central Mindanao Area
NEMA	North Eastern Mindanao Area
NWMA	North Western Mindanao Area
SEMA	South Eastern Mindanao Area
SOCCSKSARGEN	South Cotabato, Cotabato, Sultan Kudarat, Sarrangani & Gen Santos
SRP	South Road Properties
SWMA	South Western Mindanao Area

Regulatory:

ASAI	Ancillary Services Availability Indicator
CA	Connection Assets
CC/RSTC	Connection Charges/Residual Sub-transmission Charges
ConA	Congestion Availability
CSI	Customer Satisfaction Indicator
FD	Final Determination
FIT	Feed-in-Tariff
FOT / 100 Ckt-km	Frequency of Tripping per 100 circuit-km
OATS	Open Access Transmission Service
PA	Provisional Authority
PBR	Performance-Based Ratemaking
RAB	Regulatory Asset Base
RSTA	Residual Sub-transmission Assets
RTWR	Rules for Setting Transmission Wheeling Rate
SA	System Availability
SEIL	Std. Equipment Identification and Labeling
SISI	System Interruption Severity Index

Supply-Demand and Investment:

AAGCR	Annual Average Compounded Growth Rate
CAPEX	Capital Expenditures
CDOR	Consolidated Daily Operating Report
CR	Contingency Reserve

DR	Dispatchable Reserve
FRR	Frequency Regulating Reserve
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
IMF	International Monetary Fund
LoLp	Loss, Load Probability
SPD	System Peak Demand

Transmission Service Provider:

NGCP	National Grid Corporation of the Philippines

Transmission System/Projects:

ACSR	Aluminum Cable Steel Reinforced
ACSR/AS	Aluminum Cable Steel Reinforced/ Aluminum-clad Steel
AIS	Air Insulated Switchgear
CTS	Cable Terminal Station
CS	Converter Station
DC1	Double Circuit Transmission Line First Stringing
DC2	Double Circuit Transmission Line Second Stringing
EHV	Extra High Voltage
ES	Electrode Station
ERS	Emergency Restoration System
ETC	Expected Target Completion
GIS	Gas Insulated Switchgear
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
MCM	Thousand Circular Mills
OHTL	Overhead Transmission Line
O & M	Operation and Maintenance
PCB	Power Circuit Breaker
ROW	Right-of-Way
SACS	Substation Automation Control System
SO	System Operations
SCADA	Supervisory Control and Data Acquisition
SIS	System Impact Study
SPD	System Peak Demand
SPS	Special Protection System
SP-SC	Steel Pole Single Circuit
SP-DC	Steel Pole Double Circuit
ST-SC	Steel Tower Single Circuit
ST-DC	Steel Pole Double Circuit

S/S	Substation
TACSR	Thermal Aluminum Cable Steel Reinforced
T/L	Transmission Line

Unit of Measure:

ckt-km	Circuit-kilometer
km	kilometer
kV	kilo-Volt
MVA	Mega-Volt Ampere
MVAR	Mega-Volt Ampere Reactive
MW	Mega-Watt
UTS	Ultimate Tensile Strength

Appendix 6 – Contact Details

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