NGCP

BRIDGING POWER & PROGRESS

TRANSMISSION DEVELOPMENT PLAN 2016–2040

Major Network Development

VOLUME 1

Final Report

TRANSMISSION DEVELOPMENT PLAN 2016-2040

Final Report

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FOREWORD

NGCP is pleased to present its Transmission Development Plan 2016-2040, the 25-year roadmap for the expansion of the Philippine power grid. TDP 2016-2040 contains the status of ERC-approved ongoing projects for the 4th Regulatory Period (2016-2020), proposed transmission projects to also start implementation within the 4th Regulatory Period, as well as crucial projects for implementation in the 5th Regulatory Period (2021-2025). Beyond 2025 are indicative transmission projects for the succeeding five-year intervals until 2040. This extension of planning horizon up to 2040 as aligned with the Power Development Plan (PDP) 2016-2040 of the Department of Energy (DOE) is the major update in this TDP.

In Luzon, grid development is driven by incoming large capacity coal-fired and natural gas power plants that are mainly concentrated in Batangas, Quezon, Bataan, and Zambales. The establishment of the first 500 kV transmission system for bulk power delivery within Metro Manila and the development of three additional 230 kV drawdown substations will be implemented to improve power quality and supply reliability. There is also a need for looping configuration development for the 230 kV and 500 kV system, as well as the installation of reactive power compensating equipment at various substations. Part of the long-term plan is the development of a 500 kV backbone extension both in the western and eastern side of northern Luzon to serve as power generation highway.

In Visayas, the reinforcement of the existing 138 kV Cebu-Negros-Panay submarine cable interconnection, the development of 230 kV transmission backbone from Cebu up to Panay Island (Cebu-Negros-Panay 230 kV Backbone), and the development of the new 230 kV backbone up to Bohol are intended to accommodate conventional and renewable energy-based generation projects. Similarly, as a complement to the development of 230 kV Visayas Backbone, gradual establishment of a looping configuration for the 138 kV transmission system to improve system reliability will also be implemented.

In Mindanao, the entry of several coal-fired power plants with potential large capacity expansion and the forecasted load growth require the development of various 230 kV transmission lines—including the 230 kV Mindanao Backbone which will serve as the island's bulk power highway from north to south Mindanao, upgrading and extension of 138 kV lines, and looping of 69 kV lines. The implementation of the Mindanao-Visayas Interconnection Project (MVIP) will also allow export of power to the other major grids. In the long-term, additional drawdown transformers for bulk power delivery in various substations and the interconnection of various Islands of the country to the main grid are envisioned.

NGCP is also implementing resiliency planning to improve the ability of the power system to withstand the effects of adverse environmental conditions, man-made power interruptions, and other system disturbances. The increasing frequency of hazards requires the transmission system to build its preventive and risk reduction measures, adopt the “build back better” principle after disasters, and build better from the start.

Interface activities shall be undertaken with the DOE, energy industry stakeholders, local government units, and the public, among others, during the transmission planning stage. This development strategy is geared towards possible co-location of portions of the proposed transmission lines to facilitate right-of-way acquisitions and minimize its effect on human settlements.

With the support and inputs of stakeholders in the development of this document, NGCP is ensured of the smooth implementation of its comprehensive, responsive TDP towards "Bridging Power and Progress.”

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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, and 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 2040. This is the counterpart TDP to the Power Development Plan (PDP) 2016-2040 of the Department of Energy (DOE).

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 Network Provider (TNP) 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 TDP 2016-2040 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 input to the simulation studies to identify future transmission needs and transmission expansions in each grid;

Chapter 5 presents the latest generation capacity addition including Renewable Energy (RE), potential resource areas and recommended connection points of power plants as inputs to the simulation studies to determine the required 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;

Chapters 8-10 discuss the transmission outlook for 2016-2040 including discussion on project components and drivers for the proposed transmission projects for Luzon, the Visayas and Mindanao Grids;

Chapter 11 presents the major island interconnections, such as the Mindanao-Visayas Interconnection Project and transmission backbone projects for the period 2016-2040. 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., TDP 2014-2015 vs. TDP 2016-2040.

2.1 TDP Process Flowchart

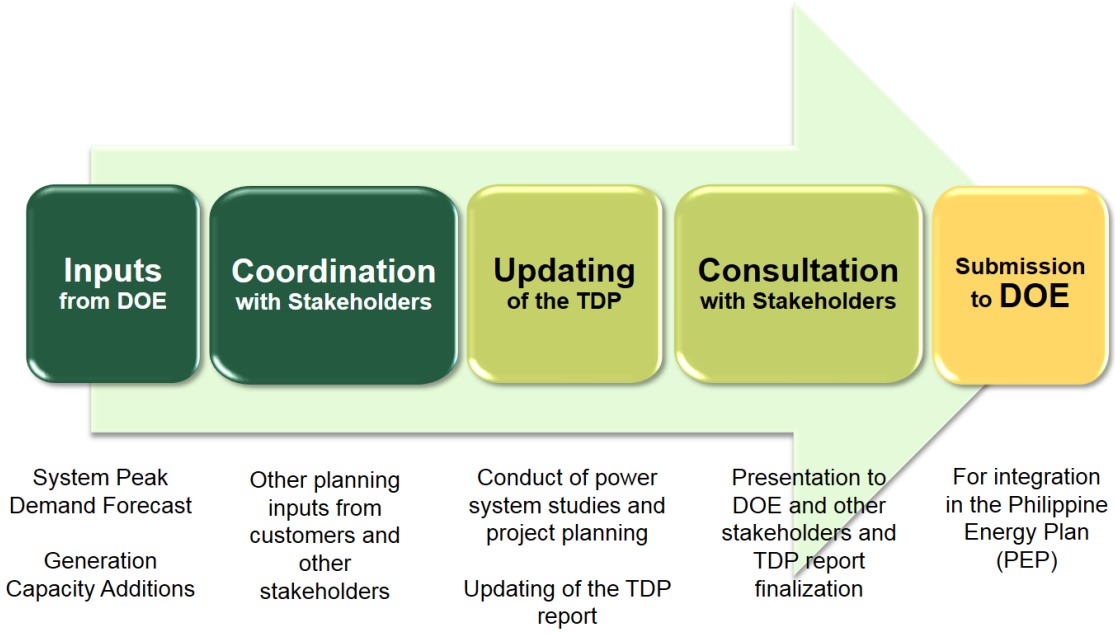


Figure 2.1 - TDP Preparation Process

2.2 Actual Duration for Each Step for the 2016-2040

Steps	Duration	Remarks
1. Inputs from DOE		System peak forecast was received on May 23, 2017 and the adopted generation addition line up was the List of Private Sector Initiated Power Projects as of September 2017.
2. Coordination with Stakeholders	2 months	
3. Updating of the TDP	5 months	Submitted to DOE on March 27, 2018 and web posting on April 5, 2018
4. Consultation with Stakeholders	2 months	April to May 2018
5. Submission to DOE		July 2018

2.3 Description of Each Steps

Step 1: Inputs from 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 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 forecasts are used.

Step 2: Coordination with 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 (DDP) of Distribution Utilities, expansion programs of Generator Companies and other directly connected customers. In addition, coordination meetings with other stakeholders are also conducted.

Step 3: Updating of the TDP

The identification of system requirements for the next 25 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 planning horizon 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 are considered for the Visayas Grid and lastly, Maximum North and Dry Season scenarios for the Mindanao Grid.

These scenarios are primarily premised on the determination of bulk power transfer capability of the grid. To also evaluate the market impact, NGCP is already developing the market model using a newly acquired tool/program which is part of the enhancementsin long-term transmission planning. As there are many uncertainties in the future, the market simulation will aim to establish a range of plausible future scenarios both for load and generation development.

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 Mindanao-Visayas Interconnection Project.

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 load transfer or load reallocation to the new substation nodes in the grid.

Step 4: Consultation with the 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 to 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). Moreover, the EPIRA also provides that prior to project implementation, approval by the Energy Regulatory Commission (ERC) is required. This is being undertaken by individual/batch of projects application or included in the capital expenditures (CAPEX) application during the regulatory reset process.

2.4 Use of the TDP 2016-2040 in the Regulatory Reset Application

The TDP 2016-2040 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 2016-2040 under the TDP 2016-2040 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 Regulatory Reset applications for 2nd and 3rd Regulatory Periods, respectively, the capital expenditures of NGCP for Major Network Development were included in the documentation of the TDP 2016-2040 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 Energy Regulatory Commission (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, which 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 limits.

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 that include the Mindanao-Visayas Interconnection Project and Batangas-Mindoro Interconnection Project (BMIP).

Project drivers are highly interrelated that project benefits will not be limited to addressing the main driver only. Projects addressing load growth, generation entry and system reliability, for instance, are same projects that will address system congestions.

2.5 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 services 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 increase or decrease of transmission rates 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 June 2017, a total of 34,007 MVA substation capacities and 20,849 circuit-km are accounted in the transmission assets being managed by NGCP. 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	2016	2017
PHILIPPINES	26,796	27,726	27,931	30,607	31,038	33,701	34,007
Luzon	20,589	21,170	21,110	23,395	23,785	25,900	25,887
Visayas	3,414	3,414	3,504	3,734	3,926	3,899	4,474
Mindanao	2,793	3,142	3,318	3,478	3,327	3,902	3,646
	TRANSMISSION LINE LENGTH (IN CKT-KM)						
	2011	2012*	2013*	2014	2015	2016	2017
PHILIPPINES	19,704	19,490	19,425	19,463	20,073	20,159	20,849
Luzon	9,529	9,374	9,439	9,370	9,428	9,602	9,795
Visayas	4,918	4,971	4,840	4,821	4,813	4,476	4,973
Mindanao	5,257	5,145	5,146	5,272	5,832	6,081	6,081

*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	3,267.1	1,472.5
Luzon	2,766	875
Visayas	238.60	575
Mindanao	262.50	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 31, 2016.

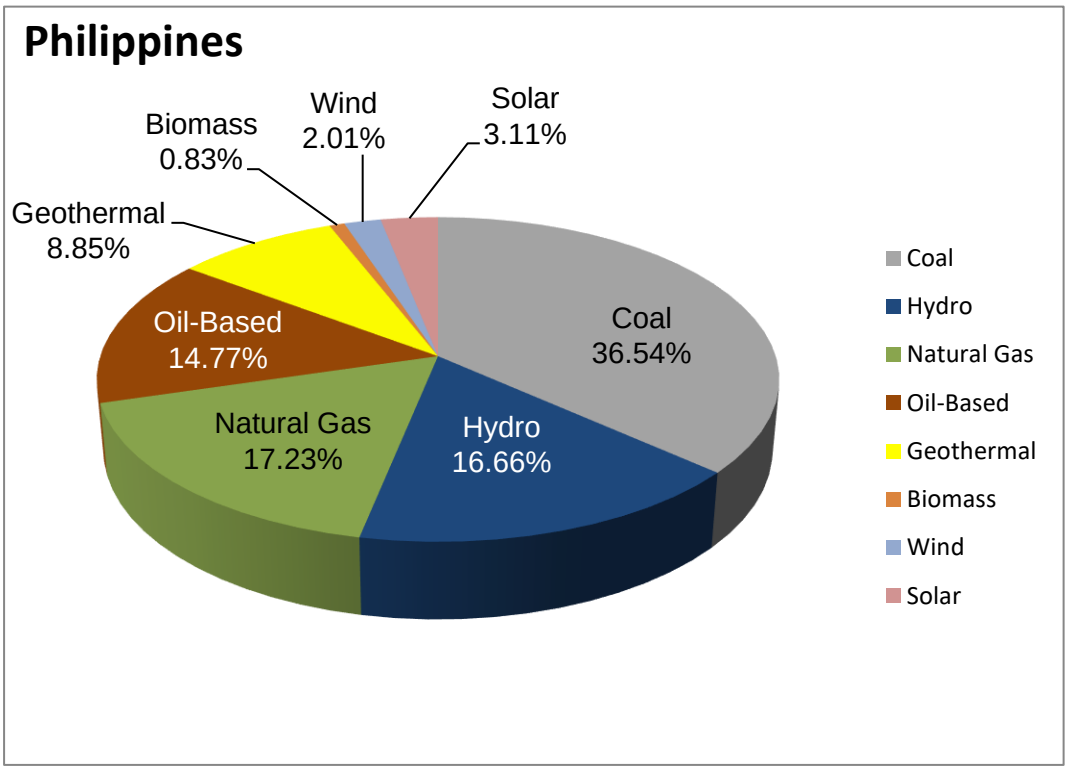


Figure 3.1 – Dependable Capacity Mix

The Philippines has a total dependable capacity of 19,097 MW including embedded generation. Of this, 6,979 MW of the capacity comes from coal-fired power plants (CFPP) and 3,181 MW comes from the hydroelectric power plants (HEPP). Natural gas, oil based and geothermal power plants accounts for 3,291 MW, 2,820 MW and 1,689 MW, respectively. The share from all other RE-based plants, on the other hand, is still relatively small with a total dependable capacity of 1,134 MW only.

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

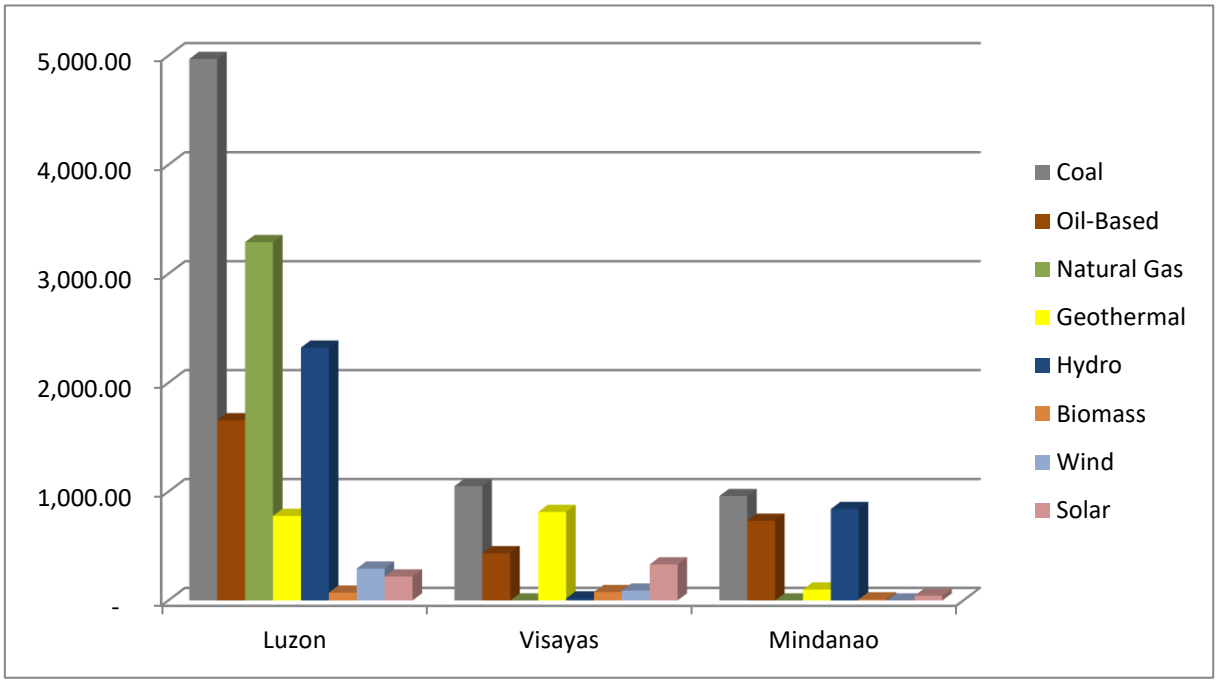


Figure 3.2: Dependable Capacity Mix for Luzon, the Visayas and Mindanao

Table 3.3: Existing Dependable Capacity

Power Plant Type / Fuel Source / RE Source	LUZON		VISAYAS		MINDANAO	
	MW	%	MW	%	MW	%
Conventional Power Plants	9,916		1,484		1,691	
▪ Coal	4,970	36.54%	1,050	37.33%	959	35.72%
▪ Oil-based	1,655	12.17%	434	15.43%	732	27.27%
▪ Natural Gas	3,291	24.20%	-	-	-	-
RE-Based Power Plants	3,684		1,329		993	
▪ Wind	293	2.15%	90	3.20%	-	-
▪ Solar PV	220	1.62%	331	11.77%	43	1.60%
▪ Biomass	71	0.52%	77	2.74%	10	0.37%
▪ Geothermal	777	5.71%	813	28.90%	100	3.72%
▪ Hydro	2,323	17.08%	18	0.64%	840	31.28%
TOTAL	13,600		2,813		2,684	

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 drawn 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 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.

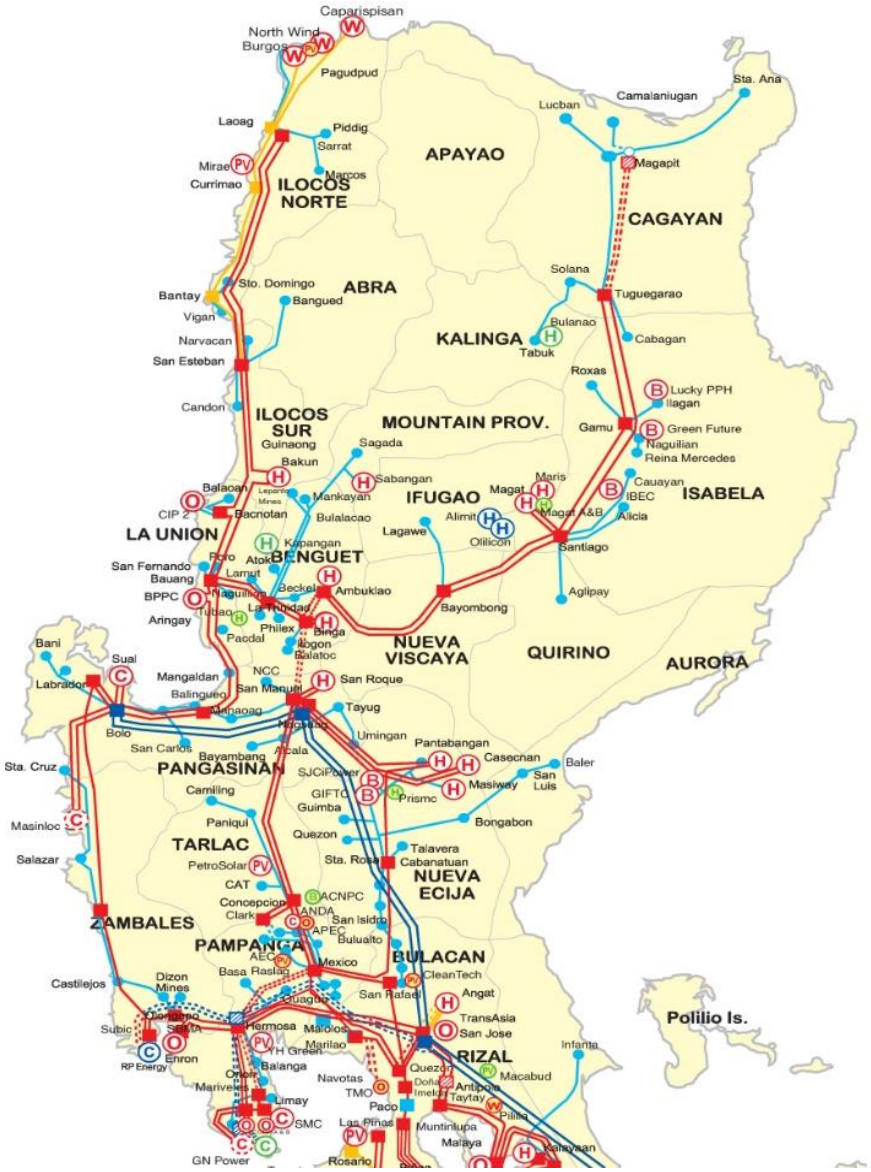


Figure 3.4 – North Luzon Transmission Corridor

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

As the center of commerce and trade, further increase in demand within Metro Manila is expected, 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 development of Antipolo, Navotas, Pasay, and Taguig 230 kV Substation Projects will cater to the demand increase in Metro Manila.

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.

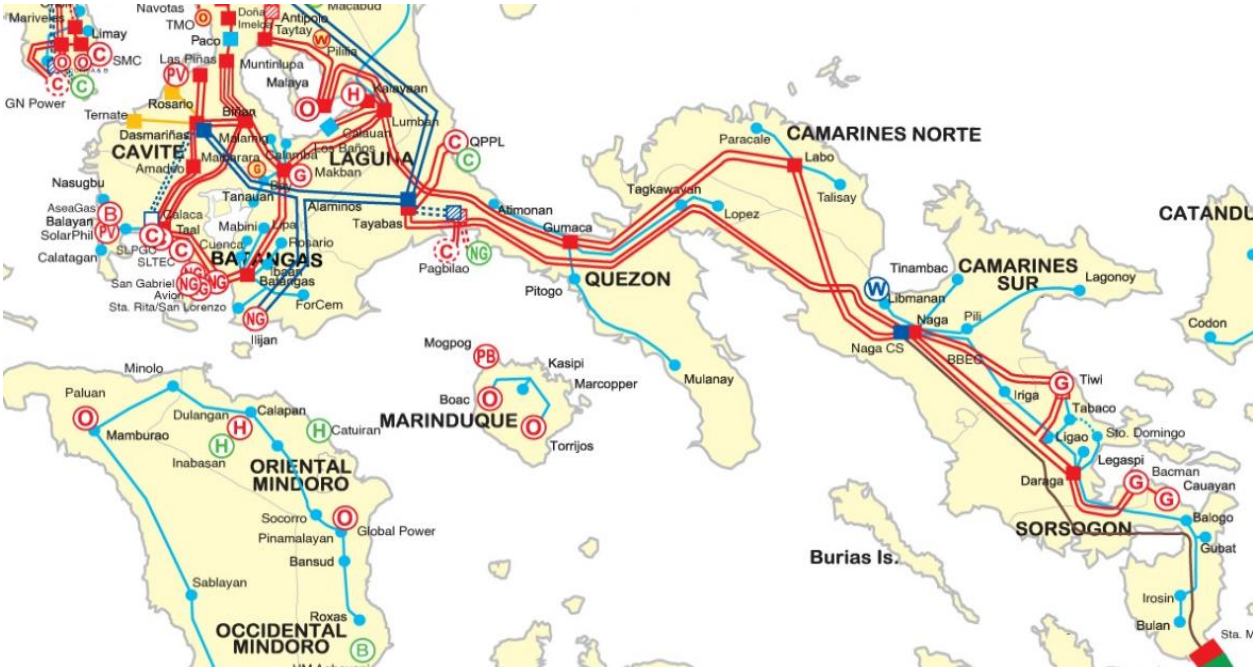


Figure 3.5 – South Luzon Transmission Corridor

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 (commissioned in 1998) 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 with indicated capacity as follows: 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 3.6 – 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 Ormoc-Babatngon and Ormoc-Maasin 138 kV lines, respectively. Also, Leyte has a 230 kV interconnection to Cebu enabling the other islands to source power from cheaper geothermal resources. Leyte is the site of 593 MW geothermal resources that comprise about 21% of the total dependable capacity in the Visayas.

Figure 3.7: 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 2017, it has a peak load of 976 MW which accounted for 49.42% of the grid's total demand. Bohol has the lowest peak load among sub-grids at 87 MW (4.41%) in 2017.

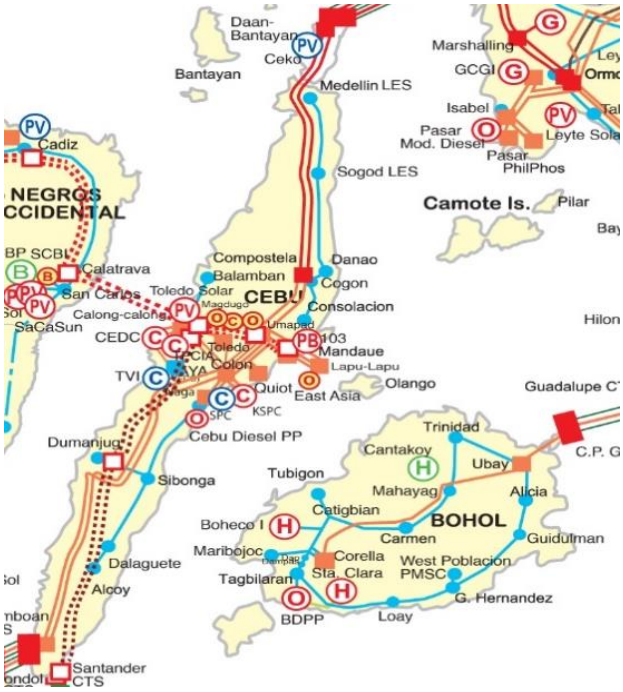


Fig 3.8: Central Visayas Transmission Network

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 239.9 MW generation

capacity was added in the Negros Island with the entry of Calumangan DPP, Helios Solar, Negros Island Solar Power, Monte Solar, San Carlos Sun Power, and Silay Solar from December 2015 to December 2016.

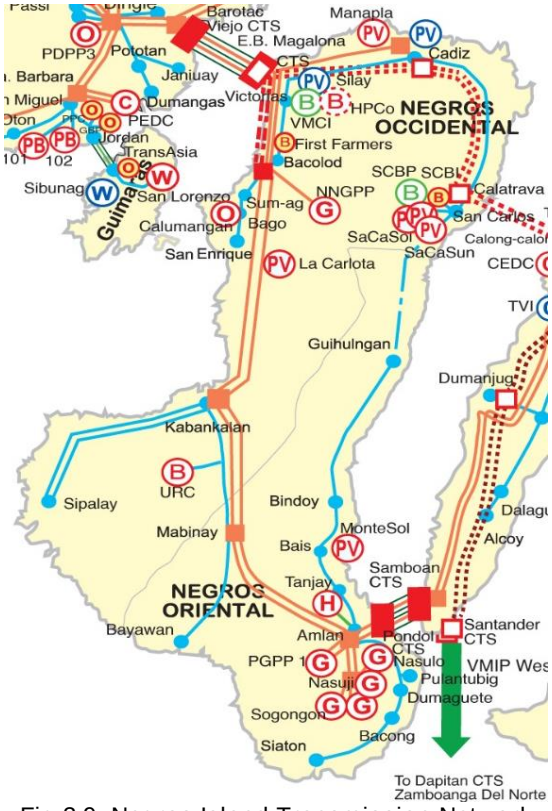


Fig 3.9: Negros Island Transmission Network

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 305.6 MW generation capacity was added in the Panay Island with the entry of PCPC Coal, PEDC Coal Unit 3, Avon-Nabas DPP, and Avon-Washington DPP from December 2015 to December 2016.

Figure 3.10: Panay Island Transmission Network

3.5 Mindanao Transmission Network

The Mindanao transmission system is composed of six Districts:

1. North Western Mindanao Area (District 1 – NWMA) covers Zamboanga area and Misamis Occidental,
2. Lanao Area (District 2 - LA) includes Lanao del Norte and Lanao del Sur,
3. North Central Mindanao Area (District 3 - NCMA) includes the provinces of Bukidnon and Misamis Oriental,
4. North Eastern Mindanao Area (District 4 - NEMA) is comprised of Agusan and Surigao provinces,
5. South Eastern Mindanao Area (District 5 - SEMA) is the Davao Region, and
6. 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. 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.

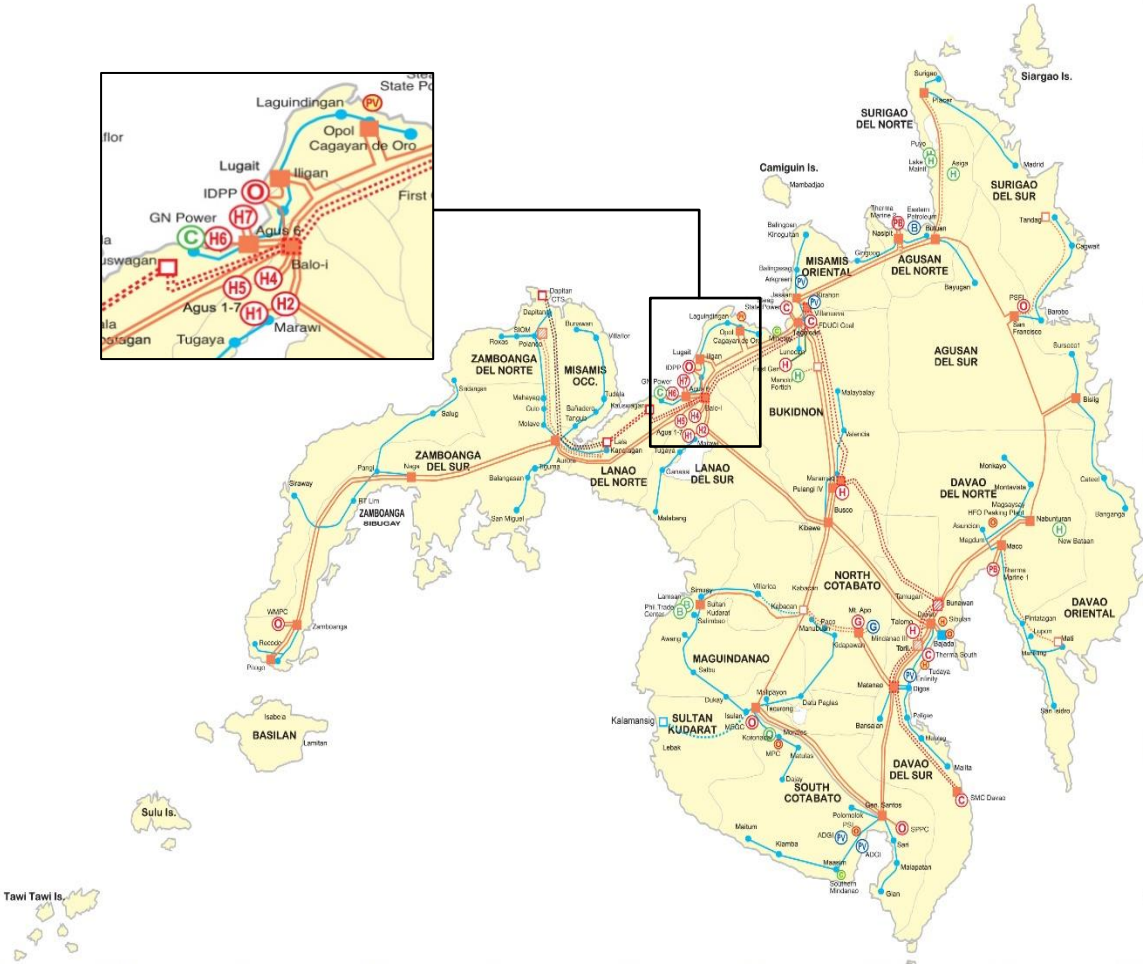


Figure 3.11 – Mindanao Transmission Network

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 TDP 2016-2040 adopted the peak demand projections of the Department of Energy (DOE) based on high GDP-to-elasticity approach with 7%-8% assumed annual GDP growth rate.

4.1.2 Historical and Projected Demand for Electricity

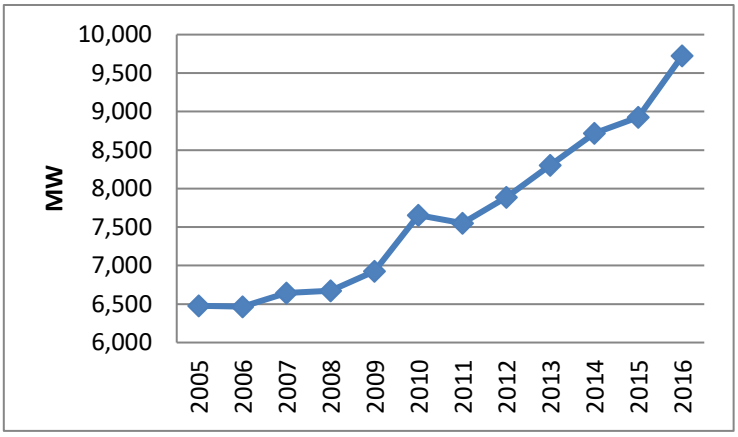
Total peak demand (in MW, non-coincident sum) of the Philippines shows consistent upward trend from 2005 to 2016 with an Average Annual Compounded Growth Rate (AACGR) of 4.03%. Total demand growth was at its highest in 2010 (at 9.53%) while it was at its most sluggish in 2011 (at 0.04%).

Table 4.1: Summary of Historical Demand per Grid (2005-2016), 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
2016	9,726	1,893	1,653	13,272
%AACGR (2006-2016)	3.76%	6.30%	3.36%	4.03%

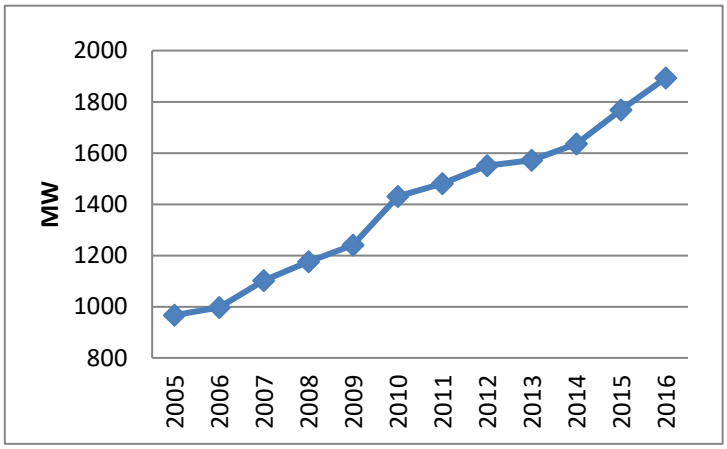
*Includes embedded generation monitored by NGCP

4.1.2.1 Luzon



The Luzon Grid has posted an AACGR of 3.76% for the period 2006-2016. 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 has 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. From 2013 to 2016, Luzon posted an average annual growth of 5.40% or by 474 MW.

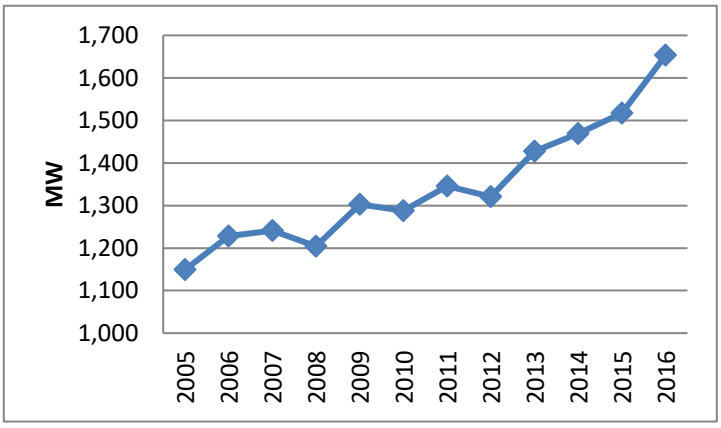
4.1.2.2 Visayas



The aggregate demand in Visayas Grid has posted an AACGR of 6.30% for the period 2006-2016. 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% in 2010. 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 generation 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. Visayas demand grew by 4.04% year after the Typhoon Yolanda and the demand continued to rise by 8.08% and 7.05% in 2015 and 2016, respectively. In the last two years, 257 MW load was added to the demand of Visayas.

4.1.2.3 Mindanao

Mindanao Grid has posted an AACGR of 3.36% for the period 2006-2016. After recording high annual growth rates from 2002 to 2004 (an annual 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 years 2005, 2008, 2010 and 2012. The year 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 was due to the El Niño phenomenon that hampered hydropower generation, which comprised about half of the Grid's installed capacity. Mindanao power demand recovered in the recent years and grew by 8.10% in 2013 then maintained at around 3.07% growth rate in the next two years. In 2016, a record high 8.98% demand growth was registered in Mindanao Grid. More than 800 MW additional generation capacity was added to Mindanao in 2016.

4.2 Forecast for TDP 2016-2040

Power demand for the country is expected to grow at an AACGR of 5.65% for the period 2017-2020, 5.60% for 2021-2030 and 5.75% for 2031-2040. It is projected that Mindanao will have the highest AACGR compared with the two other Grids. Mindanao is forecasted to reach an AACGR of 7.89% for 2017-2040 while the Luzon and Visayas Grids at 4.86% and 6.82%, respectively. The peak demand used for Luzon in 2017 is the actual year-to-date peak demand of 10,054 MW (based on generation level) which occurred in May. Table 4.2 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 25 May 2017 based on the generation level. Applicable system losses were applied to the generation level to disaggregate the forecast down to the NGCP transformers.

A comparison of the projected load and generation capacity per area per grid is also available in Appendix 3.

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

District	Area	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Luzon		9,537	10,019	10,529	11,067	11,599	12,159	12,747	13,368	14,018	17,823	22,685	28,874
MERALCO		7,228	7,618	7,936	8,265	8,619	8,995	9,393	9,817	10,253	12,768	15,915	19,854
1	NCR	5,070	5,343	5,567	5,798	6,045	6,309	6,589	6,886	7,192	8,956	11,164	13,927
2	North	315	331	345	360	374	391	407	426	445	554	690	861
3	South	1,843	1,944	2,024	2,107	2,200	2,295	2,397	2,505	2,616	3,257	4,061	5,066
North Luzon		1,696	1,761	1,907	2,085	2,247	2,409	2,563	2,716	2,879	3,859	5,142	6,803
1	Ilocos	145	149	161	173	181	193	204	216	228	302	393	509
2	Mt. Province	123	126	132	137	144	153	162	171	181	240	313	405
3	North Central	174	185	213	243	255	272	289	306	325	439	595	791
4	Cagayan Valley	177	190	208	223	236	254	273	293	315	456	676	976
5	West Central	343	350	372	413	456	498	537	571	607	816	1067	1396
6	South Central	662	687	748	821	898	961	1017	1076	1137	1506	1978	2578
7	North Tagalog	72	72	73	75	76	78	81	83	85	100	121	149
South Luzon		613	640	685	716	733	755	792	835	886	1,196	1,629	2,218
1	Batangas/Cavite	316	330	349	363	373	384	403	424	450	605	826	1131
2	Laguna/ Quezon	103	105	110	114	115	118	123	129	136	179	240	324
3	Bicol	194	205	227	240	244	252	266	281	300	412	563	762
Visayas		1,896	2,033	2,179	2,335	2,493	2,661	2,841	3,033	3,238	4,497	6,248	8,684
1	Panay	336	360	385	413	440	470	501	535	571	795	1108	1545
2a	Cebu	956	1024	1098	1176	1256	1340	1431	1527	1630	2261	3122	4314
2b	Bohol	72	78	83	89	95	102	109	116	124	173	255	377
3	Leyte-Samar	226	243	260	279	298	318	340	363	388	539	750	1043
4	Negros	306	329	352	378	404	431	461	492	525	729	1012	1406
Mindanao		1,862	2,009	2,168	2,339	2,514	2,701	2,901	3,118	3,350	4,800	6,883	9,873
1	North Western	203	220	244	268	294	322	354	385	421	642	962	1418
2	Lanao Area	115	138	148	158	168	179	191	204	218	289	369	456
3	North Central	472	477	500	524	549	577	606	638	673	887	1189	1619
4	North Eastern	161	192	216	242	268	295	321	352	382	564	827	1202
5	South Eastern	508	549	597	655	709	765	829	897	971	1467	2207	3319
6	South Western	402	433	463	494	526	562	600	641	685	952	1329	1858
Philippines		13,295	14,061	14,876	15,741	16,606	17,521	18,490	19,519	20,606	27,121	35,816	47,432

[3]Based on aggregate transformer peak demand coincident with DOE SPD forecast 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 rate 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 deferred. A significant increase in the local load absorption can help stabilize the grid as it can help address the heavily loaded transmission facilities as a result of huge 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.

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 DOE's List of Private Sector Initiated Power Projects 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 August 2015 to December 2016.

Table 5.1: List of Additional Capacities from Aug 2015 to Dec 2016

Power Plant	Location	Installed Capacity (MW)	Dependable Capacity (MW)	Commercial Operation
LUZON				
BATAAN 2020	Samal, Bataan	13	11	Sep 2015
PAMPANGA SOLAR PH2	Brgy. Suclaban, Mexico, Pampanga	13.1	9.2	Dec 2015
BURGOS SOLAR 2	Burgos, Ilocos Norte	2.7	1.9	Jan 2016
PETROSOLAR	Tarlac City, Tarlac	50.1	35	Feb 2016
YH GREEN	Hermosa, Bataan	14.5	10.2	Feb 2016
CURRIMAO SOLAR	Currimao, Ilocos Norte	20	14	Feb 2016
SLTEC PUTING BATO U2	Calaca, Batangas	135	122	Unit 2 - Feb 2016
GIFT	Talavera, Nueva Ecija	12	10.8	Mar 2016
CABANATUAN SOLAR	Cabanatuan City, Nueva Ecija	10.3	7.2	Mar 2016
CALATAGAN SOLAR	Calatagan and Balayan, Batangas	63.3	44.3	Mar 2016
VALENZUELA SOLAR	Brgy. Isla, Valenzuela City	8.5	6	Mar 2016
LIAN SOLAR	Lian, Batangas	2	1.4	Mar 2016
CLARK SOLAR	Prince Balagtas Extension, Clark Special Economic Zone, Mabalacat, Pampanga	22.3	15.6	Mar 2016
PALAUIG SOLAR	Morong, Bataan	5	3.5	Mar 2016
SAN ILDEFONSO SOLAR	San Ildefonso, Bulacan	15	10.5	Mar 2016
BULANAO HEPP	Tabuk, Kalinga	1	1	Mar 2016
SAN GABRIEL	Sta. Rita, Batangas City	450	414	Jul 2016
SLPGC U1	Calaca, Batangas	150	140	Jul 2016
SLPGC U2	Calaca, Batangas	150	140	Jul 2016
AVION	Bolbok, Batangas City	100	97	Aug 2016
ANDA	Brgy. Bundagul, Mabalacat, Pampanga	83.7	72	Sep 2016
STA. RITA SOLAR	Mt. Sta. Rita, Morong and Hermosa, Bataan	7.1	5	Nov 2016
DALAYAP SOLAR	Barangay Dalayap, Tarlac City, Tarlac	7.5	5.2	Dec 2016
	Sub-total (Luzon)	1,344.9	1,183	
VISAYAS				
SACASOL I - C & D	San Carlos, Negros Occidental	23	20	Sep 2015
TPC 1A Expansion	Toledo City, Cebu	83.7	83.7	Oct 2015
VMC	Victorias City, Negros Occidental	3	2.5	Nov 2015
HELIOS	Brgy., Tinampa-an Cadiz City, Negros Occidental	132.5	108	Mar 2016
ISLASOL II	La Carlota City, Negros Occidental	32	27	Mar 2016
ISLASOL III	Manapla, Negros Occidental	48	42	Mar 2016
MONTESOL	Bais City, Negros Occidental	18	14	Mar 2016
SACASUN	San Carlos City, Negros Occidental	23.4	23.4	Mar 2016
VILLASIGA HEPP	Bugasong, Antique	8.1	8	Apr 2016
SILAY SOLAR	Silay City, Negros Occidental	25	20	Apr 2016
CALUMANGAN DPP	Bago City, Negros Occidental	15	12.6	U2 - Apr 2016; U1 and U3 - Jun 2016
PCPC	Concepcion, Iloilo	135	135	Aug 2016
SEPALCO	Palo, Leyte	45	35	Oct 2016
	Sub-total (Visayas)	741.7	681.2	

MINDANAO				
THERMA SOUTH U1	Davao City/ Sta. Cruz, Davao Del Sur	150	130	Sep 2015
KIRAHON SOLAR	Villanueva, Misamis Oriental	12.5	10	Oct 2015
CENTRALLA SOLAR	Brgy. Centralla, Surallah, South Cotabato	6.2	5	Dec 2015
THERMA SOUTH U2	Davao City/ Sta. Cruz, Davao Del Sur	150	130	Feb 2016
KEGI - CAMIGUIN	Brgy. Maubog, Balbagon, Mambajao, Camiguin	4.1	4	Feb 2016
BPC DPP	Barangay Barandias, Municipality of Pangantucan, Province of Bukidnon	4.8	4.8	Feb 2016
KIBAWE SOLAR	Brgy. Labuagon, Kibawe, Bukidnon	10.5	7.3	Mar 2016
DIGOS SOLAR	Brgy. San Roque, DigosCity, Davao del Sur	28.6	20	Mar 2016
SEC	Maasim, Sarangani	118	105	Apr 2016
SPC - KORONADAL	Purok Garfin, Brgy. Paraiso, Koronadal, South Cotabato	11.9	11.9	May 2016
FDC MISAMIC U1	PHIVIDEC,Villanueva,Misamis Oriental	135	124.5	Oct 2016
FDC MISAMIC U2	PHIVIDEC,Villanueva,Misamis Oriental	135	124.5	Oct 2016
SMC MALITA U1	Brgy. Culaman, Malita, Davao Occidental	150	135	Nov 2016
	Sub-Total (Mindanao)	916.6	812	
	TOTAL	3003.2	2676.2	

Based on the DOE List of Existing Plants as of December 2016

The following tables shows the DOE List of Private Sector Initiated Power Projects as of September 30, 2017 for Luzon, Visayas and Mindanao.

Table 5.2: Summary of Generation Capacity Addition

	Total Committed Capacity (MW)	Total Indicative Capacity (MW)
Luzon	6,532.48	16,033.67
Visayas	780.63	3,120.93
Mindanao	1,467.43	2,080.62
PHILIPPINES	8,780.54	21,235.22

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 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			
SMC Limay Coal Phase 2 Unit 3*	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*	500	Mauban, Quezon	2018
Redondo Peninsula Coal*	600	Sitio Naglatore, Cawag, Subic Bay Freeport Zone	2018
AES Masinloc Expansion*	300	Zambales	2019
SMC Limay Coal Phase 2 Unit 4*	150	Brgy. Lamao, Limay, Bataan	2019
GN Power Dinginin Expansion Unit 2*	600	Mariveles, Bataan	2019
AOE Coal Unit 1*	600	Atimonan, Quezon	2021
Global Luzon Coal-Fired Power Plant	670	Brgys. Carisquis and Nalvo Sur, Luna, La Union	2021
AOE Coal Unit 2*	600	Atimonan, Quezon	TBD
Sub-Total Coal	5,190		
OIL-BASED			
SLPGC Gas Turbine Power Unit 3*	23	San Rafael, Calaca, Batangas	2017
SLPGC Gas Turbine Power Unit 4*	23	San Rafael, Calaca, Batangas	2017
Sub-Total Oil-Based	46		
NATURAL GAS			
Pagbilao Combined Cycle*	650	Brgy. Ibabang Polo, Pagbilao, Quezon	2018
Sub-Total Natural Gas	650		
HYDRO			
Maris Main Canal 1 HEP*	8.5	Ramon, Isabela	2017
Tubao Mini Hydro	1.5	Tubao, La Union	2018
Majayjay	3	Majayjay, Laguna	2018
REDC Labayat River*	3	Real, Quezon	2018
Colasi	1	Mercedes, Camarines Norte	2019
Man-Asok*	3	Buguias, Benguet	2019
Dupinga Hydro	3	Gabaldon, Nueva Ecija	2019
Lalawinan Mini-Hydro	3	Real, Quezon	2019
Didipio 1	2.1	Kasibu, Nueva Vizcaya	2020
Didipio 2	9.4	Kasibu, Nueva Vizcaya	2020
Ibulao Hydro*	4.5	Lagawe, Ifugao	2020
Abdao HEP	2	Tabaan Sur, Tuba, Benguet	2020
Barit Hydro	0.4	Buhi, Camarines Sur	2020
Dibuluan	5	San Agustin, Isabela	2020
Kabayan 2 (Natalang HEP)*	38	Kabayan, Benguet	2020
Maapon River Mini-Hydro Power (MHP)	2.6	Brgy. Piis, Lucban, Quezon	2020
Talubin	4.9	Bontoc, Mountain Province	2020
Laguio Malaki 1	1.6	Mauban, Quezon	2021
Laguio Malaki 2	3.1	Mauban, Quezon	2021
Pinacanauan	6	Peñablanca, Cagayan	2021
Davidavilan	1	Mauban, Quezon	2021
Matuno 1	7.4	Ambaguio, Nueva Vizcaya	2021
Matibuey	16	Matibuey, Ilocos Sur	2021
Tibag	4.40	Real, Quezon	2021
Lower Labayat	1.40	Real, Quezon	2021
Besao 1	1	Besao, Mountain Province	2021
Besao 1A	2.30	Besao, Mountain Province	2021
Besao 1B	1.70	Besao, Mountain Province	2021
Besao 2	7	Besao, Mountain Province	2021
Besao 2A	1.50	Besao, Mountain Province	2021
Besao 3	4.5	Besao, Mountain Province	2021
Ibulao 1*	6.75	Kiangan, Ifugao	2021
Lamut*	6	Asipulo & Lamut, Ifugao	2021

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
Hungduan*	4.04	Kiangan, Ifugao	2021
Alilem	16.2	Alilem, Ilocos Sur	2022
Ilaguen*	19	San Mariano & San Guillermo, Isabela	2022
Matuno	8	Bambang, Nueva Vizcaya	2022
Matuno 2	7.9	Bambang, Nueva Ecija	2022
Disabungan	4.8	San Mariano, Isabela	2022
Cawayan 2	1	Sorsogon, Sorsogon	2022
Quirino	11.5	Quirino, Ilocos Sur	2022
Piapi	3.30	Mauban, Quezon	2022
Tignoan River (Upper Cascade) HEP	1.5	Real, Quezon	2022
Asin	7.04	Kiangan, Ifugao	2022
Ilaguen 3	11	Echague, Isabela	2022
Addalam	14.20	Aglipay, Quirino	2022
Kapangan	60	Kapangan & Kibungan, Benguet	2023
Ibulao 2	7.40	Municipalities of Kiangan, Lamut and Lagawe, Province of Ifugao	2023
Addalam	3.80	Aglipay, Quirino	2024
Tinoc 1*	4.1	Tinoc, Ifugao	2025
Tinoc 2*	11	Tinoc, Ifugao	2025
Tinoc 3*	8	Tinoc, Ifugao	2025
Tinoc 4*	5	Tinoc, Ifugao	2025
Tinoc 5	6.9	Tinoc, Ifugao	2025
Tinoc 6	8	Tinoc, Ifugao	2025
Tumauini (Lower Cascade)	7.8	Tumauini, Isabela	2025
Tumauini (Upper Cascade)	14	Tumauini, Isabela	2025
Ilaguen 2*	14	Dinapique, Isabela	2025
Danac	13.2	Sugpon, Ilocos Sur	2025
Sub-Total Hydro	439.23		
SOLAR			
CW Home Depot Solar	1.675	Brgy. Pulong, Sta. Rosa City, Laguna	2016
San Rafael Solar	3.82	San Rafael, Bulacan	2016
Morong Solar	5.02	Morong, Bataan	2016
Sarrat Solar	1	Brgy. 21 San Marcos, Sarrat, Ilocos Norte	2017
Sta. Rita Solar Phase II	92.86	Morong and Hermosa, Bataan	2017
Sub-Total Solar	104.375		
GEOTHERMAL			
Maibarara 2 Geothermal	12	Batangas	2017
Bacman 3 (Tanawon)	31	Guinlajon, Sorsogon	2022
Sub-Total Geothermal	43		
BIOMASS			
SJCiPower Biomass Phase 2	12	Brgy. Tulat, San Jose, Nueva Ecija	2017
ACNPC WTE Biomass	1	Tarlac	2017
Isabela La Suerte Rice Husk-Fired	5	Camarines Sur	2017
CADPI Bagassed-Fired Power Plant	31.875	Batangas	2017
Sub-Total Biomass	49.875		
BATTERY			
AES Battery	10	Masinloc, Zambales	2017
Sub-Total Battery	10		
TOTAL COMMITTED	6,532.48		
TOTAL COMMITTED W/O BATTERY	6,522.48		
INDICATIVE POWER PLANTS			
COAL			
SRPGC Coal*	700	Brgy. San Rafael, Calaca, Batangas	2019
Merbau Coal Power Plant Unit 1 and 2*	300	Brgy. Pinamukan Ibaba, Batangas City	2018
Merbau Coal Power Plant Unit 3 and 4*	300	Brgy. Pinamukan Ibaba, Batangas City	2019
AES Masinloc Expansion Unit 4*	300	Zambales	2020
H&WB Supercritical Coal Unit 1	350	Camarines Norte	2021

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
H&WB Supercritical Coal Unit 2	350	Camarines Norte	2025
SMC Coal*	600	Brgy. Ibabang Polo, Pagbilao, Quezon	TBD
SMC Coal*	600	Sariaya, Quezon	TBD
Quezon Coal Fired Thermal Plant	1200	Tagkawayan, Quezon	TBD
Zestpower Coal Thermal Plant	660	Mariveles, Bataan	TBD
Lucidum Energy Coal	300	Silanguin Bay, Zambales	TBD
KEPCO Coal	1,000	Sual, Pangasinan	TBD
Sub-Total Coal	6,660		
OIL-BASED			
Aero Derivative Combined Cycle	150	Calamba, Laguna	TBD
AC Energy Modular Genset	300	Pililia, Rizal	TBD
Sub-Total Oil-Based	450		
NATURAL GAS			
VIRES LNG-Fired Power Barge*	500	Batangas Bay area, Batangas	2018
Sta. Maria Power Plant (Phase 2)*	450	Santa Rita, Batangas	2019
Batangas CCGT Plant Unit 1	300	Libjo, Batangas City	TBD
Batangas CCGT Plant Unit 2	400	Libjo, Batangas City	TBD
Batangas CCGT Plant Unit 3	400	Libjo, Batangas City	TBD
Sta. Ana CCGT Power Plant	383	Port Irene, Sta. Ana, Cagayan	TBD
Sual CCGT Power Plant	383	Brgy. Baquioen, Sual, Pangasinan	TBD
Sub-Total Natural Gas	2,816		
GEOTHERMAL			
Bacman 4 Botong-Rangas Geothermal*	20	Bacon District, Sorsogon	2022
Kayabon Geothermal*	30	Manito, Albay	2025
Sub-Total Geothermal	50		
SOLAR			
Botolan Solar Power	39.27	Brgy. San Juan, Botolan, Zambales	2017
Macabud Solar Photovoltaic Power	30	Brgy. Macabud, Rodriguez, Rizal	2017
Concepcion Solar*	50.55	Brgy. Sta. Rosa, Concepcion, Tarlac	2017
Cavite Solar	3	Cavite Economic Zone, Rosario Cavite	2017
Cordon Solar PV Power*	50	Cordon, Isabela	2019
Earthenergy Solar Power Plant	30	Balayan, Batangas	2019
V-mars Solar*	10	San Jose/Lupao, Nueva Ecija	2019
SJC Solar*	10	San Jose City, Nueva Ecija	2019
RGEC Solar*	30	Nasugbu and Tuy, batangas	2019
Calabanga Solar	50	Calabanga, Camarines Sur	2019
FPI Solar PV Power	50	Tarlac City, Tarlac	2019
Nueva Ecija Solar Power	100	Pantabangan, Nueva Ecija	2019
Sta. Maria Solar PV Power	125	Sta. Maria, Isabela	2019
Solana Solar Photovoltaic Plant Phase I	24	Hermosa, Bataan	2019
Solana Solar Photovoltaic Plant Phase II	14	Hermosa, Bataan	2019
Sta. Maria Solar Power*	30	Sta. Maria, Isabela	2020
Santa Solar Power	20	Nagpanaoan, Santa, Ilocos	2020
Talugtug Solar PV Power	125	Talugtug, Nueva Ecija	2020
Capas Solar PV Power	50	Capas, Tarlac	2020
Ilagan II Solar PV Power	100	Ilagan City, Isabela	2020
Cabanatuan Solar Power Plant	6.25	Cabanatuan, Nueva Ecija	2020
Magsingal Solar Power Plant	100	Magsingal, Ilocos Sur	TBD
Bongabon Solar Power Plant	18.75	Bongabon, Nueva Ecija	TBD
Calamba and Tanauan Solar Power	100	Tanauan, Batangas	TBD
Capas Solar PV Power	22	Capas, Tarlac	TBD
San Manuel 1 Solar Power	70	San Manuel, Pangasinan	TBD
San Manuel 2 Solar Power	70	San Manuel, Pangasinan	TBD
Iba Palauig Solar Power	100	Iba, Zambales	TBD
Horus Solar Power Plant	45	Morong, Bataan	TBD
Tanauan Batangas Solar I Power	100	Tanauan, Batangas	TBD
Bugallon Solar Power Plant	45	Brgy. Salomague North. Bugallon, Pangasinan	TBD
Laguna Lake Bangyas Solar Power Plant	25	Calacan and Victoria, Laguna	TBD

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
Lumban Solar Power Plant	37	Lumban, Laguna	TBD
San Miguel Solar Power Plant	50	San Miguel, Bulacan	TBD
Sub-Total Solar	1,729.82		
HYDRO			
Kabayan 1*	20	Kabayan, Benguet	2019
Kabayan 3*	27	Kabayan, Benguet	2019
Bineng 1-2b Combination HEPP*	19	La Trinidad, Benguet	2019
Tignoan HEP*	20	Real, Quezon	2019
Biyao	0.8	Balbalan, Kalinga	2019
Ranggas	1.5	Goa & Tigaon, Camarines Sur	2020
Ibulao I*	6	Kiangan, Ifugao	2020
Bansud	1	Mauban, Quezon	2020
Maris Main Canal 2 HEP*	1.75	Alfonso Lista, Ifugao	2020
100 MW Alimit*	100	Lagawe, Ifugao	2021
240 MW Alimit*	240	Lagawe, Ifugao	2021
Olilicon HEPP*	10	Lagawe, Ifugao	2021
Cervantes-Mankayan-Bakun HEPP	27	Benguet	2021
Addalam	14.20	Cabarroguis, Quirino	2022
Chico Hydroelectric Power	150	Tabuk, Kalinga	2023
Kibungan Pumped-Storage HEPP	500	Kibungan, Benguet	TBD
Ilaguen 4	10	Echague, Isabela	TBD
Wawa Pumped Storage 1 HEP	500	San Mateo, Antipolo, and Rodriguez, Rizal	TBD
Wawa Pumped Storage 2 HEP	100	San Mateo, Antipolo, and Rodriguez, Rizal	TBD
Wawa Pumped Storage 3 HEP	50	San Mateo, Antipolo, and Rodriguez, Rizal	TBD
Nabuangan Run-of-River HEP	10	Apayao	TBD
Dingalan Pumped Storage HEP	500	Dingalan, Aurora	TBD
San Roque Lower East Pumped Storage	400	Pangasinan	TBD
Sub-Total Hydro	2,708.25		
WIND			
Pasuquin East Wind*	48	Pasuquin, Ilocos Norte	2018
Balaoi Wind	45	Brgy. Balaoi, Pagudpud, Ilocos Norte	2018
Sembrano Wind*	80.4	Mt. Sembrano, Mabitac, Laguna	2019
Pagudpud Wind	84	Brgy. Balaoi and Caunayan, Pagudpud, Ilocos Norte	2019
Burgos 2 Wind Power	183	Burgos, Ilocos Norte	2019
Matnog 1 Wind Power	153	Matnog, Sorsogon	2020
Matnog 2 Wind Power	206	Matnog, Sorsogon	2020
Matnog 3 Wind Power	206	Matnog, Sorsogon	2020
Talisay Wind Power	50	Camarines Norte	TBD
Talim Wind Power	140	Rizal	TBD
Calatagan Wind Power	80	Batangas	TBD
Sub-Total Wind	1,275.40		
BIOMASS			
Polillo Biomass Power Plant	1.5	Quezon	2019
NREDC Biomass Power Plant	24	Cagayan	2019
Santa Biomass Power*	10	Brgy. Nagpanaoan, Santa, Ilocos Sur	2019
EcoMarket Solutions Coconut Waste-Fired Biomass Power	2.5	Aurora	2019
CJ Global Waste-to-Energy Power	20	Camarines Sur	2020
Napier Grass-Fired Biomass Power	12	Nueva Ecija	2020
FQBC Biogas Power Plant	1.2	Quezon	2020
Rice Husk-Fired Biomass Power Plant	12	Bulacan	2020
Multi-Feedstock Biomass Power Plant	6	Nueva Ecija	2021
Multi-Feedstock Cogeneration Power	25	Mariveles, Bataan	TBD
Sub-Total Biomass	114.2		
BATTERY			
AES Battery	40	Laoag, Ilocos Norte	TBD
AES Battery	40	Bantay, Ilocos Norte	TBD

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
AES Battery	10	Masinloc, Zambales	TBD
AES Battery	10	Masinloc, Zambales	TBD
AES Battery	10	Masinloc, Zambales	TBD
Enerhiya Central Battery Energy Storage	40	Concepcion, Tarlac	TBD
Enerhiya Sur I Battery Energy Storage	40	Lemery and Tuy, Calaca, Batangas	TBD
Enerhiya Sur II Battery Energy Storage	40	Lumban, Laguna	TBD
Sub-Total Battery	230		
TOTAL INDICATIVE	16,033.67		
TOTAL INDICATIVE W/O BATTERY	15,803.67		

*with SIS

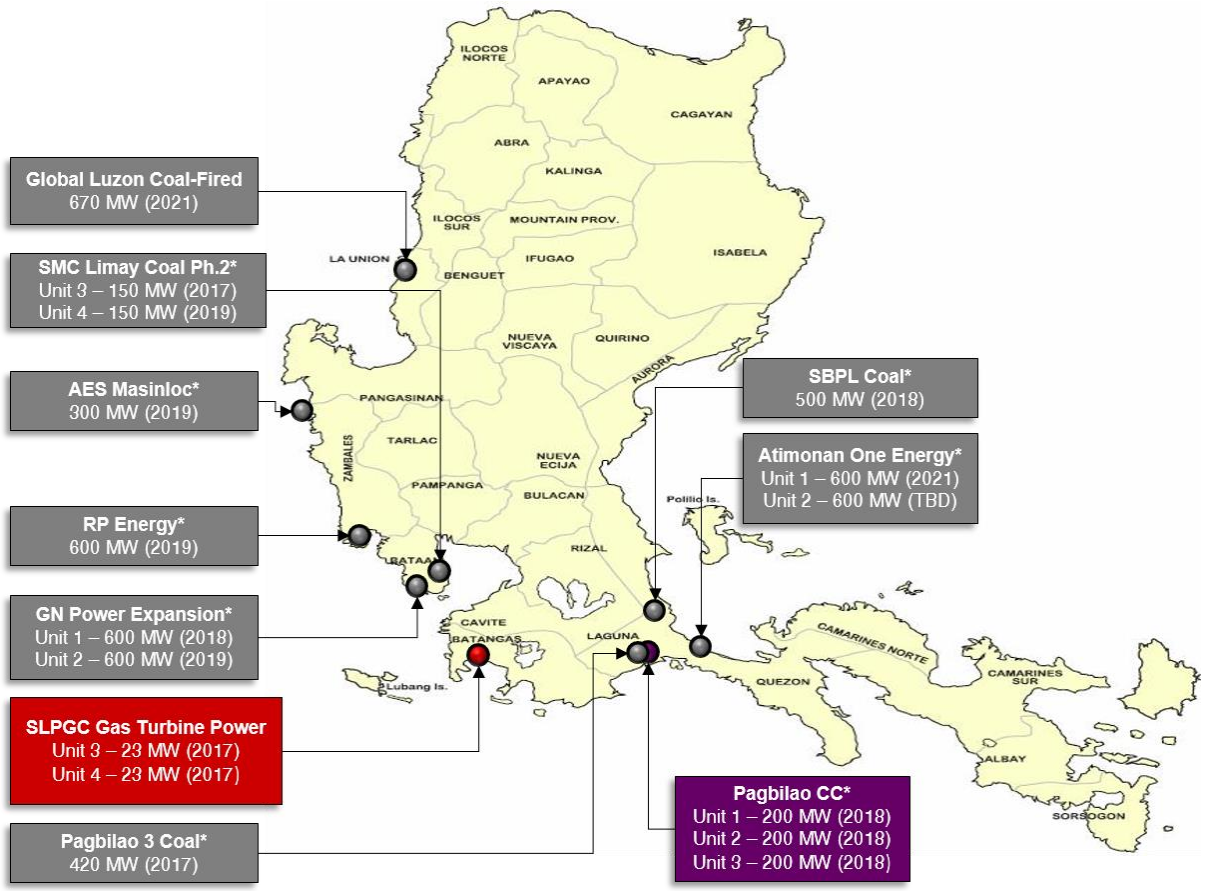


Figure 5.1(a): Luzon Generation Capacity Addition (Committed Conventional Power Plants)

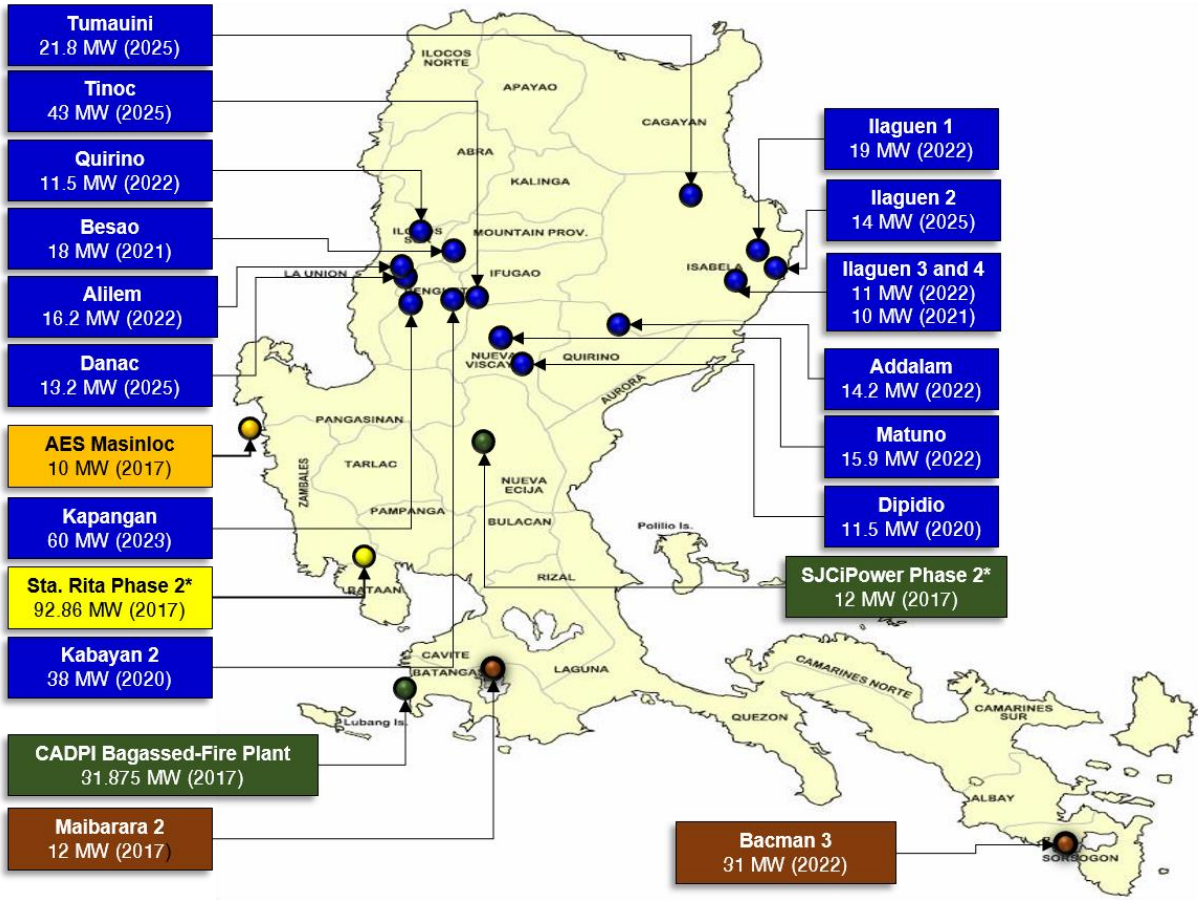


Figure 5.1(b): Luzon Generation Capacity Addition (Committed Renewable Energy Plants)

The table below shows the list of major committed plants in the Luzon Grid and the associated transmission projects that will accommodate their entry.

Table 5.3(b): List of Luzon Major Committed Plants and Associated Transmission Projects

Based on DOE List of Private Sector Initiated Power Projects as of 30 September 2017			Based on Transmission Development Plan 2016-2040		
Proposed Major Power Plants	Capacity (MW)	Comm. Year	Connection Point	Associated Transmission Project	ETC
COAL					
SMC Limay Coal Phase 2 Unit 3*	150	2017	Lamao 230 kV Substation	Bataan 230 kV Grid Reinforcement Project	Aug 2019
Pagbilao 3 Coal*	420	2017	Pagbilao 230 kV Substation	Pagbilao 500 kV Substation Project	Nov 2019
GN Power Dinginin Expansion Unit 1*	600	2018	Limay 500 kV Substation	Mariveles–Hermosa 500 kV Transmission Line Project / Hermosa–San Jose 500 kV Transmission Line Project	Sep 2019/ Dec 2019
San Buenaventura (SBPL) Coal*	500	2018	QPPL 230 kV Substation	Pagbilao 500 kV Substation	Nov 2019
Redondo Peninsula Coal*	600	2018	Hermosa 230 kV Substation	Western Luzon 500 kV Backbone (Stage 1) Project	Jun 2020
AES Masinloc Expansion*	300	2019	Masinloc 230 kV Substation	None	N/A
SMC Limay Coal Phase 2 Unit 4*	150	2019	Lamao 230 kV Substation	Bataan 230kV Grid Reinforcement Project	Aug 2019
GN Power Dinginin Expansion Unit 2*	600	2019	Limay 500 kV Substation	Mariveles–Hermosa 500 kV Transmission Line Project / Hermosa-San Jose 500 kV Transmission Line Project	Sep 2019/ Dec 2019
A1E Coal Unit 1*	600	2021	Pagbilao 500 kV Substation	Pagbilao 500 kV Substation/ Pagbilao–Tayabas 500 kV Transmission Line Project	Nov 2019/ Dec 2024
Global Luzon Coal-Fired Power Plant	670	2021	Balaoan 500 kV Substation	Bolo–San Pablo 500 kV Transmission Line Project	Dec 2024
A1E Coal Unit 2*	600	TBD	Pagbilao 500 kV Substation	Pagbilao 500 kV Substation/ Pagbilao–Tayabas 500 kV Transmission Line Project	Nov 2019/ Dec 2024
OIL-BASED					
SLPGC Gas Turbine Power Unit 3*	23	2017	Calaca 230 kV Substation	Tuy 500 kV Substation Project: Stage 1	Dec 2019
SLPGC Gas Turbine Power Unit 4*	23	2017	Calaca 230 kV Substation	Tuy 500 kV Substation Project: Stage 1	Dec 2019
NATURAL GAS					
Pagbilao Combined Cycle*	650	2018	Pagbilao 230 kV Substation	Pagbilao 500 kV Substation	Nov 2019
HYDRO					
Kabayan 2 (Natalang HEP)*	38	2020	Ambuklao 230 kV Substation	Ambuklao–Binga 230 kV Transmission Line Upgrading Project / Binga–San Manuel Transmission Line Project	Dec 2021 / Dec 2021
SOLAR					
Sta. Rita Solar Phase II	92.86	2017	Subic 230 kV Substation	Hermosa-San Jose 500 kV Transmission Line Project	Dec 2019
GEOTHERMAL					
Bacman 3 (Tanawon)	31	2022	Bacman 230 kV Substation	None	N/A
BIOMASS					
CADPI Bagasse-Fired Power Plant	31.875	2017	Calaca–Nasugbu 69 kV Line	Tuy 500 kV Substation Project: Stage 1	Dec 2019

Note: Commissioning year for each power plant is still subject to update.
*with SIS

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

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
COMMITTED POWER PLANTS			
COAL			
Therma Visayas Energy*	300	Brgy. Bato, Toledo City, Cebu	2017
Concepcion Coal Unit 2*	135	Brgy. Nipa, Concepcion, Iloilo	2018
Sub-Total Coal	435		
OIL-BASED			
CENPRI Diesel Unit 5*	8	Brgy. Calumangan,Bago City, Negros Occidental	2018
Sub-Total Oil-Based	8		
HYDRO			
Igbulo (Bais) Hydro*	5.1	Igbaras, Iloilo	2018
Timbalan*	18	Madalag, Aklan	2019
Cantakoy HEP*	8	Danao, Bohol	2020
Amlan (Plant A)*	3.2	Amlan, Negros Oriental	2020
Amlan (Plant C)*	0.8	Amlan, Negros Oriental	2020
Malogo*	6	Silay City. Negros	2020
Loboc Hydro*	1.2	Loboc, Bohol	2020
Caroan	0.84	Sebaste, Antique	2020
Ipayo	0.84	Sebaste, Antique	2020
Main Aklan River Hydro	15	Libacao, Aklan	2021
Ilaguen 4	10	Echague	2021
Lower Himogaan	4	Sagay, Negros Occidental	2022
Bansud	1.5	Bansud & Gloria, Oriental Mindoro	2022
Basak II	0.5	Badian, Cebu	2025
Amlan (Plant B)*	1.5	Amlan, Negros Oriental	2025
Hilabangan (Lower Cascade)	3	Kabankalan, Negros Occidental	2025
Hilabangan (Upper Cascade)	4.8	Kabankalan, Negros Occidental	2025
Maninila (Lower Cascade)	4.5	San Remigio, Antique	2025
Maninila (Upper Cascade)	3.1	San Remigio, Antique	2025
Sibalom (Upper Cascade)	4.2	San Remigio, Antique	2025
Sibalom (Middle Cascade)	4	San Remigio, Antique	2025
Sibalom (Lower Cascade)	3.3	San Remigio, Antique	2025
Sub-Total Hydro	103.38		
BIOMASS			
Victorias Milling Company Inc. Biomass*	40	Victoria, Negros Occidental	2017
Hawaiian-Philippine Company Biomass*	20.58	Negros Occidental	2017
San Carlos Biopower, Inc.*	20	Negros Occidental	2017
BISCOM Inc. Biomass*	48	Binalbagan, Negros Occidental	2018
Bais Biomass*	25	Calasagan, Bais City, Negros Occidental	2018
South Negros Biopower Inc.*	25	Negros Occidental	2019
Sub-Total Biomass	178.58		
GEOTHERMAL			
Biliran Geothermal*	50	Biliran, Biliran	2018
Sub-Total Geothermal	50		
SOLAR			
Miag-ao Solar*	5.67	Miag-ao, Iloilo	2016
Sub-Total Solar	5.67		
TOTAL COMMITTED	780.63		
INDICATIVE POWER PLANTS			
COAL			
SPC Expansion	300	Brgy. Colon, Naga City, Cebu	TBD
Sub-Total Coal	300		
OIL			
Datem Energy Diesel	10	Northern Samar	TBD

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
Marubeni Corporation Diesel	70	Isabel, Leyte	TBD
Supreme Power Corporation Diesel	7.2	Ubay, Bohol	TBD
Sub-Total Oil	87.2		
NATURAL GAS			
Argao Floating CCGT Power Plant	138	Brgy. Bulasa, Argao, Cebu	TBD
Sub-Total Natural Gas	138		
GEOTHERMAL			
Dauin Geothermal	40	Dauin, Negros Oriental	2025
Sub-Total Geothermal	40		
SOLAR			
Grid Tied Solar Farm	25	Biliran, Biliran	2017
Tigbauan Solar Power Project	34.3	Brgy. Cordova Norte and Bantud, Tigbauan, Iloilo	2018
Victoria Solar Energy Corp.	30.63	Brgy. XII, Victorias City, Negros Occidental	2018
CEKO Solar Farm Systems Corp.	100	Brgy. Tominjao, Daan Bantayan, Cebu	2019
Silay Solar Power Inc. Phase II	10	Silay City, Negros Occidental	2019
Mabinay Solar Power	90	Mabinay, Negros Oriental	2019
Bogo V Solar Power Project	16.7	Bogo , Cebu	2020
Bogo 3 Solar Power Plant	15	Bogo , Cebu	2020
Sanpalo Solar Power Plant	100	San Miguel, Leyte	2020
Medellin Solar Power Plant	100	Medellin, Cebu	TBD
Sub-Total Solar	521.63		
WIND			
Pulupandan Wind	50	Pulupandan, Negros Occidental	2018
Bronzeoak Wind	100	Calatrava, Salvador Benedicto and San Carlos, Negros Occidental	2020
Iloilo 1 Wind Power	213	Batad & San Dionisio, Iloilo	2020
Iloilo 2 Wind Power	500	Concepcion, Iloilo	2020
Negros Wind Power	262	Manapla & Cadiz, Negros Occidental	2020
Nabas Wind Power Phase II	14	Brgy. Pawa, Nabas, Aklan	2021
Montesol Wind Power	54	Bais City, Manjuyod and Mabinay, Negros Oriental	2022
Aklan I Wind Power Phase I	75	Nabas-Malay, Aklan	TBD
Sub-Total Wind	1,268		
HYDRO			
Aklan Pumped-Storage Hydropower	300	Malay, Aklan	2024
Bolusao Pumped Storage	300	Lawaan, Eastern Samar	2024
Ilog Hydroelectric Power Plant	21.6	Mabinay, Negros Occidental	TBD
Sub-Total Hydro	621.6		
BIOMASS			
MCEI Multi-Feedstock Biomass	12	Negros Occidental	2020
UGEP Rice Husk-Fired Biomass	2.5	Iloilo	2020
Sub-total Biomass	14.5		
BATTERY			
AES Battery Storage*	40	Kabankalan, Negros Occidental	2018
Enerhiya Delas Islas I	15	Amlan, Negros Oriental	TBD
Enerhiya Delas Islas II	15	Ormoc, Leyte	TBD
Enerhiya Delas Islas III	15	Compostela, Cebu	TBD
Cadiz Energy Storage	15	Cadiz City, Negros Occidental	TBD
Silay Battery Energy Storage	30	Silay, Negros Occidental	TBD
Sub-Total Battery	130		
TOTAL INDICATIVE	3,120.93		
TOTAL INDICATIVE W/O BATTERY	2,990.93		

*with SIS

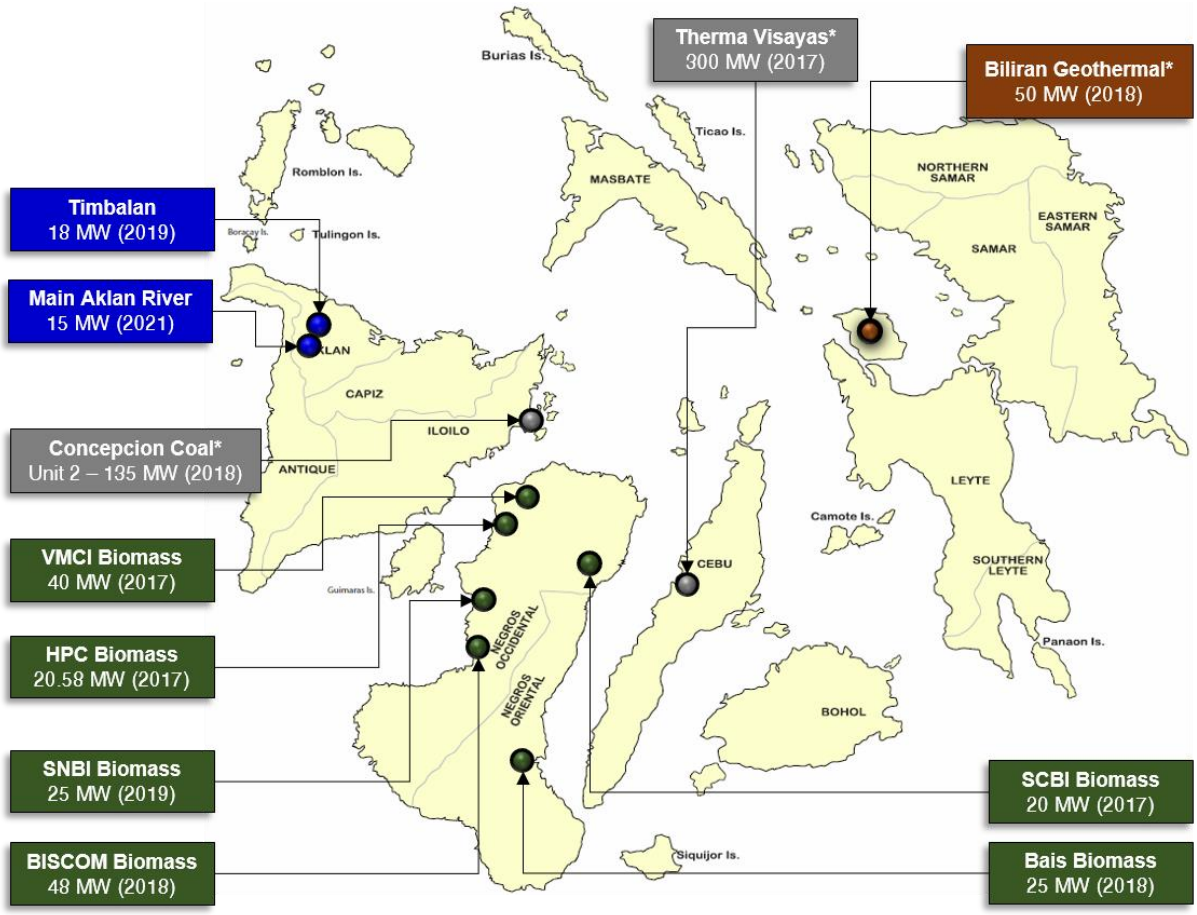


Figure 5.2: Visayas Generation Capacity Addition (Committed Power Plants)

The table below shows the list of major committed plants in the Visayas Grid and the associated transmission projects that will accommodate their entry.

Table 5.3(d): List of Visayas Committed Plants and Associated Transmission Projects

Based on DOE List of Private Sector Initiated Power Projects as of 30 September 2017			Based on Transmission Development Plan 2016-2040		
Proposed Major Power Plants	Capacity (MW)	Comm. Year	Connection Point	Associated Transmission Project	ETC
COAL					
Therma Visayas Energy*	300	2017	Direct connection to Magdugo 230 kV Substation	CNP 230 kV Backbone Stage 3 • Magdugo – Cebu 230 kV line • Magdugo Substation 230 kV Substation • Reconductoring of the Cut-in Line from Quiot S/S CNP 230 kV Backbone Stage 2 (Cebu 230 kV SS)	Dec 2020 July 2019
Concepcion Coal Unit 2*	135	2018	Direct connection to Concepcion Substation	Eastern Panay Transmission Line Project	Mar 2018
OIL-BASED					
CENPRI Diesel Unit 5*	8	2018	Tap connection along Bacolod –	CNP 230 kV Backbone Stage 3	Dec 2020

Based on DOE List of Private Sector Initiated Power Projects as of 30 September 2017			Based on Transmission Development Plan 2016-2040		
Proposed Major Power Plants	Capacity (MW)	Comm. Year	Connection Point	Associated Transmission Project	ETC
			San Enrique 69 kV line		
HYDRO					
Igbulo (Bais) Hydro*	5.1	2018	Tap connection along Sta. Barbara – Miagao 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2020
Timbalan*	18	2019	Tap connection along Panitan - Nabas 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2020
Cantakoy HEP*	8	2020	Tap connection along Ubay - Carmen 69 kV line	None	N/A
Malogo*	6	2020	Tap connection along Bacolod – Silay 69 kV	CNP 230 kV Backbone Stage 3	Dec 2020
Main Aklan River Hydro	15	2021	N/A	None	N/A
Ilaguen 4	10	2021	N/A	None	N/A
BIOMASS					
Victorias Milling Company Inc. Biomass*	40	2017	Tap along Cadiz – Victorias 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2020
Hawaiian-Philippine Company Biomass*	20.58	2017	Tap along Cadiz – Victorias 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2020
San Carlos Biopower, Inc.*	20	2017	Tap connection along Cadiz – San Carlos 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2020
BISCOM Inc. Biomass*	48	2018	Tap connection along Kabankalan – La Castellana 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2020
Bais Biomass*	25	2018	Tap connection along Amlan – Guihulngan 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2020
South Negros Biopower Inc.*	25	2019	Tap connection along Bacolod – San Enrique 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2020
GEOTHERMAL					
Biliran Geothermal*	50	2018	Tap connection along Ormoc – Biliran 69 kV line	None	N/A
SOLAR					
Miag-ao Solar*	5.67	2016	Tap connection along Sta. Barbara – Miagao 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2020

Note: Commissioning year for each power plant is still subject to update.
*with SIS

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

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
COMMITTED POWER PLANTS			
COAL			
FDC-Misamis CFB Coal-Fired Power Plant Unit 3*	135	Phividec Industrial Estate, Villanueva, Misamis Oriental	2016
GNPower Kauswagan*	600	Kauswagan, Lanao del Norte	2017
Southern Mindanao Coal Fired*	100	Brgy. Kamanga, Maasim, Sarangani	Phase II-2018
Sub-Total Coal	835		
OIL			
PSI Bunker Fired Power Plant*	13.94	General Santos City, South Cotabato	2017
PSFI Bunker Fired Power Plant*	5.2	San Francisco, Agusan del Sur	2017
PBI Bunker Fired Power Plant*	10.4	Manolo Fortich, Bukidnon	2017
Sub-Total Oil	29.54		
HYDRO			
New Bataan	2.4	New Bataan, Compostela Valley	2017
Manolo Fortich 1*	43.4	Santiago, Bukidnon	2017
Manolo Fortich 2*	25.4	Santiago, Bukidnon	2017
Lake Mainit*	25	Jabonga, Agusan del Norte	2017
Asiga	8	Santiago, Agusan del Norte	2019
Bubunawan Hydroelectric Power	23	Baungon and Libona, Bukidnon	2021
Culaman Hydroelectric Power Project*	10	Manolo Fortich, Bukidnon	2021
Katipunan River Mini Hydro Power Project	6.2	Cabanglasan, Bukidnon	2021
Upper Manupali	4.4	Valencia City, Bukidnon	2022
Mangima Hydroelectric Power Project	10	Manolo Fortich, Bukidnon	2022
Mat-i-2	1.6	Cagayan de Oro, Misamis Oriental	2022
Mat-i-3	3.25	Cagayan de Oro, Misamis Oriental	2022
Lower Maladugao River Mini-Hydropower Project	15.7	Kailangan and Wao, Bukidnon	2022
Maladugao (Upper Cascade) Hydroelectric Power Project	8.4	Kailangan, Bukidnon	2022
Maramag	1.4	Maramag, Bukidnon	2022
Manupali	9	Valencia, Bukidnon	2022
Malitbog	3.4	Malitbog, Bukidnon	2022
Pulanai	10.6	Valencia, Bukidnon	2022
Langaran	3.6	Calamba, Misamis Occidental	2022
Alamada	2.84	Alamada, North Cotabato	2022
Polandoc	5.7	Leon Postigo, Zamboanga del Norte	2022
Titunod	3.6	Kolambongan, Lanao del Norte	2022
Bayug	17.81	Iligan, Lanao del Norte	2022
Kalaong 1	7.4	Maitum. Sarangani	2022
Puyo Hydroelectric Power Project	30	Jabonga, Agusan del Norte	2023
Kalaong 2	4.8	Maitum, Sarangani	2023
Sawaga River Mini Hydro Power Project	4.5	Malaybalay , Bukidnon	2024
Cabadbaran Hydroelectric Power Project	9.75	Cabadbaran, Agusan del Norte	2024
Tagum	2.6	Maco, Compostela Valley	2024
Tagoloan	39	Impasugong & Sumilao, Bukidnon	2025
Pasonanca	0.5	Zamboanga City	2025
Clarin*	5	Clarin, Misamis Occidental	2025
Mat-i-1	4.85	Claveria, Cagayan de Oro	2025
Lanon (Lam-alu)	9.5	Lake Sebu, South Cotabato	2025
Silo-o	3.29	Malitbog, Bukidnon	2025
Agus III	225	Pantar & Balo-I, Lanao del Sur & Lanao del Norte	2025
Sub-Total Natural Hydro	590.89		

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
BIOMASS			
GEEC Biomass Cogeneration System	3.5	Maguindanao	2017
PTCI Rice Husk-Fired Biomass	3	Sultan Kudarat, Maguindanao	2017
LPC Rice Husk-Fired Biomass	5.5	Sultan Kudarat, Maguindanao	2017
Sub-Total Biomass	12		
TOTAL COMMITTED	1,467.43		
INDICATIVE POWER PLANTS			
COAL			
SMC Davao Power Plant Phase II	300	Brgy. Culaman, Malita, Davao Occidental	2018
Ozamis Coal Fired Power Plant	300	Brgy. Pulot, Ozamiz City, Misamis Occidental	Phase1: 2019 Phase2: 2020
Sibuguey Power Plant Project	100	Sibugay, Zamboanga	TBD
ZAM CFB Coal-Fired Power Station	100	Sitio San Ramon, Brgy. Talisayan, Zamboanga City	TBD
SMC Global Power	328	Brgy. Darong, Santa Cruz, Davao del Sur	TBD
Balingasag Coal-Fired Power Plant	110	Brgy. Mandangoa, Balingasag, Misamis Oriental	TBD
Sub-Total Coal	1,238		
OIL-BASED			
TPI Diesel Power Plant	5.883	Mati, Davao Oriental	2017
Nickel Asia Diesel Power Project	10.9	Surigao City, Surigao del Norte	TBD
Panasia Malita Diesel Power Plant	20	Malita, Davao	TBD
MOPP 4 Diesel Power Plant	8.433	Brgy. San Isidro, Jimenez, Misamis Oriental	TBD
Sub-Total Oil-Based	45.216		
GEOTHERMAL			
Mindanao 3 Geothermal Power Project	30	Kidapawan, North Cotabato	2021
Sub-Total Geothermal	30		
HYDRO			
Limbatangon Hydroelectric Power	9	Cagayan de Oro City, Misamis Oriental	2018
Tumalaong Hydroelectric Power Project	9	Baungon, Bukidnon	2018
Kitaotao 1	70	Bukidnon	2019
Cabulig-2 Hydroelectric	10	Jasaan, Misamis Oriental	2018
Puyo Hydroelectric Power Project	30	Jabonga, Agusan del Norte	2019
Davao Hydroelectric Power Project	140	Davao City	2023
Sub-Total Hydro	268		
SOLAR			
Sumilao Solar Power Project	2	San Vicente, Sumilao, Bukidnon	2018
GenSan Solar Power Project Phase I	48	Brgy. Conel, General Santos City, South Cotabato	2018
GenSan Solar Power Project Phase II	48	Brgy. Tabler, General Santos City, South Cotabato	2018
General Santos City Solar Power	60	General Santos City, South Cotabato	2018
San Francisco Solar Power Project	10	San Francisco, Agusan del Sur	2018
Jasaan Solar Power Project	60	Jasaan, Misamis Oriental	2019
Lal-lo Solar PV Power Plant	100	Maasim, Sarangani	TBD
Solar Power Plant	30	Zamboanga City Special Economic Zone	TBD
Hayes Solar Power Project	27	Villanueva, Misamis Oriental	TBD
Opol Solar Power Project	25	Brgy. Patag, Opol, Misamis Oriental	TBD
Sub-Total Solar	410		
BIOMASS			
12 MW Napier Grass-Fired Biomass	12	Bukidnon	2018
Malay-balay Bio-Energy Corporation	10	Bukidnon	2020
23.5 MW Woody Biomass Power Plant	23.5	Agusan del Norte	2020
NAREDCO Biogas Power Plant	24	Cagayan	2020
Napier Grass-Fired Biomass	5	Bukidnon	2020

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Comm. Year
Bagasse-Fired Co-generation	14.9	Maramag, Bukidnon	TBD
Sub-Total Biomass	89.4		
TOTAL INDICATIVE	2,080.62		

*with SIS

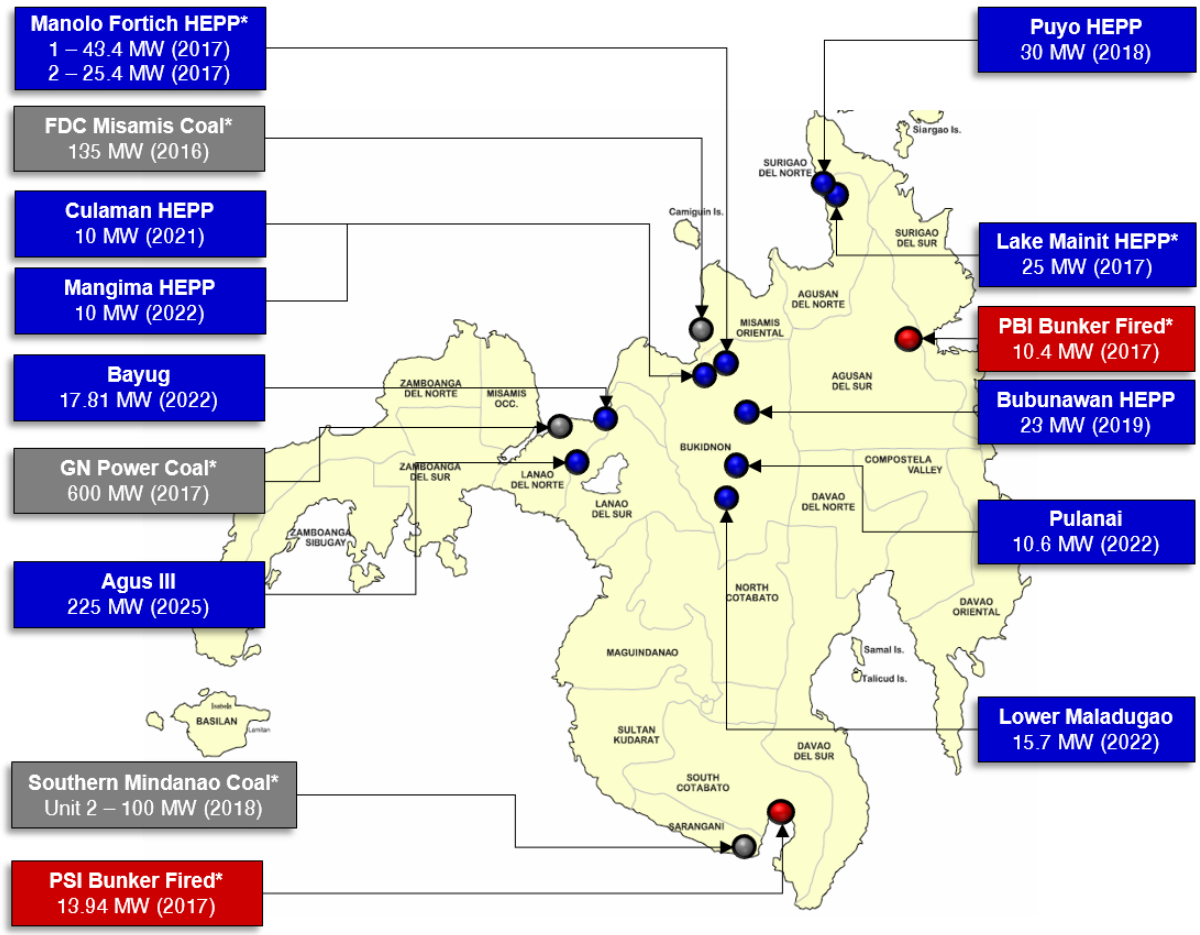


Figure 5.3: Mindanao Generation Capacity Addition (Committed Power Plants)

The table below shows the list of major committed plants in the Mindanao Grid and the associated transmission projects that will accommodate their entry.

Table 5.3(f): List of Mindanao Committed Plants and Associated Transmission Projects

Based on DOE List of Private Sector Initiated Power Projects as of 30 September 2017			Based on Transmission Development Plan 2016-2040		
Proposed Major Power Plants	Capacity (MW)	Comm. Year	Connection Point	Associated Transmission Project	ETC
COAL					
FDC-Misamis CFB Coal-Fired Power Plant Unit 3	135	2016	Villanueva Substation	None	N/A
GNPower Kauswagan	600	2017	Kauswagan Substation	Balo-I – Kauswagan 230 kV Transmission Line Project	Apr 2018
Southern Mindanao Coal Fired	100	Phase II-2018	General Santos Substation	PCB included in Kabacan Substation Project	Dec 2021
OIL					
PSI Bunker Fired Power Plant	13.94	2017	SOCOTECO II'S New Society Substation	None	N/A
PSFI Bunker Fired Power Plant	5.2	2017	ASELCO'S San Francisco Substation	None	N/A
PBI Bunker Fired Power Plant	10.4	2017	BUSECO's Lunocan Substation	None	N/A
HYDRO					
Manolo Fortich 1	43.4	2017	Manolo Fortich Switchyard	Manolo Fortich 138 kV Switching Station Project	Feb 2018
Manolo Fortich 2	25.4	2017	Manolo Fortich Switchyard	Manolo Fortich 138 kV Switching Station Project	Feb 2018
Lake Mainit	25	2017	ANECO's Santiago Substation	None	N/A
Asiga	8	2019	ANECO's 69 kV Transmission System	None	N/A
Bubunawan Hydroelectric Power	23	2021	Manolo Fortich Switchyard	Manolo Fortich 138 kV Switching Station Project	Feb 2018
Culaman Hydroelectric Power Project	10	2021	Manolo Fortich Switchyard	Manolo Fortich 138 kV Switching Station Project	Feb 2018
Katipunan River Mini Hydro Power Project	6.2	2021	BSTC's 69 kV Transmission System	None	N/A
Mangima Hydroelectric Power Project	10	2022	Manolo Fortich Swithcyard	Manolo Fortich 138 kV Switching Station Project	Feb 2018
Lower Maladugao River Mini-Hydropower Project	15.7	2022	FIBECO's 69 kV Transmission System	None	N/A
Maladugao (Upper Cascade) Hydroelectric Power Project	8.4	2022	FIBECO's 69 kV Transmission System	None	N/A
Pulanai	10.6	2022	BSTC's 69 kV Transmission System	None	N/A
Polandoc	5.7	2022	Sindangan Substation	Siom – Sindangan – Salug 69 kV Transmission Line Project	2030
Bayug	17.81	2022	N/A	None	N/A
Kalaong 1	7.4	2022	SOCOTECO II's 69 kV Transmission System	None	N/A
Puyo Hydroelectric Power Project	30	2023	Butuan Substation	None	N/A
Cabadbaran Hydroelectric Power Project	9.75	2024	Butuan – Cabadbaran – Santiago 69 kV Transmission Line	None	N/A

Based on DOE List of Private Sector Initiated Power Projects as of 30 September 2017			Based on Transmission Development Plan 2016-2040		
Proposed Major Power Plants	Capacity (MW)	Comm. Year	Connection Point	Associated Transmission Project	ETC
Tagoloan	39	2025	Manolo Fortich Swithcyard	Manolo Fortich 138 kV Switching Station Project	Feb 2018
Clarin	5	2025	Aurora – Ozamis – Oroqueta 69 kV Transmission Line	None	N/A
Lanon (Lam-alu)	9.5	2025	Tacurong Substation	None	N/A
Agus III	225	2025	Balo-I Substation	None	N/A
BIOMASS					
LPC Rice Husk-Fired Biomass	5.5	2017	Sultan Kudarat Substation	None	N/A

Note: Commissioning year for each power plant is still subject to update.
*with SIS

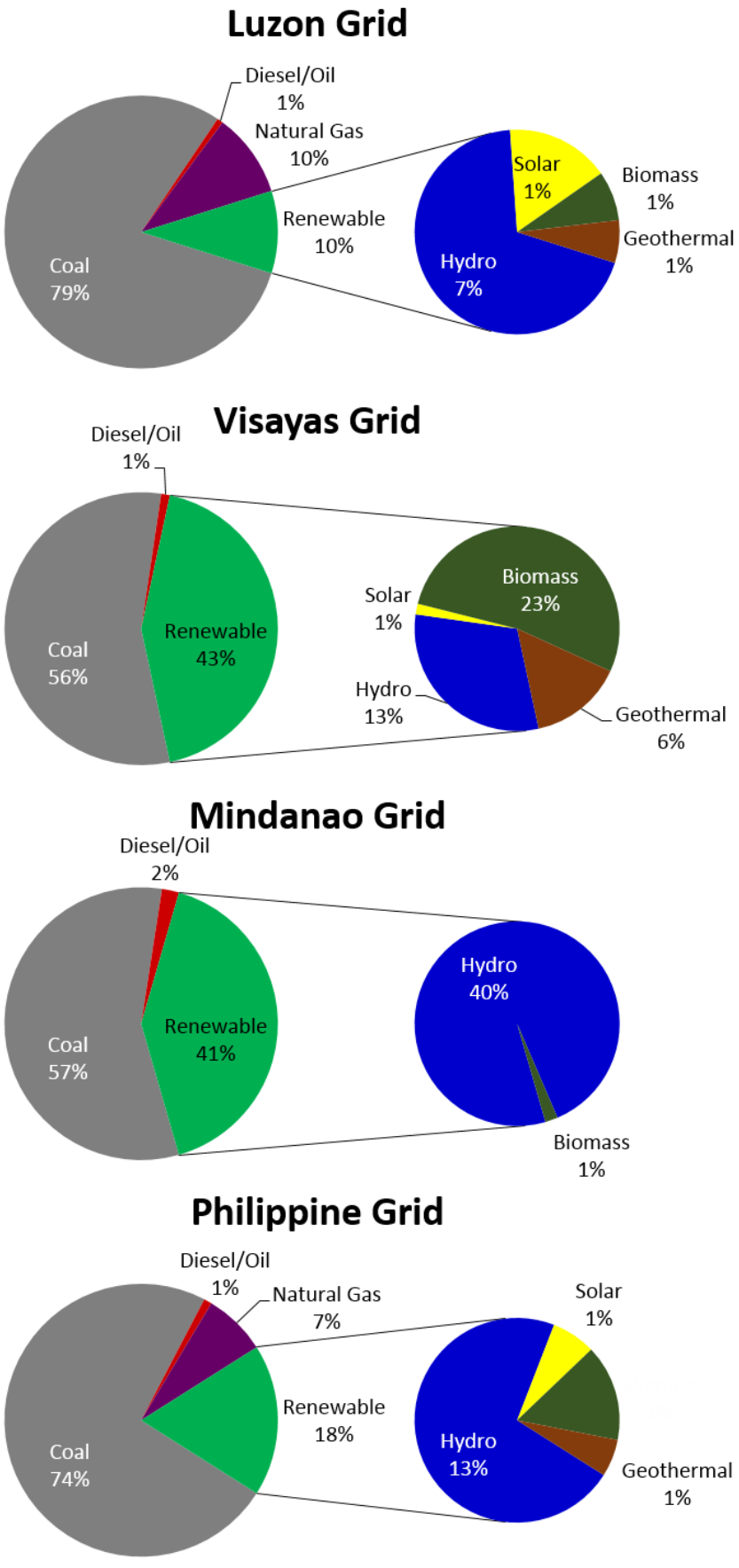


Figure 5.4: Generation Capacity Mix of Committed Power Plants

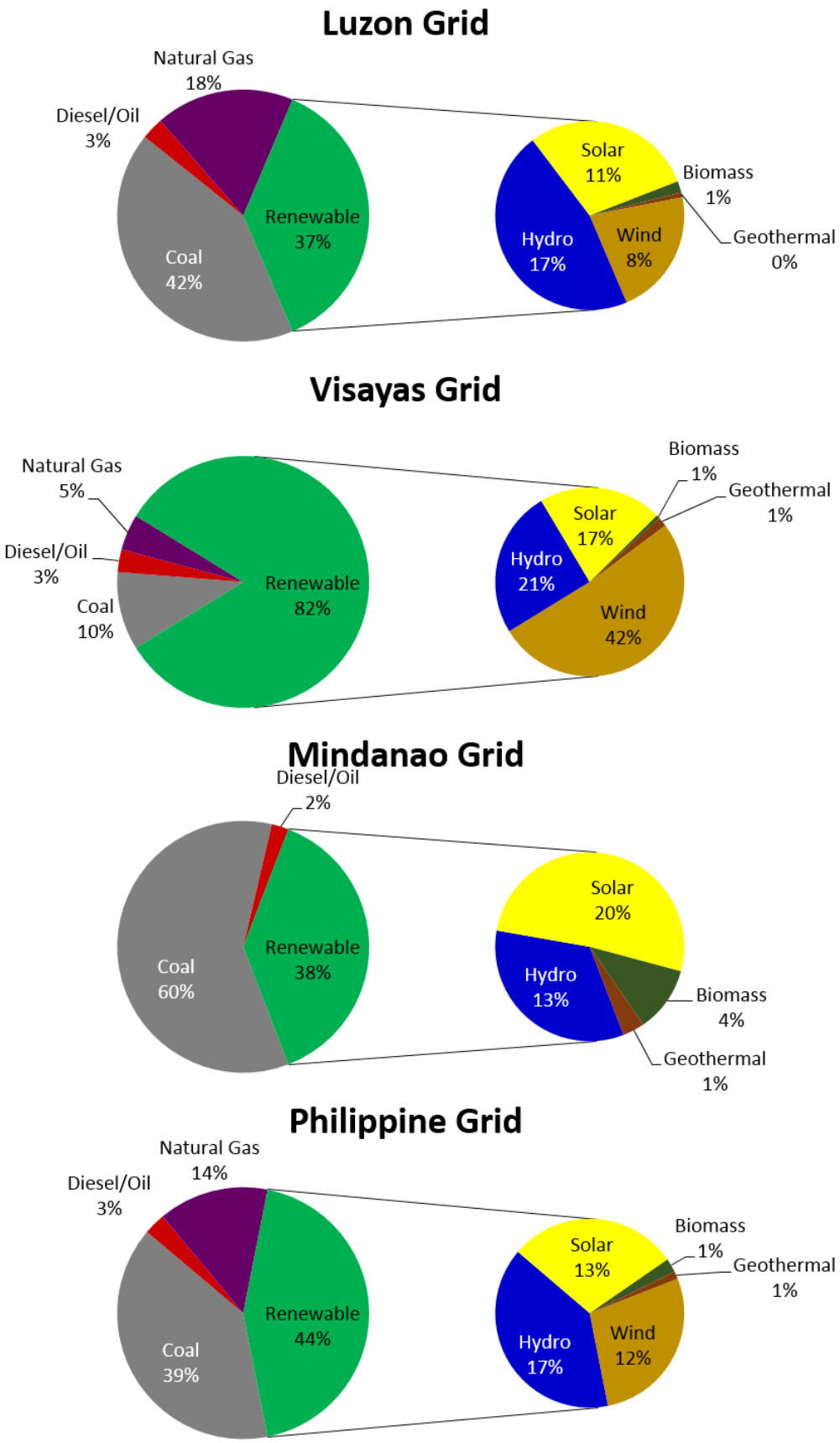


Figure 5.5: Generation Capacity Mix of Indicative Power Plants

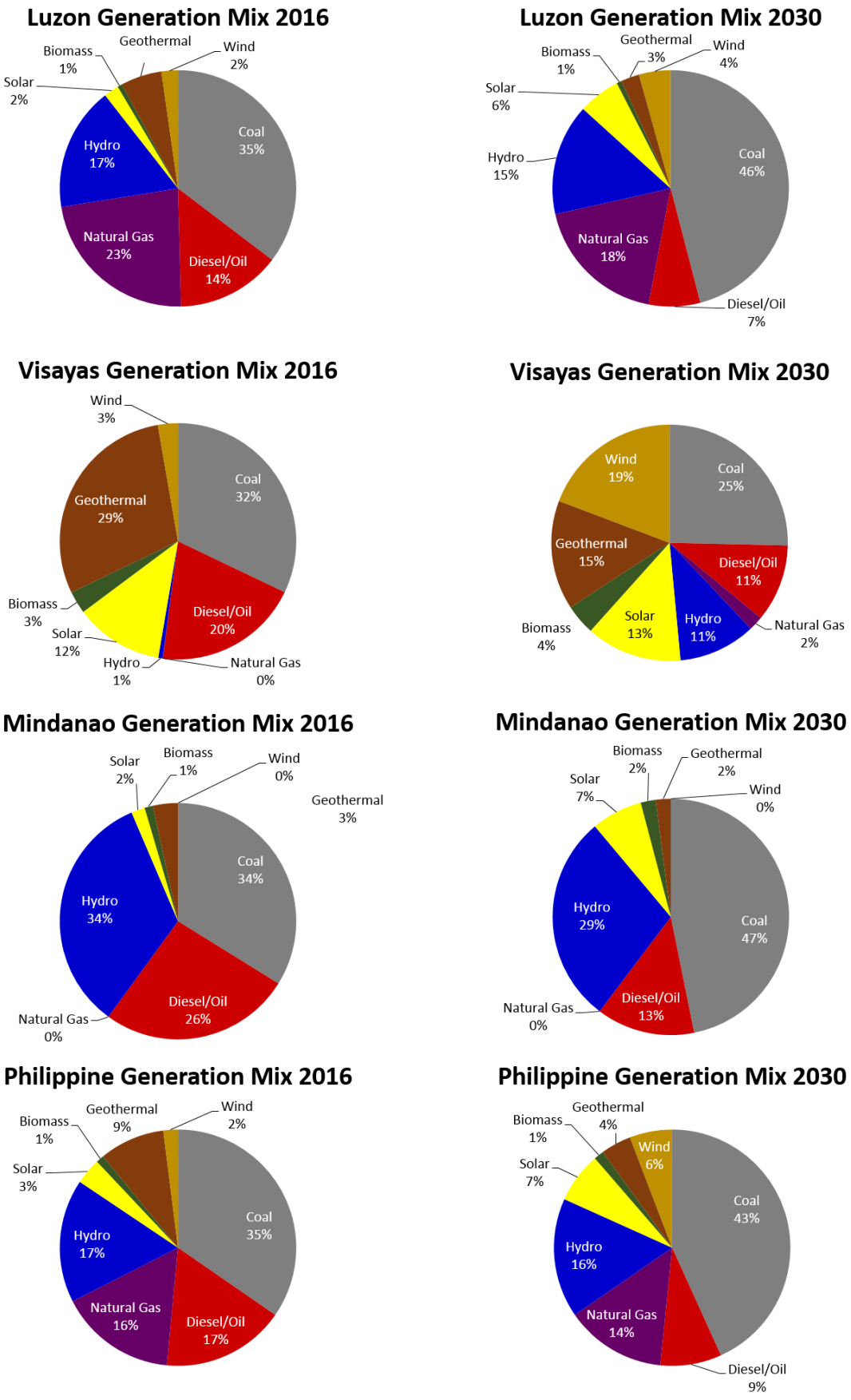


Figure 5.6: Current and Projected Generation Capacity Mix

5.2 Transmission Planning in Support to Renewable Energy

NGCP allocates this section for renewable energy resources, particularly for the development of variable RE (VRE), wind and solar PV. Discussed here are the transmission planning and current initiatives of NGCP in support to Variable Renewable Energy (VRE).

5.2.1 Transmission Planning for Renewable Energy

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 standards and ERC rules governing such connection.

In developing the expansion plans in the TDP, the grid is evaluated to meet the following objectives:

a. Demand requirements are met by available supply
b. Ensure the adequacy and security of the grid
c. Minimize the cost of transmission investments; and
d. Minimize the cost of energy by enhancing competition through the mitigation of network congestions.

Fundamentally, the grid is planned to be able to transmit and deliver the produced energy to electricity consumers in the most economic manner while having an acceptable level of reliability. The same objectives are applied with the addition of VRE resources. However, VRE introduces some challenges that required improvements in the transmission planning methodology.

Site-specific VRE, particularly wind is mostly located far from load centers. The challenge is the site's proximity to transmission facilities and available transfer capacity. Though there are some areas that are near transmission facilities, these are not designed to accommodate the potential capacity of VRE. Hence, new transmission corridors are needed to be proposed. Example of this is the proposed Northern Luzon 230 kV Loop that will serve the wind potential in north Luzon.

Construction timeline of VRE is much shorter compared to transmission expansion projects. Actual construction of VRE projects has proven that it can be completed faster compared to transmission projects. Consequently, the transmission expansion projects need to catch-up with the completion of VRE projects. This was the driver to advance the implementation Cebu-Negros-Panay Stage 3 to increase the interconnection capacity among the islands. The fast development of Solar PVs in Negros island has accelerated the need date of the project.

Added challenge from the limitation of existing transmission facilities is the operation of VRE, particularly their reactive power requirements. Although there are reactive power capability and voltage support requirements for VRE, there are still some voltage issues. In the case of north Luzon, voltage problems were initially experienced due to untuned voltage controls settings of the wind farms. Voltage stability issues were also experienced whenever there is an N-1 outage of two adjacent circuits. Furthermore, overvoltage was experienced when the wind farms are not generating, and the local load is at the minimum. Thus, additional reactive compensation devices (capacitors and reactors) were needed to solve the different operating scenarios.

5.2.2 Current Initiatives by NGCP

Previously, NGCP intended to conduct a geographic grid adequacy study to determine the maximum amount of VRE in potential areas that can be connected without violating thermal, voltage and stability limits and the required transmission expansion projects to increase the capacity. However, this would become meaningless without considering the potential sites of conventional power plants that would also need grid reinforcements. Considering VRE and conventional generation independently may lead to the sub-optimal expansion of the grid.

Thus, NGCP is currently adapting a market-based planning methodology that will consider the design of the WESM on how VREs and conventional power plants are being scheduled. NGCP will include in the model the variability of VRE and the dynamics of the WESM, i.e., generation production cost, demand variability and outages of network elements. This is to identify the possible transmission congestions, which will provide a more realistic impact of generation projects to the transmission network. The generation projects to be assessed consider the targeted generation mix, renewable portfolio standards and demand forecast. The output shall provide which areas are recommendable for generation projects and in-support transmission projects.

This planning methodology will also answer the required congestion analysis in the 2016 Grid Code. This also complements the resolution of the National Renewable Energy Board (NREB) that recommends DOE to apply geographic installation targets, thus put a cap generation capacity of VREs.

The reference methodology is from the project called "Greening the Grid Project" by the United States Agency for International Development (USAID) and National Renewable Energy Laboratory (NREL) that conducted an RE Integration Study for the DOE. The project observed the effects of integrating high levels VRE on system operations using through a production cost model that simulates the dispatch scheduling of the WESM. Furthermore, the project developed a siting algorithm for VREs and compared different siting scenarios that is, high potential areas versus minimized transmission upgrades. The advantage of such methodology is that it can show the benefits of maximizing the capability of the transmission system by optimally siting the new power plants.

The system inertia and frequency response study will be conducted as an advance study from the results of the simulations of the market-based model.

5.2.3 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.

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

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

Region	Location	Project Name	Target Date Of Commercial Operation	Declared Capacity (MW)	Required Grid Reinforcement	ETC
Solar Projects				212.68		
III	Botolan, Zambales	Botolan Solar Power Project	2018	39.27	None	
III	Botolan, Zambales	Sta. Rita Solar Power Project	2018	92.86	None	
III	Concepcion , Tarlac	Concepcion Solar Power Project	2018	50.55	None	
IV-A	Rodriguez, Rizal	Macabud Solar Power Project	2018	30	None	
Wind Projects				209.40		
I	Pasuquin, Ilocos Norte	Pasuquin East Wind Power Project	2018	48 132	San Manuel-Nagsaag 500 kV Transmission Line (initially energized at 230 kV) and Northern Luzon 230 kV Loop	Dec 2021 Jun 2024
I	Pagudpud, Ilocos Norte	Pagudpud Wind Power Project	2018	84		
I	Pagudpud, Ilocos Norte	Balaoi Wind Power Project	2018	45		
IV-A	Pililia, Rizal	Mt. Sembrano Wind Power Project	2018	80.4	North Luzon Substation Upgrading Project Stage 1 - Malaya 300 MVA Transformer	Dec 2018
Hydro Projects				146.40		
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				33		
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				34.18		
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				219.31		
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
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 4.

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
	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

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

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 300 MW 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 Oil 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 Potential Power Plant Connection Points

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 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.

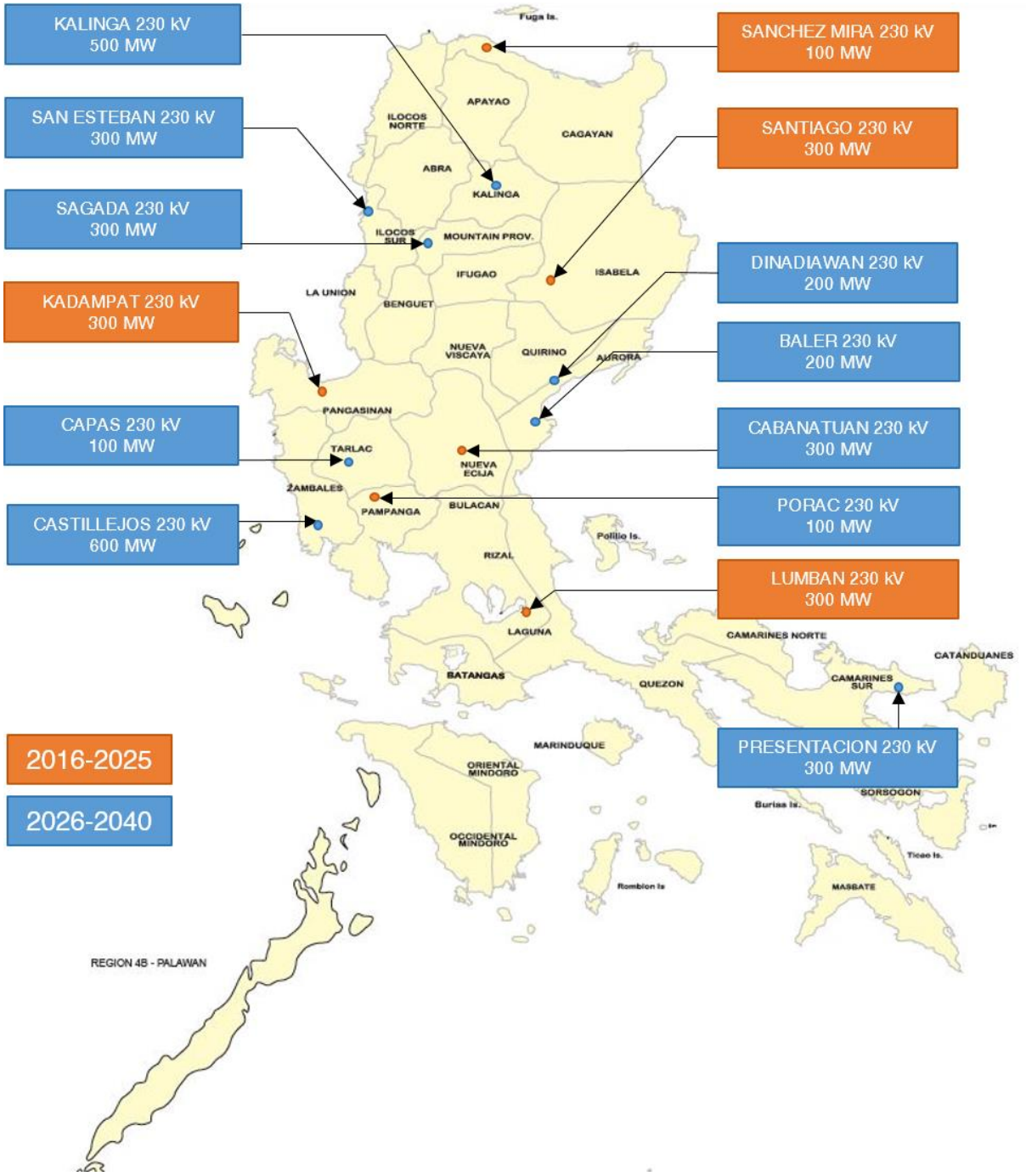


Figure 5.7: Recommended Power Plant Connection Points (Luzon)

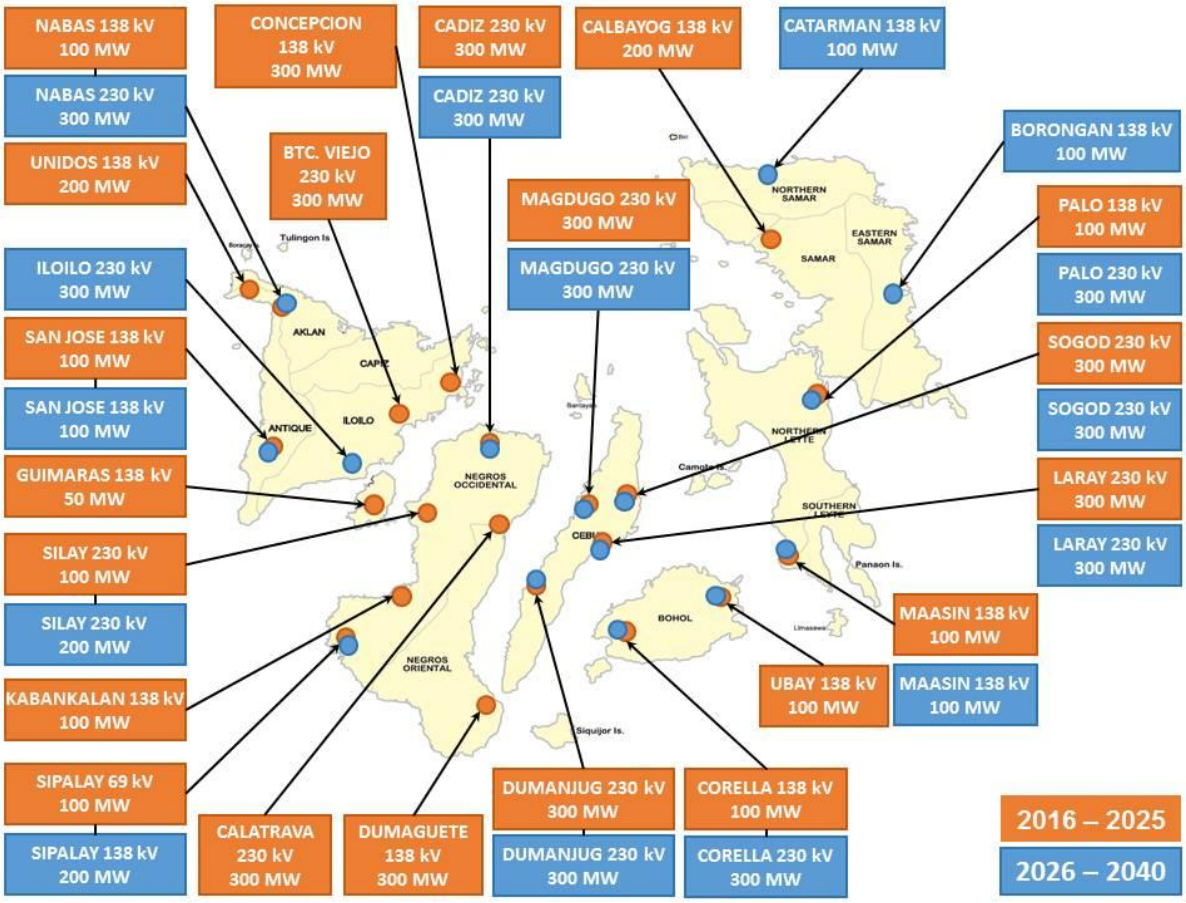


Figure 5.8: Recommended Power Plant Connection Points (Visayas)

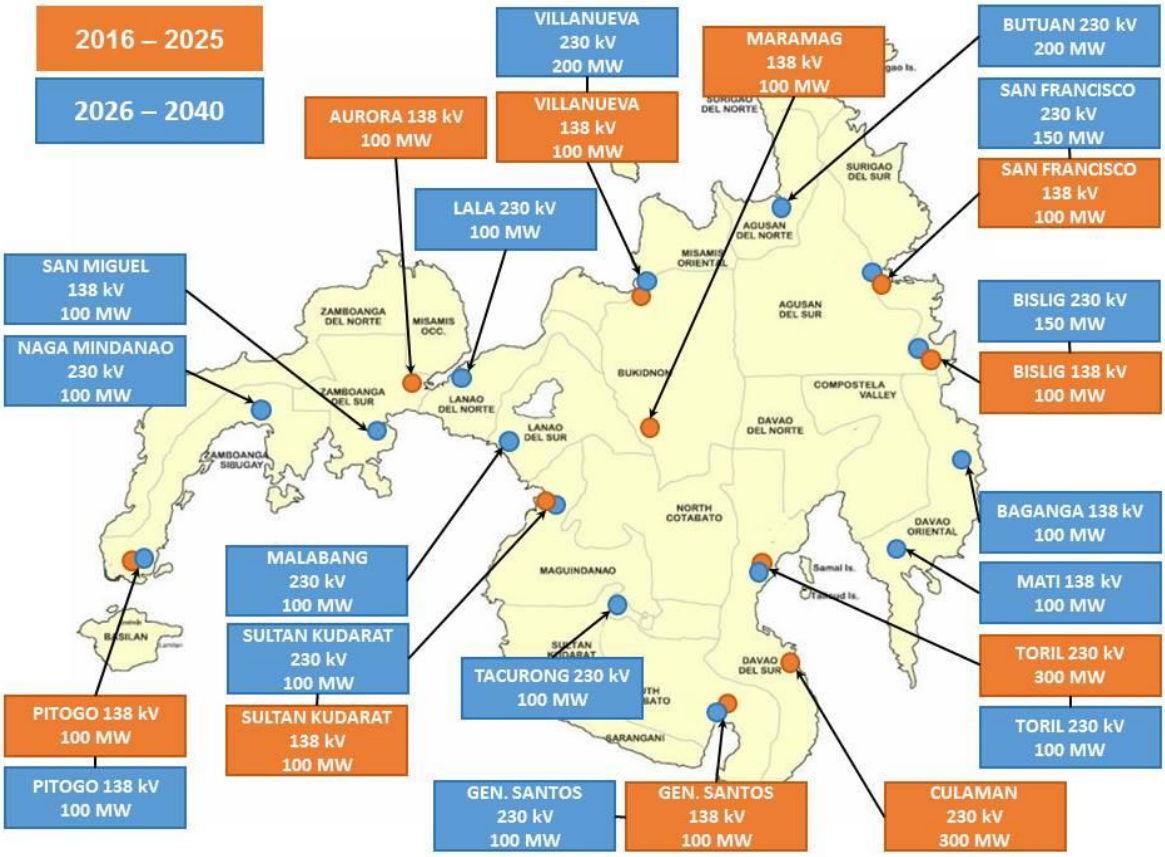


Figure 5.9: Recommended Power Plant Connection Points (Mindanao)

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 power 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 2011 to 2028 Strategic Action Plans under the National Climate Change Action Plan (NCCAP) formulated by the Climate Change Commission (CCC).

The NCCAP further emphasized that "in addition to the challenges of energy security and environmental sustainability, 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.

6.1.1 Resiliency Policy

The Philippines, considering its geographical location and being an archipelago with one of the world's longest coastlines is vulnerable to the impacts of climates change. In line with this, the DOE has introduced the Resiliency Policy, which is the adoption of resiliency planning and program in the energy industry to mitigate the adverse effects brought about by disasters. This contains adaptation measures that include both engineering and non-engineering options, to gauge infrastructure and human resource preparedness during and after the disruptive events.

6.1.2 Resiliency Planning for Transmission System

In anticipation for increasing frequency of super typhoons, earthquakes, etc. and other natural or even man-made hazards, the challenge for the transmission system is to keep improving the preventive measures and risk reduction, adopt the "build back better" principle after disasters or build better from the start. This could be done by making disaster risk assessment a prerequisite for transmission infrastructure investment[4]. As way forward, NGCP will be using hazard maps, i.e., probabilistic maps produced under Project NOAH or Nationwide Operational Assessment of Hazards, in the transmission line route and substation site selection process.

6.1.3 Enhancement of Transmission Line and Substation Site Selection

a) 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;

[3] CIGREE-IEEE joint task force on stability terms and definitions
[4] Global Platform for Disaster Risk Reduction.

b) 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;

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

d) 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.

6.1.4 Increase of Transmission Towers Strength and Capacity

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 (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 OHTL including substation take-off towers and other structures to withstand typhoon wind speed of up to 300 km per hour.

b) Transmission towers to be erected near meandering rivers with powerful river currents are required to be on board piles with enough length so that said towers will still be standing despite soil erosion reaching the tower location.

c) Anti-pilferage bolts are being specified to be used (instead of regular connection bolts) in all towers up to 9m from the ground for 138 kV lines and 12m for 230 kV and up lines to prevent the pilferage of tower parts which can cause the toppling of steel towers/piles.

6.1.5 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 level of risk and the corresponding mitigation measures that will be implemented during construction and its eventual operation.

6.2 Transmission Line Looping Configuration

To further improve the system reliability, enhance the operational flexibility during events of natural calamities, and in support to the connection of various incoming power plants, particularly RE, the long-term transmission planning involves the various transmission looping configurations. Various backbone transmission system involving 138kV, 230kV and 500kV lines will be implemented by stages, but part of several segments that will eventually form a transmission loop as the end state.

6.3 Use of HV Underground Cables

Power system could be made more resilient through underground cable installations as these are less susceptible to outages during extreme weather conditions, such as super typhoons and strong wind thunderstorms. But because of the excessive cost of underground cable installation, initial applications would be limited or confined only in highly urbanized areas, wherein land is a valuable resource, securing of ROW is a great challenge and aesthetics is a paramount consideration.

6.4 Asset Replacement

As stated in the Age Profile of Transmission Assets in TDP 2014-2015 Volume 2, about 22% of power transformers and about 36% protective relays have already reached 100% of their asset lives. For the transmission and sub-transmission lines, around 40% or 7,820 ckt-km are older than 30 years and about 8% or 1,564 ckt-km are 50 years and older. Hence, the need for an asset replacement program. This shall be done considering that the asset life cycle in a transmission utility contains several phases: Acquire/Install, Operate, Maintain and Dispose/Retire.

6.4.1 Standard Asset Lives and Asset Database

As an initial step in the creation of an asset refresh program, NGCP considered the standard asset lives adopted in the 2008 re-valuation of transmission assets for the 3rd Regulatory Period (2011-2015)[5]. Appendix 6 shows Table A6.1 – Summary of Asset Lives. The existing asset database was obtained from Enterprise Asset Management (EAM) and the two major transmission assets were initially considered for the program, i.e., power transformers and overhead transmission lines in Luzon, the Visayas and Mindanao Grids. Later this year, a system-based tool capable of performing data analytics may be used to facilitate a corporate-wide prioritization of old transmission assets that will be programmed to be replaced.

6.4.2 Asset Refresh Program for Power Transformers and Transmission Lines

Although there is a plan to work towards the establishment of a corporate-wide Asset Management System leading towards ISO 55000 Certification, however, the asset refresh program will be initially a combination of time-based and condition-based approaches. Later on, the risk-based Asset Management System shall be included in the formulation of asset refresh program in the succeeding TDP updates. Further evaluation will be needed in support of the justifications for the replacement of these power transformers and transmission lines once these are included in future CAPEX application for ERC-approval

6.5 Adoption of SMART Grid technologies/ Smart Grid Developments

There have been continuing research and development over the years toward commercial realization of the Smart Grid. Nowadays, the adoption of Smart Grid technologies and the development of Smart Grid roadmaps and pilot projects have become global trend for power utilities.

[5] Undertaken by Sinclair Knight Merz (SKM), which was commissioned by TransCo.

In the Philippines, with the goal to develop Smart Grid Policy and Roadmap for the country, the DOE issued on 11 March 2013 the Department Circular No. DC2013-03-0003 – Creating an Inter-Agency Steering Committee for the Development and Formulation of a Comprehensive and Holistic Smart Grid Policy Framework and Roadmap for the Philippine Electric Power Industry. This also aims to promote technology innovation, business growth and job creation thereby enhancing the regional and global competitiveness of the Philippines.

Smart Grid is the concept of modernizing the electric grid. The Smart Grid comprises everything related to the electric system in between any point of generation and any point of consumption. Through the addition of Smart Grid technologies the grid becomes more flexible, interactive and is able to provide real time feedback.[6]

The power flow will change from a unidirectional power flow (from centralized generation via the transmission grids and distribution grids to the customers) to a bidirectional power flow. Furthermore, the way a power system is operated changes from the hierarchical top-down approach to a distributed control. One of the main points about Smart Grid is an increased level of observability and controllability of a complex power system. This can only be achieved by an increased level of information sharing between the individual components and subsystems of the power system. Standardization plays a key role in providing the ability of information sharing which will be required to enable the development of new applications for a future power system.[7]

Over the past 8 years, NGCP has implemented several smart grid initiatives including the upgrade of SCADA-EMS (Supervisory Control and Data Acquisition-Energy Management System), establishment of the Overall Command Center, implementation of MBSC (Microprocessor-Based Substation Control), time synchronization devices, transient fault recorders in major substations, as well as holistic cyber-security enhancement program.

In general, the smart grid strategies for the power transmission in the Philippines under the operation of NGCP can be classified into three (3) broad areas: transformation, consolidation and standardization.

Transformation pertains to transmission backbone developments which include the MVIP and other island interconnections, 500 kV backbone extension, backbone looping configuration to make the grid more flexible and resilient.

Consolidation pertains to the application of advance information and communication technology to consolidate existing automatic systems and forward to nationwide level of integration.

Standardization, on the other hand, is about the establishment of multidimensional Smart Grid framework suitable to the unique geological environment of the country. Establishment of Smart Grid technical standards are crucial to ensure interoperability with all the players in the electric power industry. This is also expected to become a vital component of the Smart Grid Roadmap and Policy to be developed for the country.

Moreover, for an increased level of observability and controllability for the power grid, NGCP has continuing program for further implementation of time synchronization devices, fiber optics to increase bandwidth to support the big data exchange that will be needed by the Smart Grid, SCADA-EMS enhancement, network protection enhancements, establishment of National Control Center and the integration of all monitoring systems of the grid.

[6] From IEC Definition of Smart Grid
[7] From IEC Smart Grid Standardization Roadmap

The projects already approved by the ERC are in various stages of implementation. The approvals for the projects were obtained either during the regulatory reset process for the Third Regulatory Period or through a separate application to the ERC. For the Fourth Regulatory Period, which is from 2016 to 2020, another regulatory reset process is expected for the ERC's review and final approval of the capital expenditure.

7.1 Recently Completed Projects

Summarized below are the projects completed or energized from 01 January 2016 to 30 December 2017. In this period, NGCP completed a total of 638.30 circuit-km of overhead transmission lines and installed 2,075 MVA additional substation capacities and 85 MVAR of reactive power support.

Table 7.1: Recently Completed Projects

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
LUZON					
Luzon S/S Expansion Project 3 -Bay S/S	To maintain the provision for N-1 contingency due to increasing load.	100			Feb 2016
Luzon Voltage Improvement Project 1 -Doña Imelda S/S Capacitor Bank	To improve the voltage profile during normal condition and address the potential undervoltages during N-1 contingency conditions.		50		Feb 2016
Bacnotan Tap-Bacnotan T/L -Bacnotan-San Esteban 230 kV Line 1 -Bauang-Bacnotan 230 kV Line 2	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.			6.00	Mar 2016
Balingueo (Sta. Barbara) 230 kV S/S	To provide a new substation to adequately and reliably serve the load centers in the province of Pangasinan.	100			Mar 2016
Luzon S/S Expansion Project 4 -Tuguegarao S/S -Santiago S/S -Gumaca S/S -Nagsaag S/S	To add substation capacity that will accommodate load growth.	100 200 50 100			Apr 2016 Oct 2016 Dec 2016 Sep 2016
Luzon S/S Reliability Project 1 -San Esteban S/S -Botolan S/S	To add substation capacity that will provide N-1 contingency.	50 50			Apr 2016 Oct 2016
Luzon S/S Expansion Project 4 -Daraga S/S -Gamu S/S (transferred from Santiago S/S)	To add substation capacity to accommodate load growth.	100 50			May 2017 Jul 2017
Las Piñas S/S Expansion Project	To add capacity and provide N-1 security to adequately and reliably meet the increasing load in Metro Manila.	300			Jun 2017

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
Santiago-Tuguegarao 230kV T/L	To provide N-1 contingency for the existing transmission corridor serving Isabela and Cagayan.			118	Sep 2017
Luzon Voltage Improvement Project 3 -Laoag S/S	To maintain the voltage profile at various substations within the prescribed limits.		35		Sep 2017
VISAYAS					
Visayas S/S Reliability Project 1 -Cadiz S/S -Ormoc S/S	To provide N-1 contingency transformers at various substations.	50 150			Jan 2016 Nov 2016
Culasi-San Jose 69 kV T/L Schedule 1A & 1B	To provide N-1 contingency for the existing corridor.			31.50	Mar 2016
Southern Panay Backbone -San Jose S/S	To accommodate load growth in Southern Panay.	50			Mar 2016
Calong-Calong-Toledo-Colon 138 kV T/L -Line 1 -Line 2	To accommodate the full generation capacity of the 246 MW CEDC Coal and the 82 MW TPC Coal.			54.00	Aug 2016
Colon-Cebu 138 kV T/L Portion (Naga-Banilad) -Line 2 -Line 3	To provide additional capacity to meet load growth and to accommodate the full dispatch of coal plants.			54.80	Sep 2016
Cebu-Negros-Panay 230kV Backbone Project Stage 1 (Submarine Cable Portion)	To increase transfer capacity of the existing corridor and maintain the N-1 contingency provision.			18.90	Oct 2016
Visayas S/S Reliability Project 2 -Sta. Barbara S/S (T01) -Sta. Barbara S/S (T02) -Ormoc S/S	To provide N-1 contingency transformers at various substations.	50 50 100			Oct 2016 Dec 2016 Nov 2016
Ormoc-Maasin 138 kV T/L	To provide N-1 contingency for the existing corridor by installing a second circuit.			114.0	Dec 2016
Culasi-San Jose 69 kV T/L Schedule 2A & 2B	To provide N-1 contingency for the existing corridor.			31.50	Jan 2017
Visayas S/S Reliability Project 1 -Samboan S/S -Bacolod S/S	To provide N-1 contingency transformers at various substations.	50 100			Mar 2017 Apr 2017
Upgrading of Panitan-Nabas 138 kV T/L (Typhoon Yolanda)	To address system limitation and improve the reliability of the Panitan-Nabas 139 kV Transmission Line.				Mar 2017
Upgrading of Ormoc/Tongonan-Isabel 138kV T/L (Typhoon Yolanda) -Ormoc-Isabel Line 1 -Tongonan-Isabel Line 1 -Tongonan-Isabel Line 2	To address system limitation and improve the reliability of the Ormoc/Tongonan-Isabel 138 kV Transmission Line.				May 2017 Jul 2017 Sep 2017
MINDANAO					
Malita-Matanao 230 kV T/L -Line 1 -Line 2	To accommodate the grid connection of SMCPC's CFPP.			120.0	Mar 2016 Apr 2016
Malita-Matanao 230 kV S/S	To accommodate the grid connection of SMCPC's CFPP.	50			Mar 2016

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
Maramag (Pulangui)-Kibawe 138 kV TL	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.			20.90	Apr 2016
Matanao-Klinan (Gen. Santos) 138 kV T/L -Line 2	To provide N-1 contingency capability to the transmission corridor.			68.70	Jun 2016
Opol 138 kV S/S Project -Opol S/S	To address the increase in demand and improve power quality in the area.	75			Aug 2016
Mindanao S/S Expansion 2 -General Santos S/S -Kidapawan S/S	To add substation capacity to meet load growth.	100 50			Aug 2016 Nov 2016
	TOTAL	2,075	85	638.30	

7.2 Projects for Implementation

The list below summarized the updates on the ERC approved projects with ETC by 2018 onwards.

Table 7.2: Projects for Implementation

Project Name	Driver	Purpose and Components	ETC
LUZON			
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 2018
		Study Components: ▪ Power System Study; ▪ Feasibility Study. Bulk Cost Estimate: 194 Million Pesos	
Luzon Substation Reliability I	SR	To provide single outage or N-1 contingency to substations operating with only one power transformer.	Dec 2018
		Substation Components: ▪ Labo Substation, 1x50 MVA 230/69 kV transformer and accessories.	
Luzon PCB Replacement	SR	To replace old power circuit breakers and improve the substation reliability of San Jose, Labo, Malaya and Gumaca Substation.	Dec 2018
		Substation Components: ▪ San Jose Substation, 9-115 kV PCBs and associated equipment. ▪ Labo Substation, 3-230 kV PCBs and associated equipment. ▪ Malaya Substation, 4-230 kV PCBs and associated equipment. ▪ Gumaca Substation, 2-230 kV PCBs and associated equipment. Bulk Cost Estimate: 30 Million Pesos	
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.	Dec 2018
		Substation Components: ▪ San Jose 115 kV Substation, 2-115 kV PCBs and associated equipment. Transmission Components: ▪ San Jose-Angat 115 kV Transmission Line, ST-DC, 2-795 MCM ACSR, 18 km. Bulk Cost Estimate: 307 Million Pesos	
San Jose-Quezon 230 kV Line 3	SR	To increase transfer capacity of the existing corridor and maintain the N-1 contingency provision.	Mar 2019
		Substation Components: ▪ San Jose 230 kV Substation, 5-230 kV PCBs and associated equipment; ▪ Quezon 230 kV Substation, Line Protection and Communication System. Transmission Components: ▪ San Jose-Quezon 230 kV Transmission Line, ST/SP-SC, 2-610 mm^2 TACSR, 19 km. Bulk Cost Estimate: 965 Million Pesos	

Project Name	Driver	Purpose and Components	ETC
Hermosa–Floridablanca 69 kV Transmission Line	LG	To relieve the overloading of the existing Hermosa–Guagua line and address the low voltage issues in the area.	Jun 2019
		Transmission Components: ▪ Hermosa–Floridablanca 69 kV Transmission Line, 1-795 MCM ACSR/AS, SP/ST-SC, 17.7 km; Substation Components: ▪ Hermosa Substation, 3-69 kV PCBs and associated equipment. Bulk Cost Estimate: 283 Million Pesos	
Relocation of Steel Poles along Hermosa–Duhat 230 kV Transmission Line	SR	To ensure public safety in the Jose Abad Santos Avenue and to also protect the steel poles.	Jun 2019
		Transmission Components: Hermosa–Duhat 230 kV Transmission Line, 230 kV, SP-SC, 2-795 MCM, 20 steel poles. Bulk Cost Estimate: 222 Million Pesos	
Bataan 230 kV Grid Reinforcement	GE	To fully optimize the transmission capacities of the existing 230 kV transmission lines in Bataan and to accommodate the generation capacity addition	Aug 2019
		Substation Components: ▪ Limay Substation (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 Substation (Expansion), 4-230 kV PCBs and associated equipment. Transmission Components: ▪ Limay–Hermosa Reconductoring (single circuit termination), 230 kV, ST-DC, 1-410 mm^2 TACSR/AS, 38.01 km; ▪ Hermosa-Mexico Reconductoring, 230 kV, ST-DC, 1-410 mm^2 TACSR/AS, 35.0 km; ▪ Lamao (Limay) bus-in to the existing Mariveles–BCCPPB 230 kV lines, 230 kV, SP/ST-DC, 4-795 MCM ACSR/AS, 2-1 km. ▪ Limay–BCCPP A Line Extension, 230 kV, SP-SC, 2-410 mm^2 TACSR/AS, 1.0 km ▪ Mexico–Cabanatuan 230 kV Line bus-in to San Rafael Substation, SP-DC, 1-795 MCM ACSR, 1.0 km. Bulk Cost Estimate: 3,266 Million Pesos	
Mariveles–Hermosa 500 kV Transmission Line	GE	To accommodate the connection of incoming generations in Bataan Peninsula by developing a common collector switching station for power generation in Mariveles and a new 500 kV transmission backbone from Mariveles going to Hermosa.	Sep 2019
		Substation Components: ▪ New Mariveles 500 kV Substation, 14-500 kV PCBs and associated equipment. Transmission Components: ▪ Mariveles–Hermosa 500 kV Transmission Line, ST-DC, 4-410 mm^2 TACSR/AS, 49.2 km; Mariveles–Mariveles (GN Power): Power Supply 13.8 kV Transmission Line, SP-DC, 2/0 MCM ACSR, 3.28 km; Bulk Cost Estimate: 6,057 Million Pesos	

Project Name	Driver	Purpose and Components	ETC
North Luzon Substation Upgrading Project	SR	To cater the load growth and provide N-1 contingency to various substations in the North Luzon Region.	Oct 2019/ Jun 2022
		Stage 1: <u>Substation Components:</u> ▪ Bauang 230 kV Substation (Replacement), 1x100 MVA 230/115/69-13.8 kV Power Transformer and accessories, 6-230 kV PCBs and associated equipment; ▪ Gamu 230 kV Substation, 1x100 MVA Power Transformer and accessories,10-230 kV PCBs and associated equipment, 2-69 kV PCBs and associated equipment; ▪ Bayombong 230 kV Substation, 1x100 MVA Power Transformer and accessories, 5-230 kV PCBs and associated equipment, 3-69 kV PCBs and associated equipment; ▪ Hermosa 69 kV Substation, 10-69 kV PCBs and associated equipment; ▪ Malaya 230 kV Substation (Expansion), 1x300 MVA, 230/115-13.8 kV Power Transformer and accessories, 9-230 kV PCBs and associated equipment, 1-115 kV PCB and associated equipment; ▪ Quezon 230 kV Substation (Expansion), 3-230 kV PCBs and associated equipment ▪ San Jose 230 kV Substation (Expansion), 1x300 MVA, 230/115-13.8 kV Power Transformer and accessories and accessories, 1-230 kV PCBs and associated equipment, 7-115 kV PCBs and associated equipment. ▪ Doña Imelda Substation, 1-115 kV PCBs and associated equipment and neutral grounding transformer and accessories; ▪ Concepcion 69 kV Substation, 22-69 kV PCBs and associated equipment Stage 2: <u>Substation Components:</u> ▪ Bacnotan 230 kV Substation (Expansion), 1x100 MVA 230/69-13.8 kV Power Transformer and accessories, 1-230 kV PCB and associated equipment, 6-69 kV PCBs and associated equipment; ▪ Balingueo 230 kV Substation (Expansion), 1x100 MVA 230/69-13.8 kV Power Transformer and accessories, 5-230 kV PCBs and associated equipment, 4-69 kV PCBs and associated equipment; ▪ Labrador 230 kV Substation (Replacement), 1x300 MVA 230/69-13.8 kV Power Transformer and accessories, 5-230 kV PCBs and associated equipment, 2-69 kV PCBs and associated equipment; ▪ San Rafael 230 kV Substation (Expansion), 1x300 MVA 230/69-13.8 kV Power Transformer and accessories, 1-230 kV PCB and associated equipment, 2-69 kV PCBs and associated equipment ▪ Pantabangan Substation, 4-230 kV PCBs and associated equipment; ▪ Subic 230 kV Substation, 3-230 kV PCBs and associated equipment; Bulk Cost Estimate: 5,778 Million Pesos	
Pagbilao 500 kV Substation	GE	To develop new 500 kV substation that aims to accommodate the connection of incoming power plants in Quezon Province	Nov 2019
		<u>Substation Components:</u> ▪ Pagbilao 500 kV Substation, 3x1,000 MVA, 500/230 kV Power Transformers and accessories, 8-500 kV PCBs and associated equipment, and 11-230 kV PCBs and associated equipment; ▪ Tayabas 500 kV Substation Expansion, 3-500 kV PCBs and 1-230 kV PCB and associated equipment. <u>Transmission Components:</u> ▪ Swinging of Naga–Tayabas EHV Line at Tayabas 500 kV Substation, ST/SP-DC, 4-795 MCM ACSR, 0.5 km;	

Project Name	Driver	Purpose and Components	ETC
		▪ Naga–Tayabas Line Extension to Pagbilao 500 kV Substation, 500 kV, ST-DC, 4-795 MCM ACSR, 0.5 km; ▪ Pagbilao–Tayabas Line Extension to Pagbilao 500 kV Substation, 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. Bulk Cost Estimate: 4,016 Million Pesos	
Eastern Albay 69 kV Line Stage 2	SR	To provide the looping configuration for the 69 kV line in eastern Albay.	Nov 2019
		<u>Substation Components:</u> ▪ Sto. Domingo Substation, 1-69 kV PCBs and associated equipment; <u>Transmission Components:</u> ▪ Sto. Domingo–Tabaco 69 kV Transmission Line, ST-SC, 1-336.4 MCM ACSR, 18 km. Bulk Cost Estimate: 382 Million Pesos	
Tuguegarao–Lal-lo (Magapit) 230 kV Transmission Line	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.	Dec 2019
		<u>Substation Components:</u> ▪ Lal-lo 230 kV Substation, 2x100 MVA 230/69-13.8 kV Transformers and accessories, 6-230 kV PCBs and associated equipment, 8-69 kV PCBs and associated equipment; ▪ Tuguegarao 230 kV Substation, 3-230 kV PCBs and associated equipment. <u>Transmission Components:</u> ▪ Tuguegarao–Lal-lo 230 kV Transmission Line, ST-DC, 1-795 MCM ACSR, 64 km. Bulk Cost Estimate: 2,082 Million Pesos	
Hermosa–San Jose 500 kV Transmission Line	GE	To develop new 500 kV corridor that will accommodate the bulk generation in Bataan and Zambales area and to improve the overall reliability, security and stability of the 500 kV system.	Dec 2019
		<u>Substation Components:</u> ▪ New Hermosa 500 kV Substation, 2x1000 MVA, 500/230-13.8 kV Power Transformers and accessories, 10-500 kV PCBs and associated equipment, and 12-230 kV PCBs and associated equipment; ▪ New Hermosa 500 kV Substation, 2x60 MVAR 500 kV Shunt Reactors and accessories, 1x90 MVAR 500 kV Line Reactor and accessories; and 2x100 MVAR, 230 kV Capacitor Banks and accessories; <u>Transmission Components:</u> ▪ Hermosa-San Jose 500 kV Transmission Line, 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. Bulk Cost Estimate: 10,348 Million Pesos	
Tuy 500 kV Substation (Stage 1)	GE	To allow the connection of the 2 X 350 MW Coal-Fired Power Plant (CFPP) Project of St. Raphael Power Generation Corporation (SRPGC) and allow full dispatch of all generating plants injecting at Calaca Substation.	Dec 2019
		<u>Substation Components:</u> ▪ Dasmariñas Substation Expansion, 2-230 kV PCBs and associated equipment	

Project Name	Driver	Purpose and Components	ETC
		▪ Sta. Rita Switchyard Expansion, Line Protection and Communication System ▪ Calaca (new) Substation, Replacement of Current Transformers and Busworks <u>Transmission Components:</u> ▪ Tuy–Silang (initially 230 kV-energized), 500 kV, ST-DC, 4-410 mm^2 TACSR, 40 km, ▪ Silang–Dasmariñas, 230 kV, ST-DC, 4-410 mm^2 TACSR/AS, 8.6 km ▪ Sta. Rita 230 kV Line Extension, 230 kV, ST-DC, 4-795 MCM ACSR/AS, 10 km. ▪ Calatagan/Nasugbu Line Extension, 69 kV, SP-DC, 1-795 MCM ACSR/AS, 3.5 km. Bulk Cost Estimate: 8,454 Million Pesos	
Luzon Voltage Improvement Project – 3	SR	To address the anticipated undervoltage problem during peak load conditions and overvoltage problem during off peak load conditions at various substations in the Luzon Grid.	Jan 2020/ Jun 2022
		Stage 1: <u>Substation Components:</u> ▪ Cabanatuan 230 kV Substation, 2x50 MVAR, 230 kV Capacitor Banks and accessories, 1-230 kV PCB and associated equipment, 1-69 kV PCB and associated equipment ; ▪ Laoag 230 kV Substation, 1x35 MVAR & 1x25 MVAR 230 kV Shunt Reactors and accessories, 2x25 MVAR 230 kV Capacitor Banks and accessories, 4-230 kV PCBs and associated equipment; ▪ Nagsaag 500 kV Substation, 1x90 MVAR, 500 kV Shunt Reactor and accessories, 1-500 kV PCB and associated equipment; ▪ Tuguegarao 230 kV Substation, 1x25 MVAR Capacitor Bank and accessories and 1x25 MVAR, 230 kV Shunt Reactor and accessories, 2-230 kV PCBs and associated equipment, 2-69 kV PCBs and associated equipment; ▪ Baler Load-End 69 kV Substation, 3x2.5 MVAR, 69 kV Capacitor Banks and accessories, 4-69 kV PCBs and associated equipment; ▪ Pantabangan Load-end 69 kV Substation, 1x5 MVAR, 69 kV Capacitor Bank and accessories, 1-69 kV PCBs and associated equipment; ▪ Umingan Load-end 69 kV Substation, 3x5 MVAR 69 kV Capacitor Banks and accessories, 4-69 kV PCBs and associated equipment; ▪ Camiling Load-end 69 kV Substation, 3x5 MVAR 69 kV Capacitor Banks and accessories, 4-69 kV PCBs and associated equipment; ▪ Bantay 115 kV Substation, 1x7.5 MVAR, 115 kV Capacitor Bank and accessories, 1-115 kV PCBs and associated equipment; Stage 2: <u>Substation Components:</u> ▪ Antipolo 230 kV Substation, 2x100 MVAR, 230 kV Capacitor Banks and accessories, 2-230 kV PCBs and associated equipment; ▪ Bautista Load-end 69 kV Substation, 3x5 MVAR 69 kV Capacitor Banks and accessories, 4-69 kV PCBs and associated equipment; ▪ Botolan 230 kV Substation, 1x25 MVAR 230 kV Shunt Reactor and accessories 6-230 kV PCBs and associated equipment, 3-69 kV PCBs and associated equipment; ▪ Itogon Load-end 69 kV Substation, 1x7.5 MVAR, 69 kV Capacitor Bank and accessories, 1-69 kV PCBs and associated equipment; ▪ Mexico 230 kV Substation, 1x100 MVAR 230 kV Capacitor Bank and accessories, 12-230 kV PCBs and associated equipment ;	

Project Name	Driver	Purpose and Components	ETC
		▪ San Esteban 230 kV Substation, 2x25 MVAR, 230 kV Capacitor Banks and accessories, 2-230 kV PCBs and associated equipment; ▪ San Jose 230 kV Substation, 1x100 MVAR 230 kV Capacitor Bank and accessories, 3-230 kV PCBs and associated equipment; Bulk Cost Estimate: 3,383 Million Pesos	
Clark–Mabiga 69 kV Transmission Line	LG	To relieve the heavy loading of the existing Mexico-Clark Lines and address the low voltage issues in the area.	Feb 2020
		<u>Substation Components:</u> ▪ Clark 230 kV Substation (Expansion), 1x300 MVA 230/69-13.8 kV Power Transformer and accessories, 1-230 kV PCB and associated equipment and 3-69 kV PCBs and associated equipment. <u>Transmission Components:</u> ▪ Clark-Mabiga 69 kV Transmission Line, 1-410mm^2 TACSR/AS, SP-DC, 6 km. Bulk Cost Estimate: 549 Million Pesos	
Tiwi Substation Upgrading	SR	To improve the reliability of Tiwi A and C Substations, augment the power requirement of Malinao/Ligao Load-End Substation and establish clear asset boundaries within the Tiwi Geothermal Power Plant Complex.	Mar 2020
		<u>Substation Components:</u> ▪ Tiwi A 230 kV Substation, 4-230 kV PCBs and associated equipment; ▪ Tiwi C 230 kV Substation, 1x50 MVA, 230/69-13.8 kV Power Transformer and accessories, 12-230 kV PCBs and associated equipment and 3-69 kV PCBs and associated equipment. <u>Transmission Components:</u> ▪ Daraga/Naga–Tiwi C Line Extension 230 kV Transmission Line, ST-DC, 1-795 MCM ACSR/AS, 0.7 km; ▪ Tiwi A–Tiwi C Line Extension 230 kV Transmission Line, ST-DC, 1-795 MCM ACSR/AS, 0.3 km; ▪ Malinao/Ligao–Tiwi C Line Extension 69 kV, SP-SC, 1-336.4 MCM ACSR/AS, 1.5 km Bulk Cost Estimate: 1,467 Million Pesos	
Antipolo 230 kV Substation	LG	To accommodate the demand increase in Metro Manila and maintain the N-1 contingency provision for Taytay Substation.	Mar 2020
		<u>Substation Components:</u> ▪ Antipolo 230 kV Substation, 12-230 kV PCBs and associated equipment, 2x100 MVAR 230 kV Capacitor Banks and accessories. <u>Transmission Components:</u> ▪ Bus-in point along San Jose–Taytay 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR, 2-0.75 km. Bulk Cost Estimate: 1,153 Million Pesos	
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 upon completion of the Stage 2.	Jun 2020
		<u>Substation Components:</u> ▪ New Hermosa 230 kV Substation, 4-230 kV PCBs and associated equipment. <u>Transmission Components:</u> ▪ Castillejos–Hermosa 500 kV Transmission Line, ST-DC, 4-795 MCM ACSR/AS, 34 km. Bulk Cost Estimate: 2,631 Million Pesos	

Project Name	Driver	Purpose and Components	ETC
Luzon Voltage Improvement Project – 4	SR	To address the anticipated undervoltage problem during peak condition at various substations in the Luzon Grid.	Jul 2020/ Jun 2022
		Stage 1: <u>Substation Components:</u> ▪ Ligao Switching Station, 3x5 MVAR, 69 kV Capacitor Banks and accessories, 4-69 kV PCBs and associated equipment; ▪ Iriga Load-end 69 kV Substation, 2x5 MVAR, 69 kV Capacitor Banks and accessories, 5-69 kV PCBs and associated equipment; ▪ Bulan Load-end 69 kV Substation, 3x2.5 MVAR, 69 kV Capacitor Banks and accessories, 4-69 kV PCBs and associated equipment; ▪ Malvar Load-end 69 kV Substation, 2x5 MVAR, 69 kV Capacitor Banks and accessories, 3-69 kV PCBs and associated equipment; Stage 2: <u>Substation Components:</u> ▪ Dasmariñas 230 kV Substation, 2x100 MVAR, 230kV Capacitor Banks and accessories, 2-230 kV PCBs and associated equipment; ▪ Biñan 230 kV Substation, 2x100 MVAR, 230 kV Capacitor Banks and accessories, 2-230 kV PCBs and associated equipment; ▪ Mabini Load-end 69 kV Substation, 3x7.5 MVAR, 69 kV Capacitor Banks and accessories, 4-69 kV PCBs and associated equipment; ▪ Cuenca Load-end 69 kV Substation, 3x7.5 MVAR, 69 kV Capacitor Banks and accessories, 5-69 kV PCBs and associated equipment; ▪ Taysan Load-end 69 kV Substation, 3x7.5 MVAR, 69 kV Capacitor Banks and accessories, 4-69 kV PCBs and associated equipment; ▪ San Juan Load-end 69 kV Substation, 3x5 MVAR, 69 kV Capacitor Banks and accessories, 5-69 kV PCBs and associated equipment; ▪ Lagonoy Load-end 69 kV Substation, 3x5 MVAR, 69 kV Capacitor Banks and accessories, 4-69 kV PCBs and associated equipment. Bulk Cost Estimate: 3,122 Million Pesos	
Manila (Navotas) 230 kV Substation	LG	To provide additional substation capacity in Metro Manila to maintain the N-1 contingency provision for the transformers in Quezon, Marilao and Paco Substation.	Aug 2020
		<u>Substation Components:</u> ▪ Manila 230 kV Substation, 2x300 MVA, 230/115-13.8 kV Power Transformers and accessories, 9-230 kV PCBs (GIS) and 15-115 kV PCBs (GIS) and associated equipment. <u>Transmission Components:</u> ▪ From Marilao–Quezon cut-in point to Manila Substation, 230 kV, ST/SP-DC, 4-795 MCM ACSR/AS, 20 km. Bulk Cost Estimate: 3,486 Million Pesos	
Ambuklao–Binga 230 kV Transmission Line Upgrading	SR	To address the old age condition of the line and accommodate the generation capacity addition in Cagayan Valley area.	Dec 2021
		<u>Transmission Components:</u> ▪ Ambuklao–Binga 230 kV Transmission Line, ST/SP-DC, 2-410mm^2 TACSR, 11 km. Bulk Cost Estimate: 373 Million Pesos	
Binga–San Manuel 230 kV Transmission Line 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 2021
		<u>Transmission Components:</u> ▪ Binga–San Manuel 230 kV Transmission Line, ST-DC, 2-410 mm^2 TACSR, 40 km. Bulk Cost Estimate: 1,620 Million Pesos	

Project Name	Driver	Purpose and Components	ETC
South Luzon Substation Upgrading Project	LG/SR	To cater load growth, provide N-1 contingency and ensure reliability and flexibility to various substations in NGCP's South Luzon Region	Dec 2021/ Jun 2022
		Stage 1: <u>Substation Components:</u> ▪ Las Piñas 230 kV Substation (Expansion), 1x300 MVA, 230/115-13.8 kV Power Transformer and accessories; ▪ Lumban 230 kV Substation (Expansion), 1x100 MVA, 230/69-13.8 kV Power Transformer and accessories, 1-230 kV PCB and associated equipment; 2-69 kV PCB and associated equipment. ▪ San Juan (Kalayaan) S/Y, 8-230 kV PCBs and associated equipment; ▪ Naga 230 kV Substation (Replacement), 1x300 MVA, 230/69-13.8 kV Power Transformer and accessoriest, 1-69 kV PCB and associated equipment. Stage 2: <u>Substation Components:</u> ▪ Daraga 230 kV Substation (Replacement), 1x100 MVA 230/69-13.8 kV Power Transformer and accessories, 4-230 kV PCB and associated equipment, 2-69 kV PCBs and associated equipment; ▪ Gumaca 230 kV Substation (Replacement), 1x100 MVA 230/69-13.8 kV Power Transformer and accessories, 1-230 kV PCB and associated equipment, 2-69 kV PCBs and associated equipment; ▪ Labo 230 kV Substation, Line terminations reconfiguration. Bulk Cost Estimate: 2,175 Million Pesos	
VISAYAS			
Eastern Panay Transmission Line Project	GE	To provide a more reliable transmission service to Eastern Panay and accommodate entry of PCPC's 270 MW CFPP.	Mar 2018
		<u>Transmission Components:</u> ▪ Concepcion S/S – Tapping Point Near Sara LES 69 kV T/L, SP SC, 1-336.4 MCM ACSR, 14.2 km. Bulk Cost Estimate: 1,879 million Pesos	
Visayas Substation Reliability Project I	SR	To add substation capacity and provide N-1 contingency in various substations in the Visayas Grid.	Mar 2018
		<u>Substation Components:</u> ▪ Amlan S/S Expansion, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories; ▪ Maasin S/S Expansion, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories; Bulk Cost Estimate: 1,161 million Pesos	
Sta. Rita– Quinapondan 69 kV Transmission Line	SR	To provide a more reliable and quality transmission service to Eastern Samar.	Nov 2018
		<u>Substation Components:</u> ▪ Sta. Rita S/S Expansion, 2-69 kV PCBs and associated equipment; ▪ Quinapondan S/S Expansion, 2-69 kV Air break switches. <u>Transmission Components:</u> ▪ Sta. Rita S/S–Quinapondan S/S 69 kV T/L, ST/SP/CP-SC, 1-336.4 MCM, 103 km. Bulk Cost Estimate: 262 million Pesos	
Cebu-Negros-Panay 230 kV Backbone Project - Stage 1	GE, SR	To increase transfer capacity of the existing corridor and maintain the N-1 contingency provision.	Dec 2018
		<u>Substation Components:</u> ▪ Bacolod S/S Expansion, 2-138 kV PCBs and associated equipment. <u>Transmission Line Components:</u> ▪ Bacolod S/S - E. B. Magalona CTS, 230 kV (initially energized at 138 kV) T/L, ST-DC, 2-795 MCM ACSR, 42 km; Bulk Cost Estimate: 5,099 million Pesos	

San Carlos – Guihulngan 69 kV Transmission Line	LG	This project is intended to boost the power delivery service to accommodate increasing power demand in the Northeastern part of Negros Island by building a 69 kV loop between Cadiz and Amlan.	Dec 2018
		Transmission Components: ▪ San Carlos S/S – Guihulngan S/S 69 kV T/L, SP-SC 1-336.4 MCM ACSR, 58 km. Bulk Cost Estimate: 455 million Pesos	
Ormoc–Babatngon 138 kV Transmission Line	SR	To provide N-1 contingency for the existing corridor by installing a second circuit.	Dec 2018
		Substation Components: ▪ Ormoc S/S Expansion, 1-138 kV PCB and associated equipment; ▪ Babatngon S/S Expansion, 1-138 kV PCB and associated equipment. Transmission Components: ▪ Ormoc S/S – Babatngon S/S 138 kV T/L, ST-DC1 1-795 MCM ACSR, 78.54 km. Bulk Cost Estimate: 696 million Pesos	
Visayas Substation Reliability Project II	SR	To add substation capacity to provide N-1 contingency in various substations in the Visayas Grid.	Dec 2018
		Substation Components: ▪ Mandaue 138 kV S/S Expansion, 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV GIS Switch Bay, 1-69 kV GIS Switch Bay; ▪ Lapu-lapu 138 kV S/S Expansion, 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV GIS Switch Bay, 1-69 kV GIS Switch Bay. Bulk Cost Estimate: 662 million Pesos	
New Naga (Colon) Substation Project (Remaining Works)	LG	To upgrade existing substation to meet load growth	Sep 2019
		Substation Components: ▪ Colon 138 kV S/S, 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs and associated equipment, 2-69 kV PCBs and associated equipment. Transmission Components: ▪ 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. Bulk Cost Estimate: 272 million Pesos	
Naga (Visayas) Substation Upgrading Project	SR	To replace and upgrade the existing antiquated and aging primary and secondary equipment and device in Naga Substation.	Sep 2019
		Substation Components: ▪ Naga 138 kV S/S, 6-138 kV PCBs and associated equipment. ▪ Construction of New Control Room ▪ Dismantling of Primary and Secondary Equipment at Naga Substation Bulk Cost Estimate: 516 million Pesos	
Tagbilaran 69 kV Substation Project	SR, GE	To directly connect the Sta. Clara Power Corporation (SCPC) Hydro Power Plant and BEI to NGCP's substation, accommodate SCPC's expansion and provide reliability during maintenance shutdown of BDPP's transformer.	Nov 2019
		Substation Components: ▪ Tagbilaran 69 kV S/S (New), 1x10 MVA 69/13.8 kV Power Transformer and accessories and 3-69 kV PCBs and associated equipment. ▪ Construction of New Control Room Bulk Cost Estimate: 487 million Pesos	

Cebu-Lapu-lapu 230 kV Transmission Line Project	SR	To increase transfer capacity of the existing corridor and maintain the N-1 contingency provision.	Dec 2019
		Substation Components: ▪ Lapu-lapu 138 kV S/S, 1-138 kV GIS Switchbay. Transmission Components: ▪ Cebu-Umapad CTS 230 kV T/L (Initially energized at 138 kV), ST/SP-DC, 2-410 mm^2, 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. Submarine Cable Components: ▪ Cebu-Lapulapu Submarine Cable, SC, 2-3C 500mm^2 XLPE Submarine Cables, 1.1 km; ▪ Umapad CTS, Cable Sealing End Structures, 3-138 kV Disconnect Switches. Bulk Cost Estimate: 1,780 million Pesos	
Panitan-Nabas 138 kV Transmission Line 2 Project	SR	To provide N-1 contingency along the Panitan-Nabas 138 kV Transmission Line, thus, improving the reliability of power transmission towards the northwestern part of Panay.	Dec 2019
		Substation Components: ▪ Panitan 138 kV S/S, 1-138 kV PCB and associated equipment; ▪ Nabas 138 kV S/S, 3-138 kV PCBs and associated equipment. Transmission Components: ▪ Panitan-Nabas 138 kV T/L, ST-DC2 (2nd circuit stringing), 1-795 MCM ACSR, 95 km. Bulk Cost Estimate: 465 million Pesos	
Cebu-Negros-Panay 230 kV Backbone Project - Stage 3	GE	To accommodate the transmission of excess power from Panay and Negros Islands towards the rest of the Visayas Grid and possibly Luzon Grid.	Dec 2020
		Substation Components: ▪ Magdugo 230 kV S/S, 3x300 MVA, 230/138 kV Power Transformer and accessories, 15-230 kV PCBs, 15-138 kV PCBs and associated equipment; ▪ Calatrava 230 kV S/S, 2x100 MVA 230/69 kV Power Transformer and accessories, 14-230 kV PCBs, 14-69 kV PCBs, 4x50 MVAR 230 kV Reactor; ▪ Cadiz 230 kV S/S, 2x150 MVA 230/138 kV Power Transformer and accessories, 10-230 kV PCBs, 7-138 kV PCBs and associated equipment ▪ E. B. Magalona Switching Station, 9-230 kV PCBs and associated equipment, 1x70 MVAR 230 kV Reactor. ▪ Barotac Viejo 230 kV S/S, 3x300 MVA 230/138 kV Power Transformer and accessories, 8-230 kV PCBs, 6-138 kV PCBs and associated equipment, 1x70 MVAR 230 kV Reactor; ▪ Bacolod 230 kV S/S, 2x300 MVA 230/138 kV Power Transformer and accessories, 6-230 kV PCBs, 1-138 kV PCB and associated equipment; ▪ Colon 138 kV S/S, 2-138 kV PCBs and associated equipment. Transmission Components: ▪ Magdugo-Cebu 230 kV T/L, ST-DC, 4-795 MCM ACSR, 35 km. ▪ Talavera CTS-Magdugo 230 kV T/L, ST-DC, 4-795 MCM ACSR, 6 km; ▪ Cadiz-Calatrava 230 kV T/L, ST-DC, 4-795 MCM ACSR, 80 km ▪ Cadiz- E. B. Magalona 230 kV T/L, ST-DC, 4-795 MCM ACSR, 45 km ▪ 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 Submarine Cable Components:	

		▪ Talavera CTS, 8-230 kV PCBs, 4x50 MVAR 230 kV Reactor; ▪ Calatrava-Talavera CTS 230 kV Submarine Cable, Double Circuit, 6-1,600 mm^2 XLPE subcable, 29 km Bulk Cost Estimate: 43,643 million Pesos	
Visayas Voltage Improvement Project	PQ	To address the projected low voltage problems in Northern Samar, eastern part of Leyte and Southern Leyte due to long 69 kV transmission lines serving them coupled with the growth in demand, and in the western part of Bohol and Central Cebu due to load growth.	Dec 2021
		<u>Substation Components:</u> ▪ Compostela 138 kV S/S, 2x20 MVAR, 138 kV Capacitor Banks and accessories, 2-138 kV PCBs and associated equipment; ▪ Cebu 138 kV S/S, 2x20 MVAR, 138 kV Capacitor Banks and accessories, 2-138 kV PCBs and associated equipment; ▪ Corella 138 kV S/S, 3x5 MVAR, 69 kV Capacitor Banks and accessories, 3-69 kV PCBs and associated equipment; ▪ Himayangan LES, 1x5 MVAR, 69 kV Capacitor Bank and accessories, 1-69 kV PCB and associated equipment; ▪ Bobolosan LES, 1x5 MVAR, 69 kV Capacitor Bank and accessories, 1-69 kV PCB and associated equipment; ▪ Tolosa LES, 1-5 MVAR, 69 kV Capacitor Bank and accessories, 1-69 kV PCB and associated equipment. Bulk Cost Estimate: 786 million Pesos	
MINDANAO			
Manolo Fortich (Lingion) 138 kV Switching Station	GE	To accommodate the grid connection of Hedcor's 68.8 MW HEPP.	Feb 2018
		<u>Substation Components:</u> ▪ Manolo Fortich (Lingion) 138 kV Switching Station, 11-138 kV PCBs and associated equipment. Bulk Cost Estimate: 358 Million Pesos	
Balo-i-Kauswagan 230 kV Transmission Line (Formerly Balo-i-Kauswagan-Aurora 230 kV Transmission Line (Phase 1))	GE	To accommodate the grid connection of GNPK's 600 MW CFPP.	Apr 2018
		<u>Substation Components:</u> ▪ Kauswagan 230 kV Substation, 12-230 kV PCBs and associated equipment; ▪ Balo-I Substation Expansion, 2x300 MVA 230/138 kV Transformers and accessories, 8-230 kV PCBs and associated equipment, and 4-138 kV PCBs and associated equipment. <u>Transmission Components:</u> ▪ Balo-I–Kauswagan 230 kV Transmission Line, ST-DC, 2-410 mm^2 TACSR, 11.1 km. Bulk Cost Estimate: 2,222 Million Pesos	
Aurora–Polanco 138 kV Transmission Line	LG	To boost the power delivery service to the increasing power demand in northern part of Zamboanga Peninsula.	Jun 2018
		<u>Substation Components:</u> ▪ Polanco 138 kV Substation (New), 1x75MVA 138/69/13.8 kV Transformer and accessories, 3-138 kV PCBs and associated equipment, 4-69 kV PCBs and associated equipment; ▪ Aurora 138 kV Substation (Expansion), 4-138 kV PCBs and associated equipment; <u>Transmission Components:</u> ▪ Aurora–Polanco 138 kV Transmission Line, ST-DC, 1-795 MCM, 79 km; ▪ Cut-in 69 kV Transmission Line, SP-DC, 1-336.4 MCM ACSR, 4 km. Bulk Cost Estimate: 1,889 Million Pesos	

Sultan Kudarat (Nuling) Capacitor Project	SR	To mitigate the projected low voltage problems in Maguindanao area.	Jun 2018
		Substation Component: ▪ Sultan Kudarat 138 kV Substation (Expansion), 2x7.5MVAR, 69 kV Capacitor Banks and accessories. Bulk Cost Estimate: 64 Million Pesos	
Agus 6 Switchyard Upgrading / Rehabilitation Project	SR	To upgrade the existing obsolete and aging primary and secondary equipment and devices in Agus 6 Switchyard.	Jun 2018
		Substation Component: ▪ Agus 6 Switchyard, 6-138 kV PCBs and associated equipment, 17-69 kV PCBs and associated equipment. Bulk Cost Estimate: 721 Million Pesos	
Butuan–Placer 138 kV Transmission Line	SR	To provide N-1 contingency to the existing corridor by installing a second circuit.	Oct 2018
		Transmission Components: ▪ Butuan–Placer 138 kV, ST-SC, 1-795MCM, 100km; Substation Components: ▪ Placer 138 kV Substation, 2-138 kV PCBs and associated equipment; ▪ Butuan 138 kV Substation, 2-138 kV PCBs and associated equipment. Bulk Cost Estimate: 924 Million Pesos	
Toril 138 kV Substation Phase 2	LG	To add substation capacity to provide N-1 contingency	Feb 2019
		Substation Components: ▪ Toril 138 kV Substation, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs and associated equipment, 3-69 kV PCBs and associated equipment. Bulk Cost Estimate: 956 Million Pesos	
Mindanao 230 kV Transmission Backbone	GE	To increase transfer capacity of the existing corridor and maintain the N-1 contingency provision.	Mar 2019
		Substation Components: ▪ Malita 230 kV Substation, 1x50 MVA 230/69 kV Power Transformer and accessories; ▪ Matanao 230 kV Substation, 2-230 kV PCBs and associated equipment; ▪ Toril 230 kV Substation, 2x300 MVA 230/138 kV Power Transformers and accessories,10-230 kV PCBs and associated equipment, and 6-138 kV PCBs and associated equipment; ▪ Bunawan 230 kV Substation, 2x300 MVA 230/138 kV Power Transformers and accessories, 10-230 kV PCBs and associated equipment, and 1-69 kV PCBs and associated equipment; ▪ Balo-i 230 kV Substation, 2-230 kV PCBs and associated equipment; ▪ Villanueva 230 kV Substation, 2x300 MVA 230/138 kV Power Transformers and accessories, 2x35 MVAR Shunt Reactors and accessories, and 12-230 kV PCBs and associated equipment; ▪ Maramag 230 kV Substation, 4-230 kV PCBs and associated equipment Transmission Components: ▪ Matanao–Toril 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR, 34 km; ▪ Toril–Bunawan 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR, 40.2 km; Bulk Cost Estimate: 6,858 Million Pesos	

Agus 2 Switchyard Upgrading Project	SR	To upgrade the existing antiquated and aging primary and secondary equipment and devices in Agus 2 Switchyard	May 2019
		Substation Components: ▪ Agus 2 Switchyard, 10-138 kV PCBs and other old or defective equipment and expansion of the existing Control Building Flood Control System. Bulk Cost Estimate: 569 Million Pesos	
Kauswagan–Lala 230 kV Transmission Line (Formerly Balo-i–Kauswagan–Aurora 230 kV Transmission Line (Phase 2)	GE, SR	To enhance reliability of power delivery towards Zamboanga Peninsula. This will also complement the transmission of excess power from Mindanao Grid towards the Visayas Grid and vice versa.	Dec 2020
		Substation Components: ▪ Lala 230 kV Substation (New): 2x300 MVA 230/138-13.8 kV Power Transformer and accessories, 6-230 kV PCB, 6-138 kV PCB and associated equipment; ▪ Aurora 138 kV Substation (Expansion): 3-138 kV PCB and associated equipment; Transmission Components: ▪ Kauswagan–Lala 230 kV Transmission Line: ST-DC, 4-795 MCM ACSR, 58 km; ▪ Lala-Aurora 138 kV Transmission Line: ST-DC, 2-795 MCM ACSR, 30 km Bulk Cost Estimate: 5,347 Million Pesos	
Tacurong–Kalamansig 69 kV Transmission Line	SR	To connect the currently off-grid part of southwestern area in Sultan Kudarat to the Mindanao Grid.	Sep 2021
		Substation Components: ▪ Tacurong 69 kV Substation, 1-69 kV PCB and associated equipment; ▪ Kalamansig 69 kV Switching Station, 1x7.5 MVAR 69 kV Capacitor Banks and accessories, and 3-69 kV PCBs and associated equipment Transmission Components: ▪ Tacurong–Kalamansig 69 kV Transmission Line, ST-SC, 1-336.4 MCM ACSR, 120 km Bulk Cost Estimate: 1,257 Million Pesos	
Mindanao Substation Upgrading	LG	To add substation capacity to provide N-1 contingency	Dec 2022
		▪ Substation Components: ▪ Polanco 138 kV Substation, 1x75 MVA 138/69 kV Power Transformer and accessories, 3-138 kV PCB, 1-69 kV PCB and associated equipment; ▪ Naga 138 kV Substation, 1x100 MVA 138/69 kV Power Transformer and accessories, 2-69 kV PCBs and associated equipment; ▪ Pitogo 138 kV Substation, 1x100 MVA 138/69 kV Power Transformer and accessories, 1-138 kV PCB, 1-69 kV PCB and associated equipment; ▪ Agus 6 138 kV Substation, 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs and associated equipment; ▪ Maramag 138 kV Substation, 1x75 MVA 138/69 kV Power Transformer and accessories, 1-138 kV PCB, 1-69 kV PCB and associated equipment; ▪ Opol 138 kV Substation, 1x75 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 5-69 kV PCBs and associated equipment;	

		▪ Butuan 138 kV Substation, 1x100 MVA 138/69 kV Power Transformer and accessories, 2x7.5 MVAR Shunt Capacitor, 5-138 kV PCBs, 5-69 kV PCBs and associated equipment; ▪ Placer 138 kV Substation, 1x100 MVA 138/69 kV Power Transformer and accessories, 1x7.5 MVAR Shunt Capacitor, 3-138 kV PCBs, 5-69 kV PCBs and associated equipment; ▪ Bislig 138 kV Substation, 1x50 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 5-69 kV PCBs and associated equipment; ▪ San Francisco 138 kV Substation, 1x50 MVA 138/69 kV Power Transformer and accessories, 2x7.5 MVAR Shunt Capacitor, 4-138 kV PCBs, 3-69 kV PCBs and associated equipment; ▪ Kidapawan 138 kV Substation, 1x50 MVA 138/69 kV Power Transformer and accessories (from Culaman Substation), 1-138 kV PCB, 2-69 kV PCBs and associated equipment; ▪ Gen. Santos 138 kV Substation, 1x7.5 MVAR Shunt Capacitor, 1-138 kV PCB, 8-69 kV PCBs and associated equipment; ▪ Tacurong 138 kV Substation, 1x7.5 MVAR Shunt Capacitor, 1-138 kV PCB, 10-69 kV PCBs and associated equipment. Bulk Cost Estimate: 5,065 Million Pesos	
Mindanao Substation Rehabilitation	SR	To upgrade the existing obsolete and aging primary and secondary equipment and devices in various Mindanao Substations	Dec 2022
		<u>Substation Components:</u> ▪ Aurora 138 kV Substation, 1-138 kV and 3-69 kV PCBs and associated equipment; ▪ Zamboanga 138 kV Substation, 3-138 kV and 2-69 kV PCBs and associated equipment; ▪ Agus 5 Substation, 4-138 kV PCBs and associated equipment; ▪ Balo-I 138 kV Substation, 13-138 kV PCBs and associated equipment; ▪ Lugait 138 kV Substation, 5-138 kV PCBs and associated equipment; ▪ Tagoloan 138 kV Substation, 4-138 kV and 1-69 kV PCBs and associated equipment; ▪ Pulangi 4 Substation, 10-138 kV and 3-69 kV PCBs and associated equipment; ▪ Nasipit 138 kV Substation, 4-138 kV PCB and associated equipment; ▪ Davao 138 kV Substation, 4-138 kV and 6-69 kV PCBs and associated equipment; ▪ Maco 69 kV Substation, 2-69 kV PCBs and associated equipment; ▪ Bunawan 138 kV Substation, 6-138 kV PCBs and associated equipment; ▪ Nabunturan 138 kV Substation, 3-138 kV and 5-69 kV PCBs, and associated equipment; ▪ Sultan Kudarat 69 kV Substation, 4-69 kV PCBs and associated equipment. Bulk Cost Estimate: 3,451 Million Pesos	

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

7.2.1 Luzon Grid

7.2.1.1 Bataan–Cavite Transmission Line (Feasibility Study)

The feasibility study for Bataan–Cavite Transmission line aims to establish the most feasible submarine cable link between Bataan and Cavite as part of the long-term plan to form a backbone loop system. This undertaking is in relation to several power plant projects being proposed in the Luzon Grid particularly in the province of Bataan.

The project involves system studies for the establishment of the appropriate cable capacity based on the available technologies and conduct of surveys for both submarine and overhead portion of the Bataan–Cavite Transmission Line.

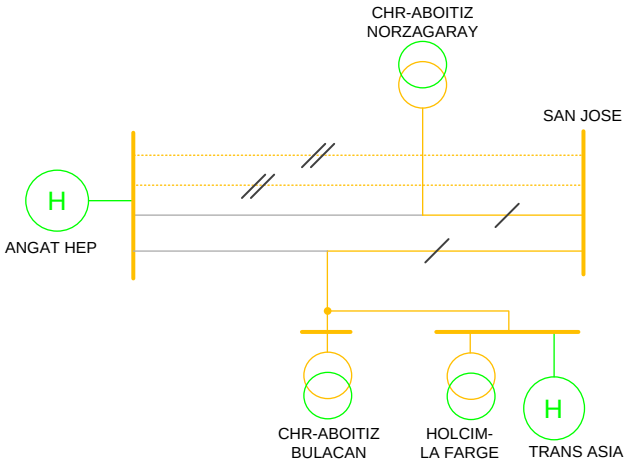
7.2.1.2 Luzon Substation Reliability I

The Luzon Substation Reliability Project 1 aims to provide N-1 contingency and operational flexibility to Tayabas, Botolan, San Esteban, Gumaca and Labo Substations. The project involves the installation of additional transformer for each substation so that power interruptions during transformer shutdown or maintenance would not be experienced by the power customers served by each substation.

7.2.1.3 Luzon PCB Replacement

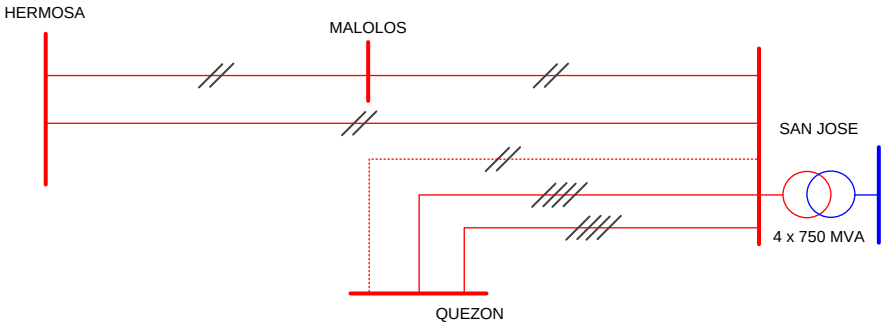
The Luzon PCB Replacement Project aims to improve the system reliability in San Jose, Gumaca, Malaya and Labo Substations in the Luzon Grid. The Project involves the replacement of old and underrated power circuit breakers (PCB). The PCBs with insufficient interrupting capacities pose risk in efficiently responding to any system disturbances in the power network.

7.2.1.4 San Jose–Angat 115 kV Line Upgrading



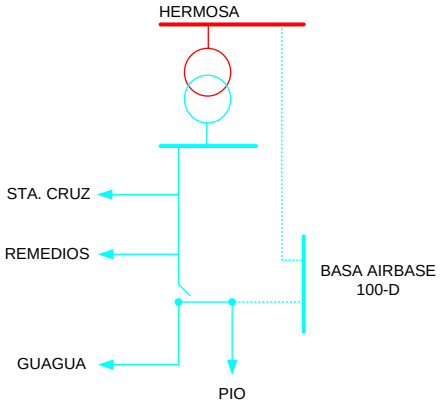
The San Jose–Angat 115 kV Line Upgrading Project aims to ensure the reliability of the existing 115 kV transmission lines connecting Angat HEPP to the Luzon Grid. The San Jose-Angat Lines 1 and 2 were built in 1967 while Line 3 (wood pole) was built in 1960. The 300 MVA capacity per circuit of the project 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. Furthermore, this project will eliminate the T-connection of existing industrial customers along the existing San Jose–Angat 115 kV Lines. The project involves the construction of a new 18 km 115 kV double-circuit line with higher ampacity. It will utilize the existing right-of-way of San Jose–Angat Line 3. The existing industrial customers that were previously T-connected will utilize the existing Lines 1 and 2 and will radially source its power requirement to San Jose 115 kV Substation.

7.2.1.5 San Jose–Quezon 230 kV Line 3



The San Jose–Quezon 230 kV Line 3 project aims 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. The project involves the construction of the third circuit in the San Jose-Quezon 230 kV transmission corridor. Due to the difficulty in implementing the transmission line approaching the Quezon 230 kV Substation, the proposed line will utilize the ROW of the existing San Rafael–Quezon 230 kV line up to Quezon 230 kV Substation. The proposed scheme requires the transfer of termination of the San Rafael 230 kV line from Quezon Substation to San Jose Substation utilizing the idle San Jose–Caysio, ST-DC, 1-795 MCM ACSR, 230 kV line.

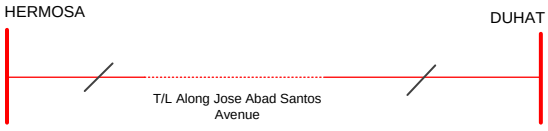
7.2.1.6 Hermosa–Floridablanca 69 kV Transmission Line



The Hermosa–Floridablanca 69 kV Transmission Line Project aims to relieve the imminent overloading of the existing Hermosa-Guagua 69 kV single-circuit line and address the undervoltage issues on its delivery points; to address the line reliability issue due to old age; and to adequately supply the increasing load in the areas being served.

The Hermosa–Floridablanca 69 kV Transmission Line Project involves the construction of a 16.86 kilometer, single-circuit 69 kV transmission line from Hermosa to Floridablanca. Upon implementation of the Hermosa–Floridablanca 69 kV line, PELCO II Sta. Cruz and Remedios will be the only two loads left to the old Hermosa-Guagua line.

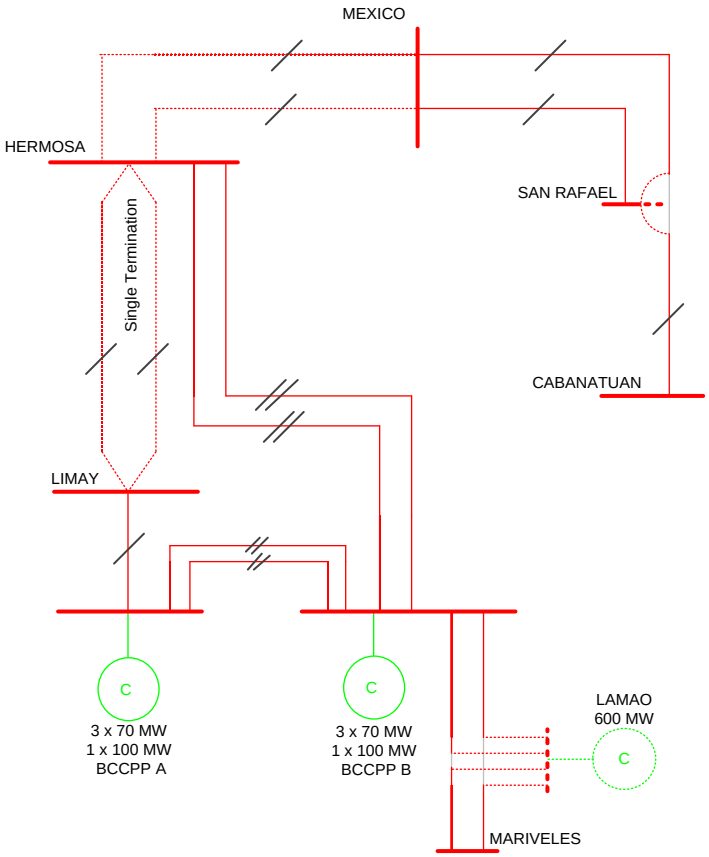
7.2.1.7 Relocation of Steel Poles along Hermosa–Duhat 230 kV Transmission Line



This undertaking is in connection to the road widening project along Jose Abad Santos Avenue in San Fernando, Pampanga which left some 18 steel poles at the middle of the road. The proposed relocation will eliminate the danger brought about by the remaining steel pole structures as well as to prevent accidents that will cause power interruption to the Hermosa-Duhat 230 kV Line. The project involves the relocation of 18 steel pole structures along the road Right-of-Way (ROW) limit of the DPWH in San Fernando–Gapan–Olongapo National Road, San Fernando City. This will be implemented through re-routing of the affected line using new steel pole structures.

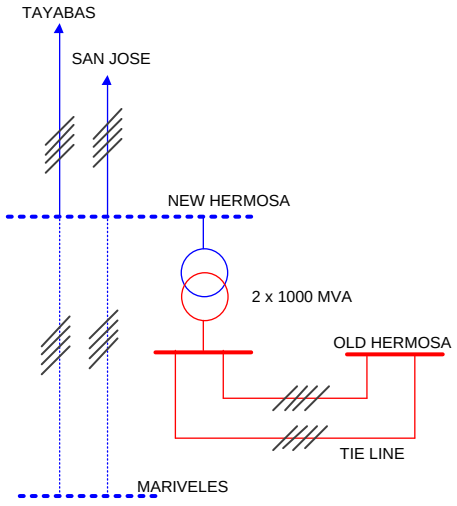
7.2.1.8 Bataan 230 kV Grid Reinforcement Project

The Bataan 230 kV Grid Reinforcement Project aims to accommodate the connection of a committed power plant, the 600 MW SMC Consolidated Power Corporation Coal-Fired Power Plant (SMC CPC CFPP) Project. The power plant will be connected through bus-in scheme to the Luzon Grid through the existing Mariveles–BCCPP-B 230 kV transmission line. The Project involves the development of Lamao 230 kV Substation, reconductoring of Limay-Hermosa and Hermosa-Mexico 230 kV Lines, replacement of underrated power circuit breakers at Limay Substation and BCCPP Block A & B Switchyard, and the reconfiguration of the Mexico-Cabanatuan 230 kV corridor to fully dispatch the generation capacity of the existing and the proposed power plants.



7.2.1.9 Mariveles–Hermosa 500 kV Transmission Line

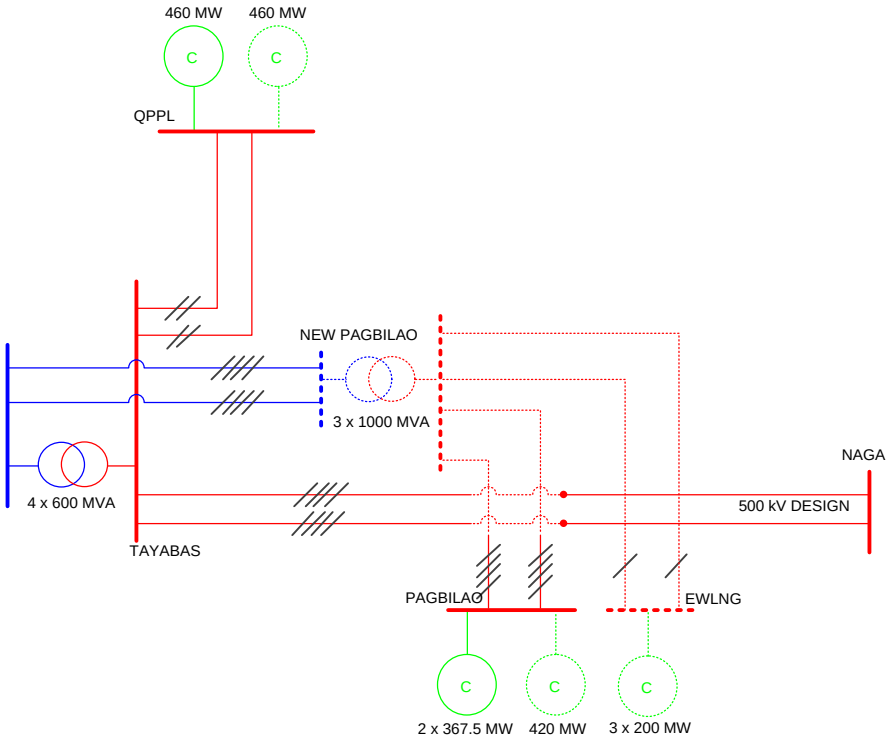
The Mariveles–Hermosa 500 kV Transmission Line Project aims to allow the connection of incoming generations in Bataan Peninsula which include 2x668 MW GN Power Dinginin CFPP, 8x150 MW SMC Consolidated Power Corporation CFPP and 2x150 MW KEPCO-HHIC CFPP Power Plant Project. While the Bataan 230 kV Grid 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. The Project involves the development of new Mariveles 500 kV Substation and construction of 500 kV transmission line backbone from new Mariveles 500 kV Substation to Hermosa 500 kV Substation. 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.



7.2.1.10 North Luzon 230 kV Substation Upgrading Project

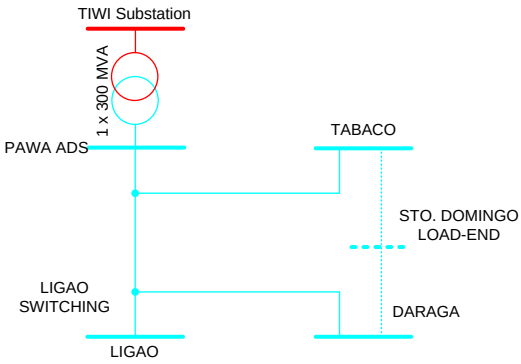
The North Luzon Substation Upgrading Project aims to cater the load growth and provide N-1 contingency to various substations in NGCP's North Luzon Region, Bauang, Gamu, Bayombong, Hermosa, Doña Imelda, Malaya, San Jose, Quezon, Balingueo, Bacnotan, Labrador, and San Rafael Substations. The Project involves transformer installations, and replacement and rearrangements of power circuit breakers to ensure reliability and flexibility of operations on the concerned substations.

7.2.1.11 Pagbilao 500 kV Substation



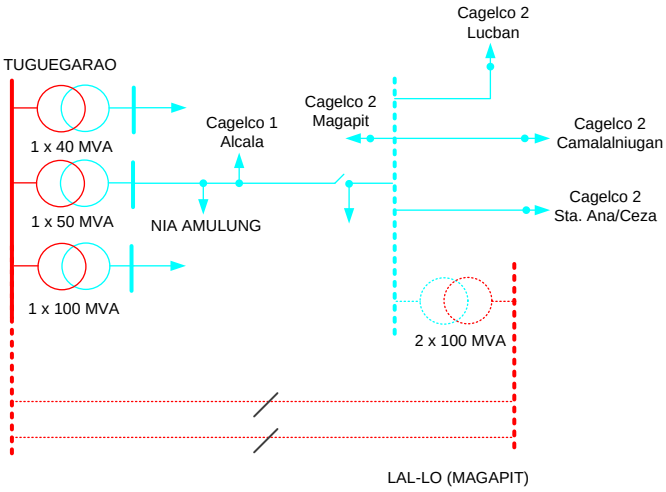
The Pagbilao 500 kV Substation Project will accommodate the connection of incoming power plants in Quezon Province which include the 420 MW Pagbilao Coal-Fired Power Plant (CFPP) Expansion, 500 MW San Buenaventura Power Ltd. Co. (SBPL) Coal-Fired Power Plant and 600 MW Energy World Corporation (EWC) Combined-Cycle Power Plant. The Pagbilao EHV Substation Project will address the overloading of Tayabas 500/230 kV transformers and the fault level issue at Tayabas 230 kV Substation. The Project involves the development of Pagbilao 500 kV substation and expansion of the Tayabas 500 kV Substation. It will be connected bus-in to the grid through Naga-Tayabas 230 kV Line. The 17 km segment of the Naga-Tayabas 230 kV Line will be energized at 500 kV level to accommodate the connection of the Project.

7.2.1.12 Eastern Albay 69 kV Transmission Line Stage 2



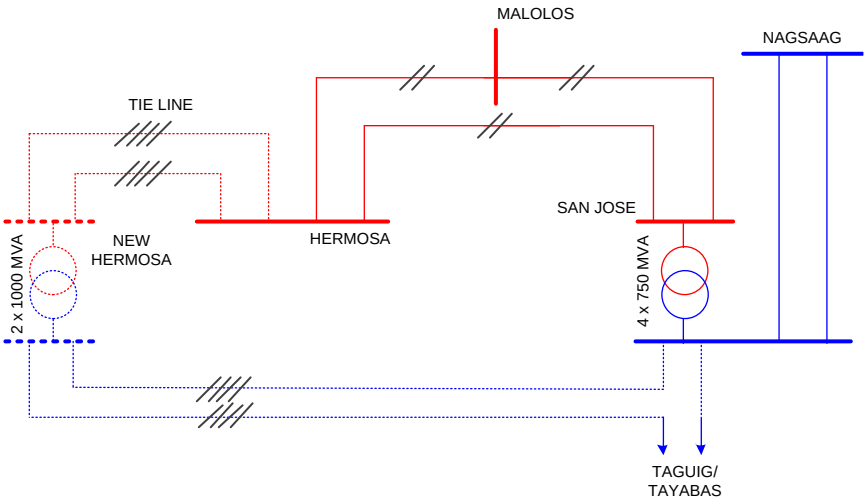
The Eastern Albay 69 kV Line Project aims to provide a more reliable transmission corridor in the eastern coast of Albay to serve the increasing eco-tourism developments in the area which include the Misibis Resort, Estate and Spa in Cagraray Island. The Eastern Albay 69 kV Line Project is divided into two stages. Stage 1 includes the development of the Sto. Domingo Load-End Substation with a 10 MVA, 69/13.8 kV transformer and the single-circuit Daraga–Sto. Domingo 69 kV Transmission Line which will be 21 km long and composed of a single-bundle of 336.4 MCM ACSR/AS conductors. Stage 2 meanwhile includes the development of the single-circuit Sto. Domingo-Tabaco 69 kV Line which will be 18 km long and composed of a single-bundle of 336.4 MCM ACSR/AS conductors.

7.2.1.13 Tuguegarao–Lal-lo (Magapit) 230 kV Transmission Line



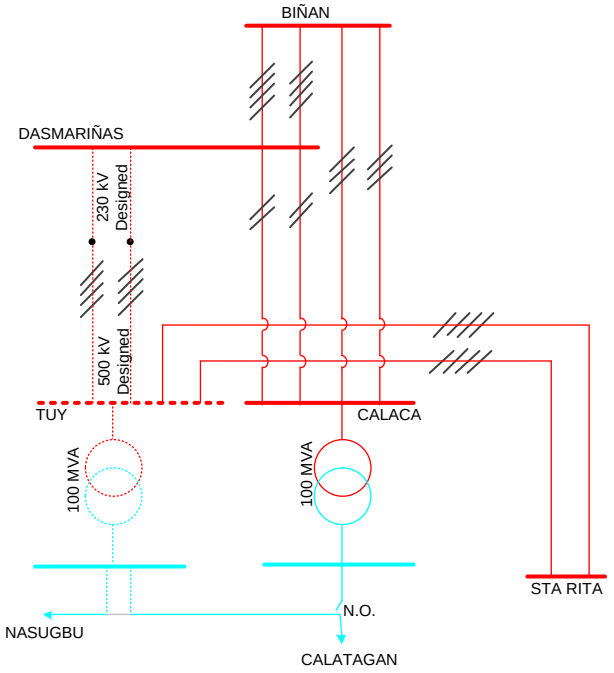
The Tuguegarao–Lal-lo (Magapit) 230 kV Transmission Line project aims to address the imminent overloading of the Tuguegerao–Magapit 69 kV Line due to the forecasted load growth in the northern part of Cagayan Province. It also aims to improve the power quality and reliability of supply in the area which is presently being served by a very long 69 kV line. 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. The project involves the construction of a 64 double-circuit 230 kV transmission line from Tuguegarao to Lal-lo and the development of Lal-lo 230/69 kV Substation with a capacity of 2x100 MVA.

7.2.1.14 Hermosa–San Jose 500 kV Transmission Line



The Hermosa–San Jose 500 kV Transmission Line Project aims to accommodate the generation capacity additions in Bataan and Zambales area. The Project will serve as a new 500 kV corridor for the 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 and SMC CFPP. The Project involves the development of new Hermosa 500 kV Substation and construction of a 500 kV transmission line from new Hermosa 500 kV Substation up to San Jose 500 kV Substation. The old Hermosa 230 kV Substation will transfer power through construction of a 230 kV Tie Line to the new Hermosa 500 kV Substation. Shunt Reactors, Line Reactor and Capacitor Banks will also be installed for system voltage regulation during off-peak and peak conditions.

7.2.1.15 Tuy 500 kV Substation (Stage 1)



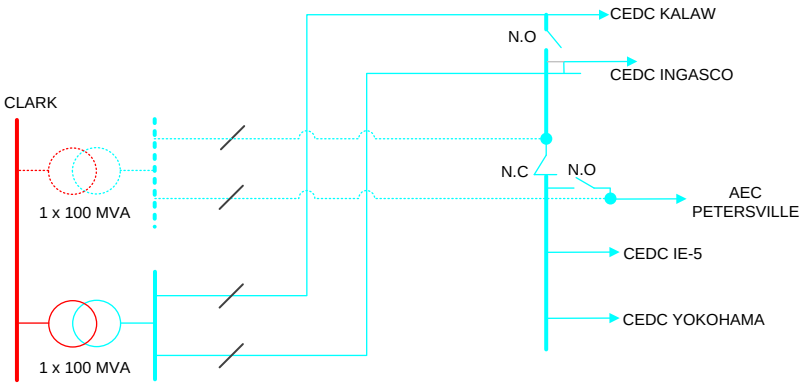
The Tuy 500 kV Substation (Stage 1) aims to accommodate the connection of the 2x350 MW SRPGC Coal Plant and allow full dispatch of bulk generation capacity additions in Batangas. The generation capacity additions will turn Calaca Substation into a merging point of more than 2,000 MW of power generation. 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.

The Tuy 500 kV Substation (Stage 1) Project will involve the development of Tuy 500 kV Substation which will be initially energized at 230 kV voltage level. The project will also invove the development of Tuy–Dasmariñas 500 kV designed transmission line but will also be initially energized at 230 kV. Furthermore, a new 100 MVA, 230/69-13.8 kV Power Transformer will be installed to provide N-1 contingency to the existing 100 MVA Power Transformer at Calaca Substation.

7.2.1.16 Luzon Voltage Improvement Project 3

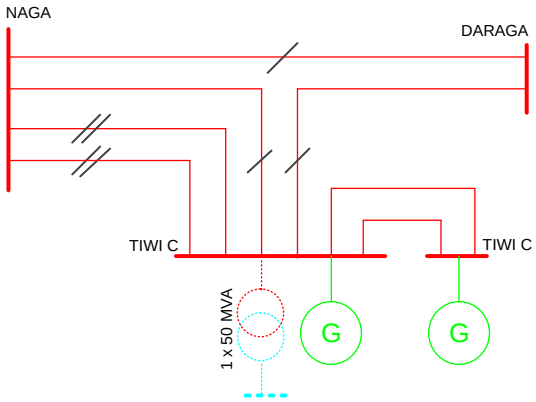
The Luzon Voltage Improvement Project 3 aims to address the anticipated undervoltage problem during peak load condition and overvoltage problem during off peak load condition at various 500 kV, 230 kV and 69 kV load-end substations in the North Luzon Grid. The Luzon Voltage Improvement Project 3 involves the installation of capacitors and reactors to substations in the North Luzon Region, Laoag, Cabanatuan, Nagsaag, Tuguegarao, Baler, Pantabangan, Umingan, Paniqui, Bantay, San Esteban, Botolan, Mexico, San Jose, Itogon, Antipolo and Bayambang Substations.

7.2.1.17 Clark–Mabiga 69 kV Transmission Line



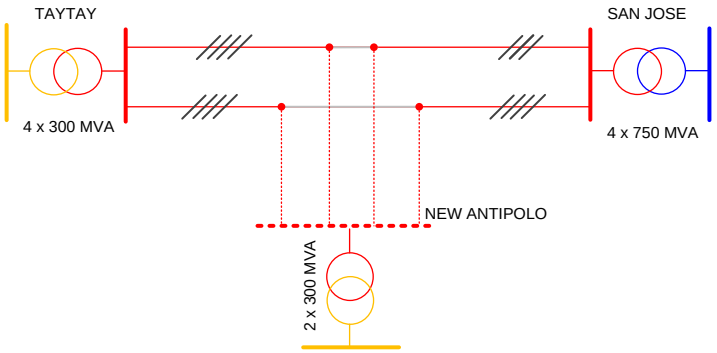
The Clark-Mabiga 69 kV Line Project aims to reinforce the Mexico–Clark 69 kV Line which is serving PRESCO, PELCO I, PELCO II, Angeles Electric Corporation (AEC), Quanta Paper Corporation and Clark Electric Development Corporation (CEDC). This will address the load growth in the area of Angeles and Mabalacat together with the new industries in Clark Freeport Zone and improve the power quality of supply in the area. The project involves the installation of a new transformer at Clark 230 Substation and the construction of a 69 kV line from the Clark Substation up to the area of Mabiga in Pampanga.

7.2.1.18 Tiwi Substation Upgrading



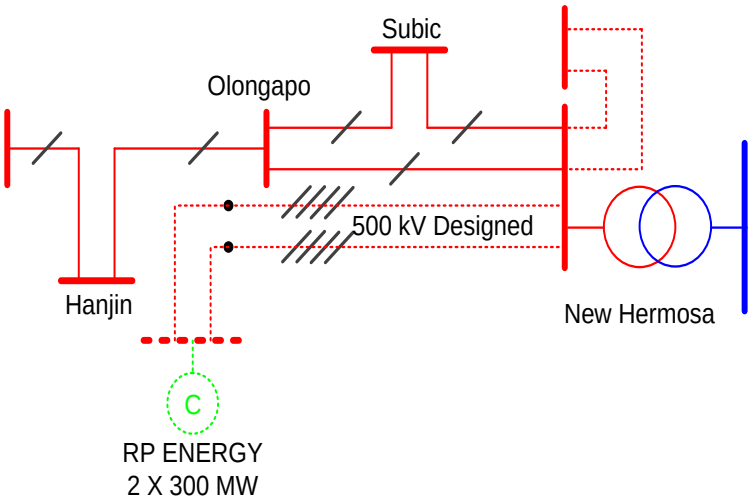
The project aims to upgrade the old and deteriorated substation equipment at Tiwi A and C Substations to improve the reliability of the system. It will also augment the power requirement of Malinao/Ligao LES by installation of additional power transformer at Tiwi C Substation and will clearly identify asset boundaries within the Tiwi Geothermal Power Plant Complex through construction of NGCP's own control facilities. The project involves the upgrading of equipment at Tiwi A and C Substations and installation of 50 MVA, 230/69-13.8 kV Power Transformer at Tiwi C Substation. It also involves the diversion of the Daraga/Naga 230 kV Line to Tiwi C Substation and extension of the Malinao/Ligao 69 kV Line from Tiwi A to Tiwi C Substation.

7.2.1.19 Antipolo 230 kV Substation



The Antipolo 230 kV Substation aims to cater the load growth in the Sector 2 of MERALCO. With the further increase in load, the existing 230/115 kV substations in Taytay and Doña Imelda become heavily loaded and have been losing already the provision for N-1 contingency and have space constraints for further expansion. This will expose the Metro Manila loads to supply reliability risk as well as power quality concerns during system peak load condition. The project 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 conductors. Initially, the substation will also be installed with capacitor banks for voltage support. To draw supply from Antipolo, MERALCO will be installing 2x300 MVA 230/115 kV transformers and 115 kV Substation. MERALCO will also put up line connections to their existing 115 kV network in the area.

7.2.1.20 Western 500 kV Backbone (Stage 1)

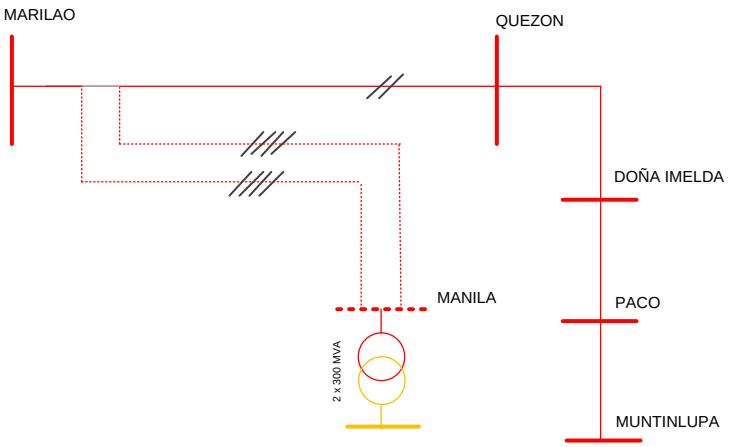


The Western Luzon Backbone (Stage 1: Castillejos–Hermosa 500 kV Transmission Line Project) aims to provide a transmission facility to connect the 2x300 MW RP Energy CFPP to the Luzon Grid through Hermosa Substation.The project involves the implementation of a 32 km double circuit 500 kV designed transmission line from Castillejos to Hermosa. This line will be initially energized at 230 kV and will be connected to the RP Energy Coal Plant–Castillejos 230 kV line. This Castillejos–Hermosa 500 kV Line segment is part of the proposed long term plan for 500 kV backbone loop development from Bolo (Kadampat) down to Hermosa Substation.

7.2.1.21 Luzon Voltage Improvement Project 4

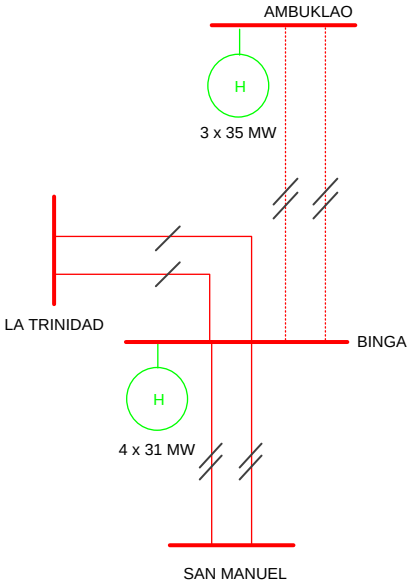
The Luzon Voltage Improvement Project 4 aims to address the anticipated undervoltage problem during peak load condition at various 230 kV and 69 kV load-end substations in the South Luzon Grid. The Luzon Voltage Improvement Project 4 involves the installation of capacitors to substations in the South Luzon Region. These include the Biñan and Dasmariñas 230 kV Substation In addition, capacitor installation will also be implemented in Ligao, Iriga, Mabini, Cuenca, Taysan, Juan, Lagonoy, Bulan and Malvar 69 kV Load End Substations.

7.2.1.22 Manila (Navotas) 230 kV Substation



The Manila (Navotas) 230 kV Substation aims to cater the load growth in the Sector 1 of MERALCO and serve as a connection point for power plants in the area such as the TMO and Millennium Power Plants. 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. The proposed Manila/Navotas 230 kV Substation will be initially linked to the grid through cut-in connection along the existing Marilao-Quezon 230 kV line and will ultimately terminate in the future Marilao 500 kV Substation. The Project will be a Gas Insulated Switchgear (GIS) substation due to the space constraints for an outdoor substation.

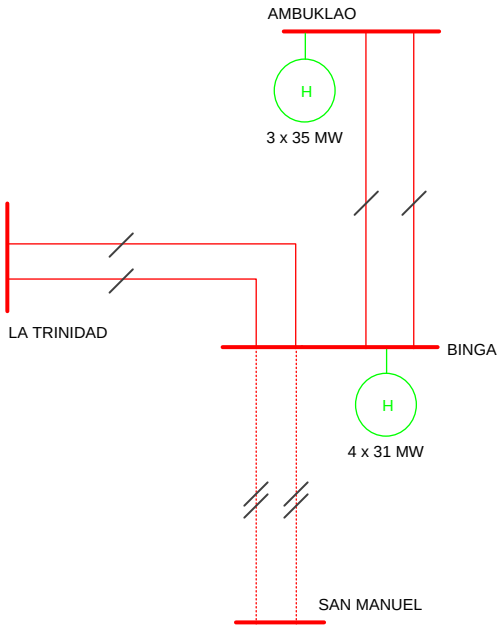
7.2.1.23 Ambuklao–Binga 230 kV Transmission Line Upgrading



The Ambuklao–Binga 230 kV Transmission Line Upgrading 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 and the proposed generation capacity additions in the Cagayan Valley area. 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. The project involves the construction of 11 km, 230 kV, double circuit, steel tower-steel pole transmission line to replace the old Ambuklao-Binga 230 kV line which presently conveys the generated power of Ambuklao and Magat HEPPs to the transmission backbone of the Luzon Grid.

7.2.1.24 Binga–San Manuel 230 kV Transmission Line

The Binga–San Manuel 230 kV Transmission Line upgrading 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. 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.



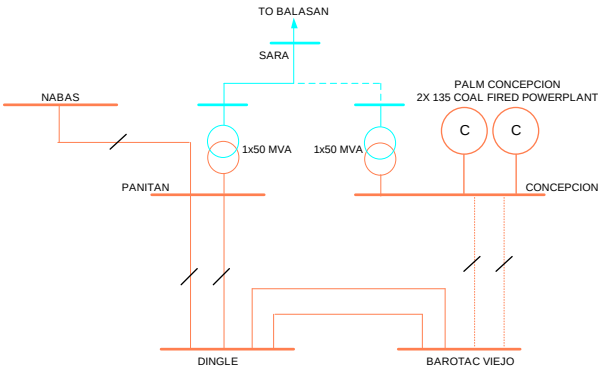
7.2.1.25 South Luzon 230 kV Substation Upgrading Project

The South Luzon Substation Upgrading Project aims to cater the load growth and provide N-1 contingency to various substations in NGCP's South Luzon Region which include Las Piñas, Lumban, Labo, Naga, Gumaca and Daraga Substations. The Project involves transformer installations, and replacement and rearrangements of power circuit breakers to ensure reliability and flexibility of operations on the concerned substations.

7.2.2 Visayas Grid

7.2.2.1 Eastern Panay Transmission Line Project

With the entry of the 2x135 MW Coal Plant of Palm Concepcion Power Corporation (PCPC) in Concepcion, Panay, the existing transmission facilities in the area are insufficient to cater the full dispatch of the power plant.



The project is intended to accommodate the entry of the said coal plant. The new substation in Concepcion will also provide and alternate drawdown substation for ILECO III. This will result in improved voltage in the area and compliance to the N-1 criteria for Northeastern Panay.

The project involves the construction of a new Concepcion Substation and a 42 km 138 kV double circuit line to Barotac Viejo Substation. Additionally, a 14.2 km 69 kV line will also connect Sara LES to Concepcion Substation, to provide an alternate drawdown for ILECO III.

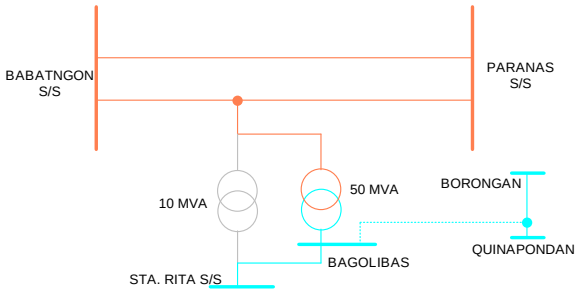
7.2.2.2 Visayas Substation Reliability Project I

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

The substations under this project are Ormoc (230 kV), Bacolod (138 kV), Cadiz (138 kV) and Samboan (138 kV) which are already completed, while Amlan (138 kV) and Maasin (138 kV) are still ongoing.

7.2.2.3 Sta. Rita – Quinapondan 69 kV Transmission Line

The Paranas – Taft – Borongan – Quinapondan 69 kV Line is a single circuit, 190.5 km line utilizing 336.4 MCM ACSR conductor. This is a radial line serving ESAMELCO, particularly the Taft, Borongan and Quinapondan Substations. Considering the 190.5 km length of the line, the Eastern Samar Area has been prone to trippings, high system loss and low voltage problems.

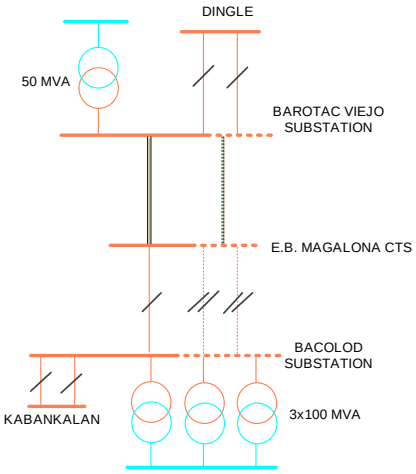


This project involves the construction of a 103 km 69 kV line connecting Sta. Rita and Quinapondan Substations.

7.2.2.4 Cebu-Negros-Panay 230 kV Backbone Project - Stage 1

The development of new power plants, particularly in Panay and Negros Islands will result in the increase in power exchange between the islands of Panay, Negros and Cebu. However, the existing Negros-Panay interconnection system has limited capacity to cater the excess power generation from Panay towards Negros which could result in power curtailment.

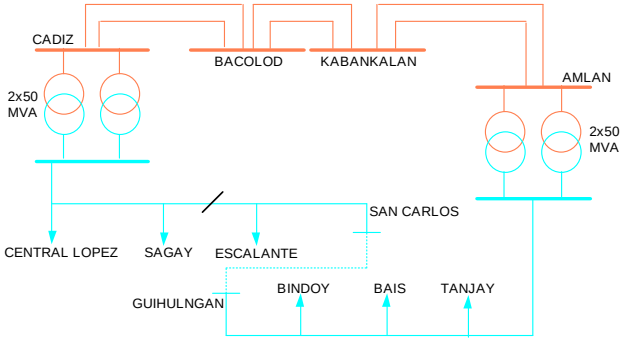
In order to ensure the effective transmission of excess power generation from Panay towards Negros, a high capacity transmission corridor is being proposed. Strategically, the project will be designed consistent with the long-term transmission master plan of having a 230 kV transmission backbone in the Visayas by establishing a 230 kV interconnection from Panay to Cebu.



The project involves the development of transmission corridor from Barotac Viejo S/S to Bacolod S/S and will be composed of submarine cable system and overhead transmission lines. It is designed at 230 kV voltage level but will be initially energized and operated at 138 kV. The submarine cable component was already completed in October 2016. The project will also involve associated expansion works at Barotac Viejo and Bacolod Substations.

7.2.2.5 San Carlos-Guihulngan 69 kV Transmission Line

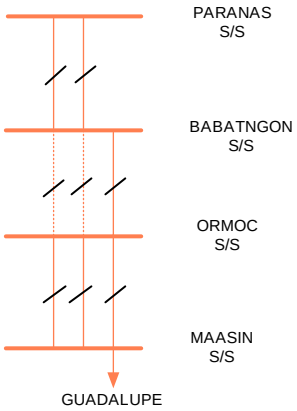
This project is intended to accommodate power demand in the northeastern part of Negros island by building a 69 kV transmission loop from Cadiz to Amlan. This loop will ensure the security and reliability of power supply to eastern Negros.



This project involves the construction of a 58 km 69 kV line utilizing a 1-336.4 MCM ACSR conductor from San Carlos to Guihulngan.

7.2.2.6 Ormoc – Babatngon 138 kV Transmission Line

The Ormoc – Babatngon 138 kV line is one of the two 138 kV lines that compose the Leyte –Samar transmission corridor, the Babatngon – Paranas 138 kV line being the other one. The Babatngon – Paranas 138 kV line is a double circuit line while the Ormoc – Babatngon 138 kV line is only single circuit. Thus, the outage of this line will result to a loss of supply for Samar.



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

7.2.2.7 Visayas Substation Reliability Project II

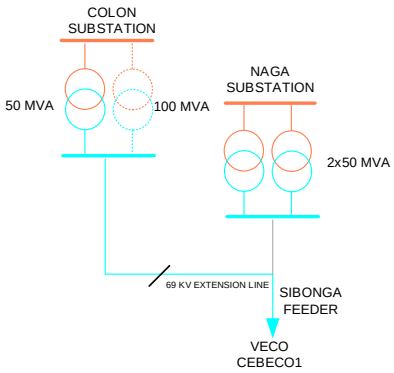
Various substations in the Visayas Grid have limited transformation capacity to provide continuous power delivery towards the load customers during single transformer outages, which will result in power curtailment.

The project aims to cater the load growth and provide N-1 contingency and accommodate additional generation capacity to various substations in Panay, Leyte and Cebu. The project will involve upgrading of Ormoc, Babatngon, Sta. Barbara, Mandaue, and Lapu-lapu Substations. Expansions in Lapu-lapu and Mandaue are still ongoing while the expansions on the other substations are already completed.

The project involves the installation of power transformer, including the associated substation expansion required to ensure reliability and flexibility of operations on the substations.

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

The Naga Substation was commissioned in 1977, hence, most of the equipment are already antiquated and are difficult to maintain. In line with the plan to improve the reliability of the power delivery in the area, the Naga-Sibonga-Dumanjug 69 kV line which draws power from Naga S/S is proposed to be transferred to Colon S/S. However, the existing Colon S/S does not have sufficient capacity to cater the projected power demand upon the connection of new loads. Hence, there will be power curtailment.



In order to accommodate the projected demand of Colon S/S, there is a need to increase the substation capacity. The project involves the installation of 100 MVA 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.

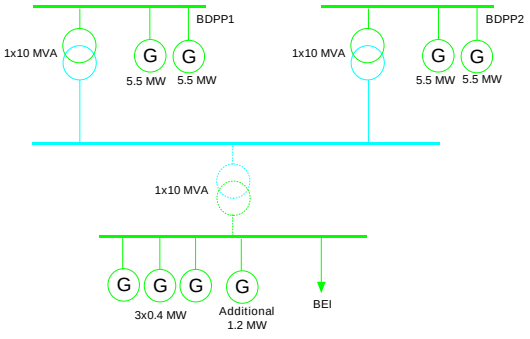
7.2.2.9 Naga (Visayas) Substation Upgrading Project

The equipment at Naga Substation, which was commissioned in 1977, is already antiquated and is difficult to maintain. Thus, outages due to equipment failure, maintenance and repair works are expected to occur more frequently and at longer duration. Accordingly, these outages may result in power curtailment.

In order to improve the reliability of the substation, equipment shall be replaced. The project involves the construction of new steel tower structures and installation of associated overhead line component. It also involves the use of steel tower structures with higher wind design capability. This project was formerly named as Naga Substation Rehabilitation Project.

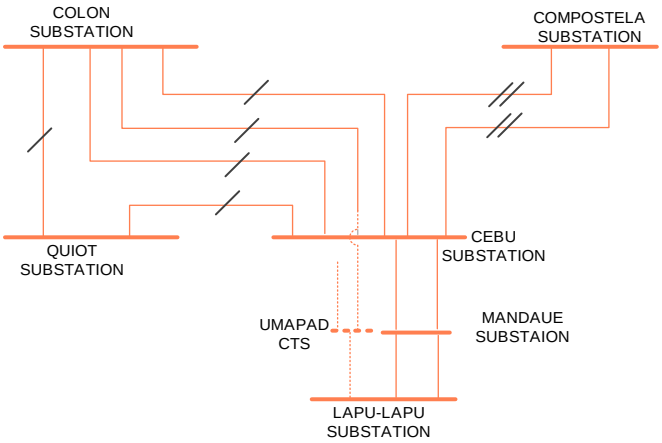
7.2.2.10 Tagbilaran 69 kV Substation Project

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.



7.2.2.11 Cebu-Lapu-Lapu 230 kV Transmission Line Project

The existing transmission corridors serving the major load centers in Mandaue and Mactan in Cebu do not have N-1 contingency provision. During outage of one of the two 138 kV circuits of the Cebu-Mandaue-Lapu-lapu Transmission Corridor, the remaining circuit will be overloaded, therefore, in order to prevent damage to the equipment, power will be curtailed.

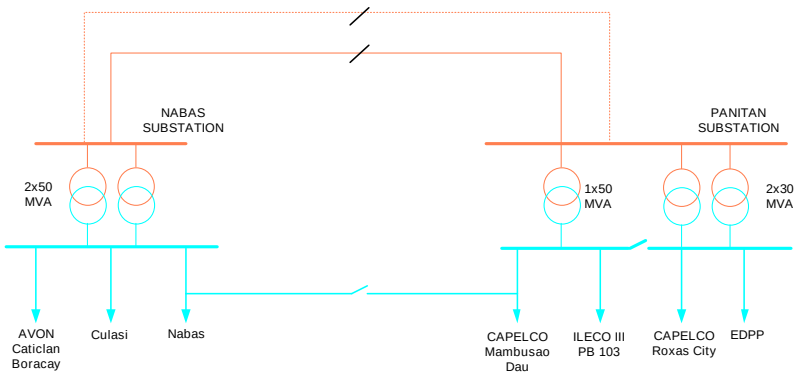


In order to maintain the continuous transmission of power towards the major loads centers in Mandaue and Mactan even during N-1 condition, a new transmission corridor, composed of overhead transmission line and submarine/underground cable system, is proposed between Cebu S/S and Lapu-lapu S/S.

The project will be designed consistent with the long-term transmission master plan of developing a 230 kV transmission backbone in the Visayas, therefore, portion of transmission corridor will be designed at 230 kV voltage level but will be initially energized at 138 kV.

7.2.2.12 Panitan-Nabas 138 kV Transmission Line 2 Project

The northwestern part of Panay, which includes the Boracay Island, is served by Nabas S/S which normally draws power from the grid through the existing Panitan-Nabas 138 kV Transmission Line. The Nabas S/S is also linked to Nabas S/S and San Jose S/S by 69 kV transmission lines. 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.



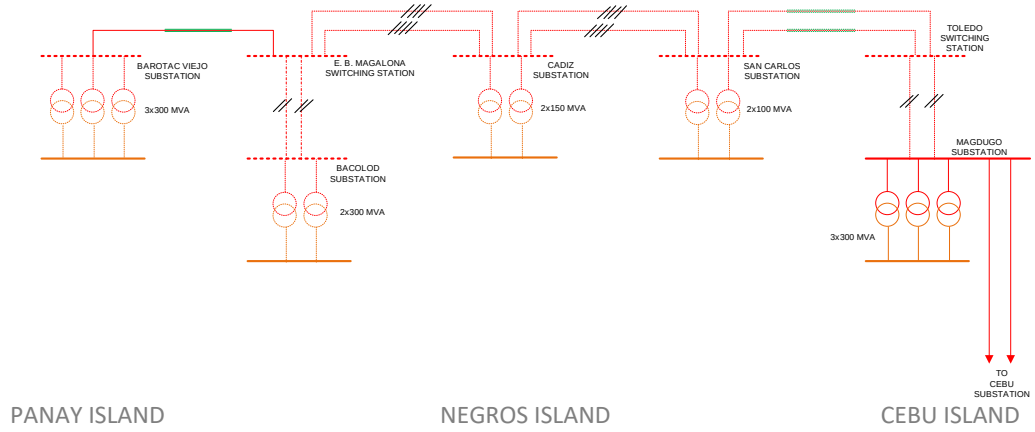
In order to cater the entire power requirement of Nabas S/S even during N-1 condition, a new 138 kV circuit will be installed from Panitan S/S and Nabas S/S. The project will involve the second circuit stringing of the existing Panitan-Nabas 138 kV Line, which is already designed to support two circuits. It will also include associated substation expansion works.

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

The development of new power plants, including baseload and renewable, in Panay and Negros Islands will result in the increase in power exchange between the islands of Panay, Negros and Cebu. Currently, the existing Negros-Panay interconnection system has limited capacity to accommodate the transmission of excess power from Panay towards Negros.

Similarly, the existing Cebu-Negros interconnection system has limited capacity to cater the excess power generation from Panay and Negros towards Cebu. Hence, there will be power curtailment.

In order to ensure the effective transmission of excess power generation from Panay and Negros towards Cebu, a high capacity transmission corridor is being proposed and this will serve as the stage 3 or the final stage for the Cebu-Negros-Panay 230 kV Backbone Project. The project involves the construction of 230 kV facilities that will extend from Barotac Viejo Substation in Panay to a new Magdugo Substation in Cebu. It will be primarily composed of overhead transmission lines, submarine cable interconnections and corresponding new substation facilities.



7.2.2.14 Visayas Voltage Improvement Project

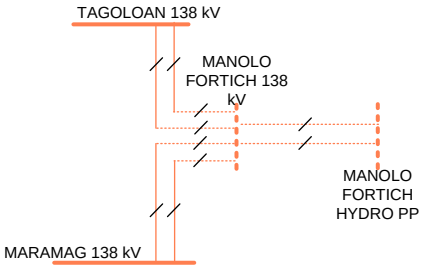
Various areas in Samar and Leyte are experiencing low voltage occurrences due to long 69 kV transmission lines. Likewise, areas in Cebu and Bohol are also experiencing low voltage occurrences due to high concentration of load. These low voltages may result in power curtailment.

In order to address the low voltage problems in these areas, capacitor banks are proposed to be strategically installed at identified substations and load-ends.

7.2.3 Mindanao Grid

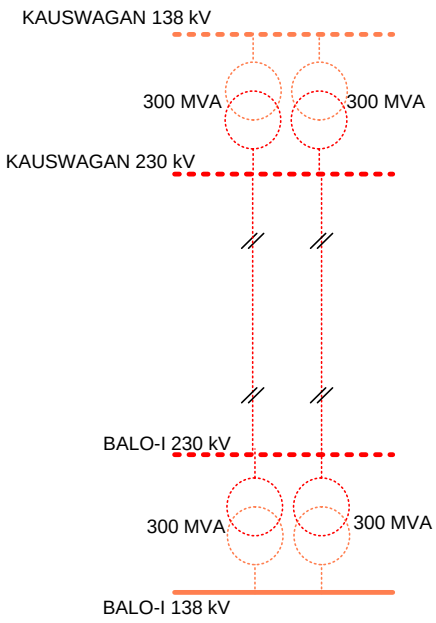
7.2.3.1 Manolo Fortich (Lingion) 138 kV Switching Station

The proposed project is a switching station to be located in Brgy. Lingion, Manolo Fortich, Bukidnon. It is the connection point of the proposed 68.8 MW Manolo Fortich Hydroelectric Power Plant.



The project will utilize a breaker-and-a-half configuration to bus-in along existing Tagoloan-Maramag 138 kV double circuit transmission line between structures 52 and 54. Completion of the project in February 2018 will enable the full capacity dispatch of the power plant.

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

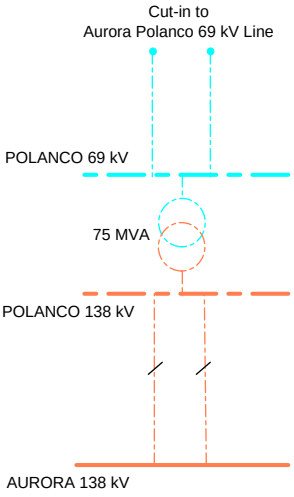


The existing transmission facility is not equipped to cater the entry of GNPower Kauswagan Ltd. Co.'s 600 MW coal power plant. Development of the transmission network is needed in the area to accommodate the new power plant and effectively distribute the generated power.

This project is the initial stage of the envisioned extension of the 230 kV backbone to North Western Mindanao Area which will provide power transmission reliability towards Zamboanga Peninsula.

The project involves the construction of the new Kauswagan Substation and expansion of the Balo-i 230 kV Substation which will be linked together by 11 kilometers, 230 kV, double circuit line using 2-410mm^2 TACSR conductors.

7.2.3.3 Aurora-Polanco 138 kV Transmission Line



The primary objective of the Aurora – Polanco 138 kV TL Project is to accommodate the growing power demand and provide the much-needed system reliability and power quality in Zamboanga del Norte and Misamis Occidental. The existing long and old 69 kV line which emanates from Aurora substation will be insufficient to support the load growth in the area.

The project will involve the construction of the new Polanco 138 kV substation with a 75 MVA 138/69 kV power transformer and construction of 79 km Aurora – Polanco 138 kV double circuit transmission line. Also, construction of 4 km of double circuit 69 kV lines will cut-in and relieve the existing Aurora – Polanco 69 kV Sub-Transmission Line.

7.2.3.4 Sultan Kudarat (Nuling) Capacitor Project

The proposed 138 kV single circuit Tacurong-Sultan Kudarat transmission line project is intended to complete the 138 kV network within South Western Mindanao Area (SWMA). The envisioned General Santos-Tacurong-Sultan Kudarat-Kibawe link will provide strong transmission backbone that will ensure reliable power delivery. However, due to security concerns in the areas traversed by the proposed line, the implementation of the project was deferred.

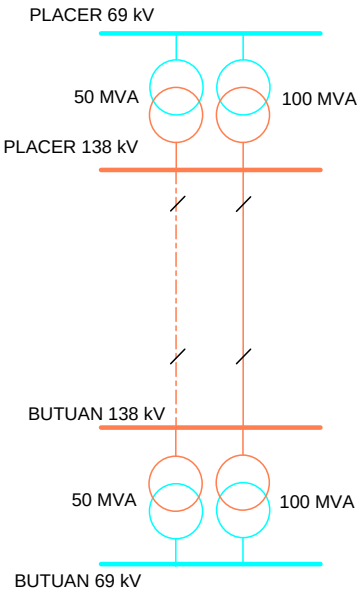
As a remedial solution to improve the low voltage that will occur in the area during outage of the Kibawe-Sultan Kudarat 138 kV line, 2 x 7.5 MVAR, 69 kV capacitor banks will be installed at the Sultan Kudarat Substation. Maguindanao Electric Cooperative and Cotabato Light and Power Company Inc. are the beneficiaries of this project.

7.2.3.5 Agus 6 Switchyard Upgrading / Rehabilitation Project

Considering the age and the deteriorating condition of various switchyards in Mindanao, most facilities and equipment are already due for rehabilitation and replacement. This project was tagged with the highest priority amongst other switchyards, and is intended to address the critical situation of the primary and secondary equipment in the Agus 6 HEPP Switchyard. In addition, in order to accommodate all the secondary devices, which were previously housed in the Agus 6 HEPP's control room, construction of a new control house is needed.

7.2.3.6 Butuan-Placer 138 kV Transmission Line

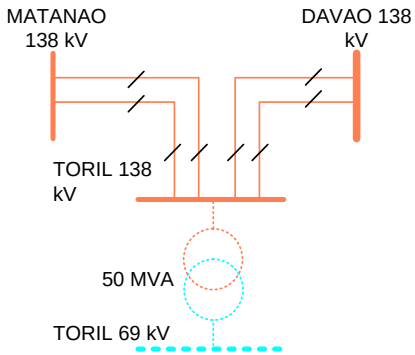
Currently, the Butuan and Placer Substations are only connected by a single circuit transmission line, where power delivery to northeastern Mindanao is in critical condition. An outage in this segment will discontinue the supply of power which will cause significant load dropping in the area due to lack of alternate line. The Butuan – Placer 138 kV Transmission Line Project will provide required line reinforcement to achieve reliable and continuous power delivery. This project will satisfy the compliance of the transmission line facility to the single outage contingency criterion of the PGC. In addition, the supplementary line will also reduce transmission losses and will improve voltage level in the served area.



This project was part of the Reliability Compliance Project I - Mindanao. It involves the installation of the second circuit for the existing Butuan – Placer 138 kV transmission corridor by using 100 km, single circuit, 795 MCM conductor and 4 – 138 kV power circuit breakers.

7.2.3.7 Toril 138 kV Substation (Phase 2)

The Toril 138 kV Project (Phase I) was implemented to accommodate the entry of the 300 MW Therma South Inc. (TSI) power plant. The second stage of this project will provide necessary facility to admit the connection of load customers - DLPC and DASURECO. This involves installation of a 50 MVA, 138/69 kV power transformer using 2-138 kV and 3-69 kV power circuit breakers. This also includes the required feeder and breaker failure protection systems as well as control, metering and communication systems.



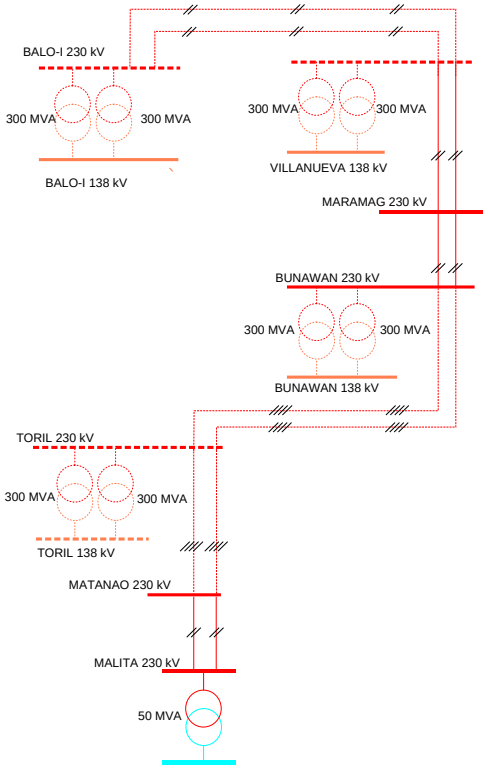
The Toril 138 kV Substation is located in Barangay Binugao, Toril District, Davao City. It is a substation between Matanao and Davao 138 kV Substations.

7.2.3.8 Mindanao 230 kV Transmission Backbone

The project will upgrade the thermal capacity of the existing transmission backbone. It will also extend the transmission line towards Matanao Substation in Davao del Sur. The full capacity dispatch from SMCCI, TSI and other power plants will be made possible by these additional grid facilities.

It entails two major activities: One is the construction of the Matanao-Toril-Bunawan 230 kV Line. Another is the energization of the existing Balo-i-Villanueva-Maramag-Bunawan Line to 230 kV voltage level.

The transmission line portion of the project will utilize the existing 230 kV PCB in Matanao Substation and the installation of transformers in Toril and Bunawan Substations. However, the energization of the whole stretch of the backbone to 230 kV level will require the installation of additional transformers in Malita, Toril, Bunawan, and Villanueva Substations.



7.2.3.9 Agus 2 Switchyard Upgrading Project

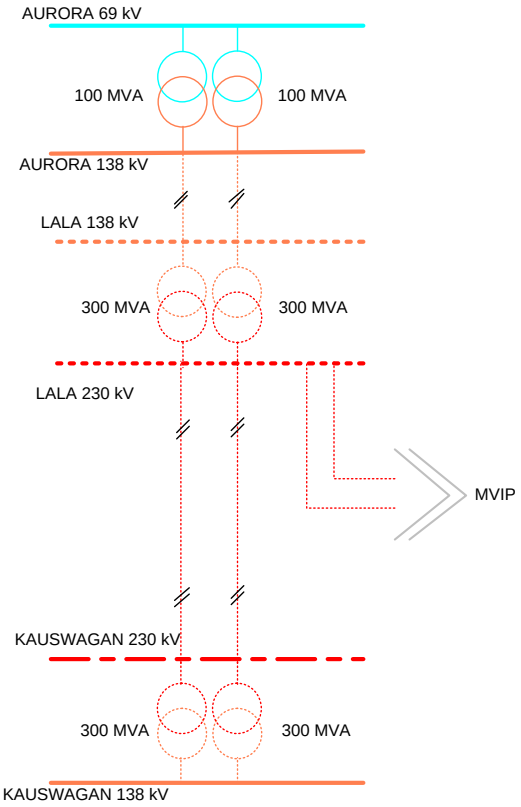
The development of the Agus 2 Switchyard will improve operational capability to efficiently respond on any system disturbance. The project will enhance operation stability which ensures the continuity of service of the power plant's transmission corridor. It also aims to provide clear demarcation of asset boundaries between NGCP and the power plant. The Agus 2 Switchyard is an old transmission facility which is having difficulties in operation and maintenance. The outmoded installed equipment in the switchyard struggles in maintenance due to scarcity of spare parts in the market.

The project implementation involves the replacement of obsolete power circuit breakers, capacitive potential transformers, telecom equipment and other secondary devices. The switchyard facility upgrading includes expansion and renovation of the control building with the installation of new monitoring, switching, metering, annunciation and control equipment in order to have full control of the switchyard.

7.2.3.10 Kauswagan-Lala 230 kV Transmission Line (Formerly Balo-i -Kauswagan-Aurora 230 kV Transmission Line Phase 2)

Majority of the power consumption in Zamboanga Peninsula is supplied through Balo-i – Aurora and Balo-i – Agus 5 – Aurora 138 kV lines. These transmission lines are critically loaded during N-1 contingency condition. The project will provide reliable transmission network passage for Zamboanga Peninsula to achieve continuous normal grid operation in the area. It is the extension of the planned Mindanao 230 kV transmission backbone facility which will complement the Mindanao – Visayas Interconnection Project.

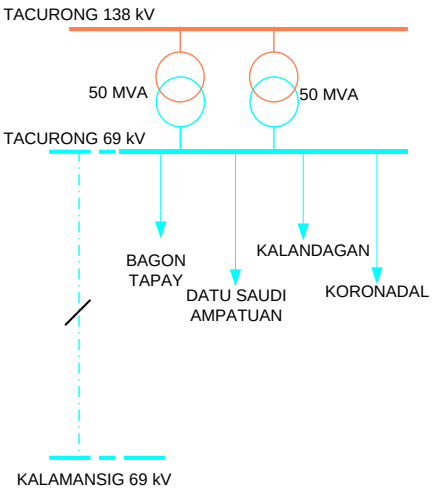
The project will be implemented by connecting Kauswagan Substation and the proposed Lala Substation utilizing a double-circuit tower in a bundle-of-two power conductor configuration in 230 kV voltage level. The project will also include the installation of two power transformers in Lala Substation which will be linked to the existing Aurora Substation thru a 138 kV transmission line. To complete the project, the installation of 6-230 kV and 9-138 kV power circuit breakers will be needed in the involved substations.



7.2.3.11 Tacurong-Kalamansig 69kV Transmission Line

This project will allow the towns of Lebak, Kalamansig, Bagumbayan and Senator Ninoy Aquino to enjoy the cheaper electricity by connecting to the grid. These areas located in the Province of Sultan Kudarat in SOCCSKSARGEN Region are considered off-grid loads being served by limited and more costly power supply.

The required facilities for the project is the 69 kV single circuit steel tower, expansion of the Tacurong Substation and the construction of the switching station in Kalamansig. When the project is completed in September 2021, the power consumers will end their dependence from SPUG and will start to benefit reliable power supply from the grid.



7.2.3.12 Mindanao Substation Upgrading

The existing transformer capacities in various substations in Mindanao will be insufficient to accommodate the projected load growth while some substations do not comply yet with the single outage (N-1) contingency requirements of the Philippine Grid Code. Additionally, voltage violation and breaker failures frequently occur in some areas in the Mindanao Grid.

The objective of the Mindanao Substation Upgrading Project (MSUP) is to provide additional transformers, install capacitor banks, and replace defective, old, obsolete and underrated power circuit breakers (PCB) to ensure adequate, reliable, and high quality power transmission system in Mindanao. MSUP involves the installation of a total of 875 MVA power transformers, 52.5 MVAR capacitor banks, nineteen (19) – 138 kV PCBs and twenty one (21) – 69 kV PCBs. Also included in this project is the replacement of eleven (11) – 138 kV and twenty seven (27) – 69 kV PCBs in various substations in the grid.

7.2.3.13 Mindanao Substation Rehabilitation

The efficiency and accuracy of power circuit breakers (PCB) greatly contribute to the performance quality of the transmission system. On the other hand, unreliability of this equipment imposes tremendous risk and danger not only on the system operation but also on equipment and personnel safety.

Mindanao Substation Rehabilitation Project (MSRP) will replace power circuit breakers (PCB) in various substations in Mindanao due to defectiveness, old age, obsolescence and low fault level capacity. Implementation of the project will increase the reliability of the network, reduce/prevent unserved energy, avoid costly maintenance expenses, improve personnel safety and decrease incidents of breaker failures. MSRP involves the replacement of fifty-one (51) – 138 kV PCBs and twenty-four (24) – 69 kV PCBs in twelve NGCP substations in Mindanao. Also included in the project is the additional six (6) – 138 kV PCBs and two (2) -69 kV definite purpose type PCBs in Bunawan Substation.

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 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 the 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, the two existing 500 kV substations located at San Jose del Monte City in Bulacan and Dasmariñas in Cavite that serve as the only Extra High Voltage (EHV) drawdown facilities supporting the Metro Manila loads, will become critical nodes in the grid. The capacity expansion and space limitations in these substations could result in grid congestion unless new 500 kV drawdown substations will be 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 strategic location. But it has major challenges in the construction of its associated 500 kV transmission line that traverses portion of 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 also very important in supporting load growth in the long term.

Being the center of nation's economy, the grid reinforcement projects that 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 its implementation to realize these important 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 Antipolo, Pasay and Manila/Navotas Substations which would also involve the implementation of associated 230 kV transmission lines.

After Metro Manila, together with the industrialized areas of 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 to support the load increase in the coming years. Other provinces, on the other hand, will be supported by installation of additional transformers at existing substations or development of new substations and 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.

8.1 Proposed Transmission Projects up to 2025

The major transmission projects covering the year 2016-2025 aim to support the adequacy and reliability of power supply to Metro Manila, which is the country's center of commerce and trade. These can be attained by the seamless delivery of existing and new generation capacities from the identified generation hubs going to Metro Manila through adequate and reliable transmission facilities.

The identified generation hubs in Luzon Grid are the Provinces of Batangas, Quezon, Bataan Peninsula and Zambales. In Batangas, the development of the Tuy 500 kV Substation (Stage 1) and Pinamukan 500 kV Substation will accommodate around 3,000 MW from coal and LNG generation capacities. Meanwhile the Pagbilao–Tayabas 500 kV Transmission Line Project will accommodate an additional 1,200 MW from coal generation capacity in Quezon Province.

To meet the forecasted load growth in Metro Manila, three (3) major 500/230 kV drawdown substations will be developed around Metro Manila. These will be located in Taguig City, Marilao in Bulacan and Silang in Cavite. These will be also complemented by the development of additional 230/115 kV drawdown substations in Antipolo, Navotas and in Pasay.

The reliability of power transmission delivery to Metro Manila will be addressed through the development of new transmission corridors in Metro Manila such as the Silang–Taguig 500 kV Transmission Line, Taguig–Taytay 230 kV Transmission Line, Navotas–Pasay 230 kV Transmission Line and Navotas–Doña Imelda 230 kV Transmission Line.

Outside Metro Manila, several drawdown substations will also be developed to address the forecasted load growth. These are the Pinili 230 kV Substation in Ilocos Norte, San Simon and Porac 230 kV Substations in Pampanga, Plaridel 230 kV Substation in Bulacan, Liberty 230 kV Substation in Nueva Ecija, Calamba 230 kV Substation in Laguna, Tanauan 230 kV Substation in Batangas and Abuyog 230 kV Substation in Sorsogon.

For renewable energy developments particularly in northern part of Luzon, the implementation of the Northern Luzon 230 kV Loop will 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 called Santiago–Nagsaag 500 kV Transmission Line from San Manuel, Pangasinan going up north would also be needed. Solar plants and other new small scale Variable Renewable Energy-based plants (VRE-based plants), on the other hand, are well-dispersed in the grid and generally will not require major grid reinforcements. In addition, the development of Bolo–San Esteban 500 kV Transmission Line will address the generation entry of the proposed coal, hydro, and wind generating plants in the northeastern part of the grid.

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 7.

Table 8.1: Proposed Transmission Projects for Luzon

Project Name/Driver(s)	Province(s) and Components	ETC
Generation Entry		
Northern Luzon 230 kV Loop	Ilocos Norte, Apayao, Cagayan	Jun 2024
	Substation Components: ▪ Laoag 230 kV Substation (Expansion), 4-230 kV PCBs and associated equipment; ▪ Bangui 230 kV Substation (New), 2x300 MVA, 230/115-13.8 kV Power Transformer and accessories, 10-230 kV PCBs, 11-115 kV PCBs and associated equipment; ▪ Sanchez Mira 230 kV Substation (New), 2x300 MVA, 230/115-13.8 kV Power Transformers and accessories, 10-230 kV PCBs and associated equipment, 6-115 kV PCBs and associated equipment; ▪ Pudtol 230 kV Substation (New), 10-230 kV PCBs and associated equipment; ▪ Lal-lo (Magapit) 230 kV Substation (Expansion), 4-230 kV PCBs and associated equipment. Transmission Components: ▪ Laoag–Bangui 230 kV Transmission Line, ST-DC, 1-795 MCM ACSR/AS, 50 km; ▪ Bangui–Sanchez Mira 230 kV Transmission Line, ST-DC, 2-795 MCM, ACSR, 70 km. ▪ Sanchez Mira–Pudtol, 230 kV Transmission Line, ST-DC, 2-795 MCM, ACSR, 57 km. ▪ Pudtol–Lal-lo (Magapit), 230 kV Transmission Line, ST-DC, 2-795 MCM, ACSR, 38 km. Bulk Cost Estimate: 14,450 Million Pesos	
Pinamukan 500 kV Substation	Batangas	Oct 2024
	Substation Components: ▪ Pinamukan 500 kV Substation, 10-500 kV PCBs and associated equipment; Transmission Components: ▪ Pinamukan 500 kV bus-in Transmission Line, ST-DC, 4-795 MCM ACSR, 1 km. Bulk Cost Estimate: 4,233 Million Pesos	
Bolo–San Pablo 500 kV Transmission Line	Ilocos Sur, La Union, Pangansinan	Dec 2024
	Substation Components: ▪ San Pablo 500 kV Substation, 2x750 MVA, 500/230-13.8 kV Power Transformer and accessories, 6-500 kV PCBs and associated equipment. ▪ San Pablo 230 kV Substation, 10-230 kV PCBs and associated equipment. ▪ Balaoan 500 kV Switching Station, 10-500 kV PCBs and associated equipment. ▪ Bolo 500 kV Substation, 2-500 kV PCBs and associated equipment. Transmission Components: ▪ Bolo–Balaoan–San Pablo 500 kV Transmission Line, ST-DC, 4-410 mm^2 TACSR/AS, 209 km. ▪ San Esteban 230 kV Line Extension, ST-DC, 1-795 MCM ACSR/AS, 1 km. ▪ Laoag 230 kV Line Extension, ST-DC, 1-795 MCM ACSR/AS, 1 km. Bulk Cost Estimate: 16,313 Million Pesos	
Pagbilao–Tayabas 500 kV Transmission Line	Quezon	Dec 2024
	Substation Components: ▪ Pagbilao 500 kV Substation, 4-500 kV PCBs and associated equipment 4-230 kV PCBs and associated equipment. Transmission Components: ▪ Pagbilao–Tayabas 500 kV Transmission Line, ST-DC, 4-795 MCM ACSR/AS, 21 km. ▪ Naga Line Extension 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR/AS, 1.5 km. Bulk Cost Estimate: 3,934 Million Pesos	

Project Name/Driver(s)	Province(s) and Components	ETC
Santiago–Nagsaag 500 kV Transmission Line	Isabela, Pangasinan	Dec 2024
	Substation Components: ▪ New Santiago 500 kV Substation, 2x750 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 Substation, 4-230 kV PCBs and associated equipment; ▪ Nagsaag 500 kV Substation, 4-500 kV PCBs and accessories, 2x60 MVAR 500 kV Line Reactor and accessories. Transmission Components: ▪ Santiago–Nagsaag 500 kV Transmission Line, ST-DC, 4-795 MCM ACSR/AS, 140.0 km; ▪ Old and New Santiago Substation 230 kV tie-line, ST-DC, 4-795 MCM ACSR/AS, 1.0 km. Bulk Cost Estimate: 10,645 Million Pesos	
Bolo 5th Bank	Pangasinan	Dec 2025
	Substation Components: ▪ Bolo 500 kV Substation (Expansion), 1x600 MVA, 500/230 kV Transformer and accessories, 3-500 kV PCBs and associated equipment. Bulk Cost Estimate: 2,521 Million Pesos	
Load Growth		
Calamba 230 kV Substation	Laguna	Jul 2019
	Substation Components: ▪ Calamba 230 kV Substation, 2x300 MVA, 230/115-13.8 kV Power Transformer and accessories to be implemented by MERALCO, 10-230 kV PCBs and associated equipment. Transmission Components: ▪ Bus-in Lines, 230 kV Transmission Line, SP-DC, 2-610 mm^2 TACSR/AS, 1.5km. Bulk Cost Estimate: 1,052 Million Pesos	
Tanauan 230 kV Substation	Batangas	Jun 2020
	Substation Components: ▪ Tanauan 230 kV Substation, 2x100 MVA, 230/69 kV Power Transformer and accessories, 8-230 kV PCBs and associated equipment; 5-69 PCBs and associated equipment. ▪ Calamba 230 kV Substation, 2-230 kV PCBs and associated equipment; Transmission Components: ▪ Calamba–Tanauan 230 kV Transmission Line, ST/SP-DC, 1-795 MCM ACSR/AS, 12 km. Bulk Cost Estimate: 2,493 Million Pesos	
Pasay 230 kV Substation	Metro Manila	Aug 2020
	Substation Components: ▪ Pasay 230 kV Substation, 5-230 kV PCBs (GIS) and associated equipment. Transmission Components: ▪ Las Piñas–Pasay 230 kV Transmission Line, 230 kV, SP-DC, 2-795 MCM ACSR/AS, 4.2 km; 230 kV UG-DC, 2-1C-2,000 mm² XLPE, 3.9 km. Bulk Cost Estimate: 13,018 Million Pesos	
Concepcion–Sta. Ignacia 69 kV Transmission Line	Tarlac	Dec 2020
	Transmission Components: ▪ Concepcion–Sta. Ignacia 69 kV Transmission Line, 69 kV, SP-DC1, 1-795 MCM ACSR, 27 km; Bulk Cost Estimate: 697 Million Pesos	
Nagsaag–Tumana 69 kV Transmission Line	Pangasinan	Dec 2020
	Transmission Components: ▪ Nagsaag–Tumana 69 kV Transmission Line, 69 kV, ST/SP-DC1, 1-795 MCM ACSR, 23 km; Bulk Cost Estimate: 711 Million Pesos	

Project Name/Driver(s)	Province(s) and Components	ETC
Taguig 500 kV Substation	Rizal, Metro Manila	Feb 2021
	Substation Components: ▪ Taguig 500 kV Substation, 2x1,000 MVA, 500/230-13.8 kV Power Transformer and accessories and accessories, 1x90 MVAR, 500 kV Shunt Reactor and accessories, 3x100 MVAR, 230 kV Capacitor Banks and accessories, 8-500 kV PCBs (GIS), 10-230 kV PCBs (GIS), and associated equipment. Transmission Components: ▪ Taguig cut-in to San Jose–Tayabas 500 kV Transmission Line, 500 kV, ST-DC, 4-795 MCM ACSR, 37 km; ▪ Taguig bus-in to Muntinlupa–Paco 230 kV Transmission Line, 230 kV, SP-SC, 2-410 mm^2 TACSR, 2-2.4 km. Bulk Cost Estimate: 9,529 Million Pesos	
Plaridel 230 kV Substation	Bulacan	Mar 2021
	Substation Components: ▪ Plaridel 230 kV Substation, 10-230 kV PCBs and associated equipment. Transmission Components: ▪ Plaridel 230 kV bus-in Transmission Line, ST-DC, 2-795 MCM ACSR, 1 km. Bulk Cost Estimate: 2,353 Million Pesos	
San Simon 230 kV Substation	Pampanga	May 2021
	Substation Components: ▪ San Simon 230 kV Substation, 2x300 MVA 230/69 kV transformer and accessories, 2-100 MVAR 230 kV capacitor, 8-230 kV PCBs, 4-69 kV PCBs and associated equipment. ▪ Mexico 230 kV Substation, 6-69 kV PCBs and associated equipment. Transmission Components: ▪ 230 kV Transmission Line Extension, 2-795 MCM ACSR, SP-DC, 1.5 km. from the cut-in point along Hermosa–Duhat Line. ▪ Mexico–STR 120D (Calumpit Line Segment) 69 kV Line, SP-SC, 1-410 mm^2 TACSR, 12.3 km. ▪ STR 120D–PELCO 3 (Apalit Tap) 69 kV Line, SP-SC, 1-410 mm^2 TACSR, 2.52 km. ▪ San Simon–Real Steel 69 kV Line, SP-SC, 1-410 mm^2 TACSR, 3.27 km. ▪ San Simon–Melters 69 kV Line, SP-SC, 1-410 mm^2 TACSR, 6.10 km. Bulk Cost Estimate: 2,318 Million Pesos	
Pinili 230 kV Substation	Ilocos Norte	Jun 2021
	Substation Components: ▪ Pinili 230 kV Substation (New), 1x100 MVA 230/69 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 5-69 kV PCBs and associated equipment. Transmission Components: ▪ *Pinili 'bus-in' to San Esteban*–Laoag 230 kV Transmission Line, ST-DC, 1-795 MCM ACSR/AS, 2 km; ▪ Pinili–Currimao 69 kV Transmission Line, ST-DC, 1-795 MCM ACSR/AS, 7 km; Bulk Cost Estimate: 1,632 Million Pesos	
Marilao 500 kV Substation	Bulacan	Jun 2023
	Substation Components: ▪ Marilao 500 kV Substation, 2x1,000 MVA, 500/230-13.8 kV Power Transformer and accessories, 16-500 kV PCBs, 12-230 kV PCBs, and associated equipment, 2x90 MVAR Line Reactor and accessories, 2x100 MVAR Shunt Capacitor and accessories. Transmission Components: ▪ Nagsaag–San Jose 500 kV Line Extension to Marilao 500 kV Substation, 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/AS, 1.5 km; ▪ Marilao–Duhat 230 kV Transmission Line, SP-DC, 2-795 MCM ACSR/AS, 3.2 km; ▪ Navotas Line Extension to Marilao 230 kV Transmission Line, SP-DC, 4-795 MCM ACSR/AS, 3.6 km. Bulk Cost Estimate: 7,393 Million Pesos	

Project Name/Driver(s)	Province(s) and Components	ETC
Abuyog 230 kV Substation	Sorsogon	Dec 2023
	Substation Components: ▪ Abuyog (Sorsogon) 230 kV Substation, 2-50 MVA 230/69-13.8 kV Power Transformer and accessories, 2-25 MVAR Capacitor, 2-25 MVAR Shunt Reactor, 10-230 kV PCBs, 5-69 kV PCBs and associated equipment; Transmission Components: ▪ Bacman-Abuyog 230 kV Transmission Line, 1-795 MCM ACSR/AS, ST-DC, 25 km. Bulk Cost Estimate: 3,541 Million Pesos	
Liberty 230 kV Substation	Nueva Ecija	Dec 2024
	Substation Components: ▪ Liberty 230 kV Substation, 1x100 MVA 230/69 kV Power Transformer and accessories, Control Room, 5-230 kV PCBs and associated equipment, 1-69 kV PCBs and associated equipment; Transmission Components: ▪ *Liberty 'cut-in' to* Pantabangan–Nagsaag 230 kV Transmission Line, ST-DC, 1-795 MCM ACSR/AS, 2 km; ▪ 69 kV line extension, SP-SC, 1-336.4 MCM ACSR, 2 km. Bulk Cost Estimate: 2,822 Million Pesos	
Porac 230 kV Substation	Pampanga	Dec 2024
	Substation Components: ▪ Porac 230 kV Substation, 2x300 MVA 230/69 kV transformer and accessories, 8-230 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ Hermosa 230 kV Substation (Expansion), 4-230 kV PCBs and associated equipment; ▪ Clark 230 kV Substation (Expansion), 4-230 kV PCBs and associated equipment. ▪ Capas 230 kV Substation (Expansion), 4-230 kV PCBs and associated equipment. Transmission Components: ▪ Hermosa–Porac–Capas, ST-DC, 4-795 MCM ACSR, 64 km. ▪ Clark 230 kV Transmission Line Extension, ST-DC, 4-795 MCM ACSR, 5 km. Bulk Cost Estimate: 3,823 Million Pesos	
Capas 230 kV Substation	Tarlac	Dec 2025
	Substation Components: ▪ Capas 230 kV Substation, 2x300 MVA 230/69 kV transformer and accessories, 6-230 kV PCBs, 6-69 kV PCBs and associated equipment; ▪ Concepcion 230 kV Substation (Expansion), 4-230 kV PCBs and associated equipment; Transmission Components: ▪ Concepcion–Capas, ST-DC, 4-795 MCM ACSR, 14 km. Bulk Cost Estimate: 1,573 Million Pesos	
Silang 500 kV Substation	Cavite	Dec 2025
	Substation Components: ▪ Silang 500 kV Substation, 2x1,000 MVA, 500/230 kV Power Transformer and accessories, 10-500 kV PCBs and associated equipment, 14-230 kV PCBs and associated equipment; Transmission Components: ▪ Silang 500 kV bus-in Transmission Line, 500 kV, ST-DC, 4-795 MCM ACSR, 1 km. ▪ Tuy 500 kV Line diversion (initially energized at 230 kV), 500 kV Transmission Line, ST-DC, 4-410 mm^2 TACSR/AS, 11 km. Bulk Cost Estimate: 8,256 Million Pesos	

Project Name/Driver(s)	Province(s) and Components	ETC
System Reliability		
Tower Structure Upgrading of Bicol Transmission Facilities	Albay	Jul 2018
	Transmission Components: ▪ Naga–Daraga–Tiwi A 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR/AS, 42 Steel Tower Structures; ▪ Naga–Tiwi C 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR/AS; 40 Steel Tower Structures Bulk Cost Estimate: 963 Million Pesos	
La Trinidad–Calot 69 kV Transmission Line	Benguet	Dec 2021
	Substation Components: ▪ La Trinidad 69 kV S/Y Expansion, 1-69 kV PCB and associated equipment. Transmission Components: ▪ La Trinidad–Calot 69 kV Transmission Line, SP/ST-DC, 1-795 MCM ACSR/AS, 21 km; ▪ 69 kV Line Tapping Points, 5-72.5 kV, 3-way Air Break Switches Bulk Cost Estimate: 410 Million Pesos	
Nasugbu 69 kV Switching Station	Batangas	Dec 2021
	Substation Components: ▪ Nasugbu Switching Station, 8-69 kV PCBs and associated equipment. Transmission Components: ▪ Nasugbu 69 kV Line extension, 69 kV, SP/CP-SC, 1-336.4 MCM ACSR 1.0 km. Bulk Cost Estimate: 983 Million Pesos	
San Manuel–Nagsaag 230 kV Transmission Line	Pangasinan	Dec 2021
	Substation Components: ▪ Nagsaag 500 kV Substation (Expansion), 3x200 MVA, 500/230-13.8 kV Power Transformer and accessories, 2-500 kV PCBs and associated equipment and 8-230 kV PCBs and associated equipment; ▪ San Manuel 230 kV Substation (Expansion), 3-230 kV PCBs and associated equipment; Transmission Components: ▪ San Manuel–Nagsaag 230 kV Tie-Line Upgrading, SP-DC, 2-410 mm^2 TACSR/AS, 0.6 km; ▪ Binga Line Extension, 230 kV, SP-DC, 2-795 MCM ACSR/AS, 0.8 km Bulk Cost Estimate: 1,874 Million Pesos	
Taguig–Taytay 230 kV Transmission Line	Rizal, Metro Manila	Sep 2022
	Substation Components: ▪ Taytay 230 kV Substation Expansion, 6-230 kV PCBs and associated equipment. Transmission Components: ▪ Taguig–Taytay 230 kV Transmission Line, SP-DC, 2-610 mm^2 TACSR/AS, 10 km; Bulk Cost Estimate: 3,823 Million Pesos	
Manila(Navotas)–Dona Imelda 230 kV Transmission Line	Metro Manila	Dec 2023
	Substation Components: ▪ Navotas 230 kV Substation Expansion, 2-230 kV PCBs and associated equipment. Transmission Components: ▪ Manila/Navotas–Dona Imelda 230 kV Transmission Line, SP-DC, 2-610 mm^2 TACSR, 4.6 km. and 230 kV XLPE cable, 4.7 km. Bulk Cost Estimate: 3,514 Million Pesos	
Minuyan 115 kV Switching Station	Bulacan	Apr 2024
	Substation Components: ▪ Minuyan Switching Station, 11-115 kV PCBs and associated equipment. Bulk Cost Estimate: 944 Million Pesos	

Project Name/Driver(s)	Province(s) and Components	ETC
Balayan 69 kV Switching Station	Batangas	Jun 2024
	Substation Components: ▪ Balayan Switching Station, 6-69 kV PCBs and associated equipment. Transmission Components: ▪ Balayan–Calatagan Line extension, 69 kV, SP/CP-SC, 1-336.4 MCM ACSR 0.7 km. Bulk Cost Estimate: 850 Million Pesos	
Calaca–Salong 230 kV Transmission Line 2	Batangas	Mar 2025
	Substation Components: ▪ Salong 230 kV Substation, 2-230 kV PCBs and associated equipment. Transmission Components: ▪ Calaca-Salong 230 kV Transmission Line, SP-SC, 1-795 MCM ACSR, 6 km. Bulk Cost Estimate: 249 Million Pesos	
Western 500 kV Backbone – Stage 2	Pangasinan, Zambales	Jun 2025
	Substation Components: ▪ Castillejos 500 kV Substation, 2x1000 MVA, 500/230-13.8 kV Power Transformer and accessories, 1x90 MVAR 500 kV Shunt Reactor, 11-500 kV PCBs and associated equipment. ▪ Castillejos 230 kV Substation, 2x300 MVA, 230/69 kV Power Transformer and accessories, 12-230 kV PCBs, and associated equipment. ▪ Bolo 500 kV Substation, 4-500 kV PCBs and associated equipment. ▪ Hermosa 500 kV Substation, 4-500 kV PCBs and associated equipment. Transmission Components: ▪ Castillejos–Bolo 500 kV Transmission Line, ST-DC, 4-410 mm^2 TACSR, Castillejos–Masinloc: 84 km, Masinloc–Bolo: 90 km. Bulk Cost Estimate: 8,525 Million Pesos	
Navotas–Pasay 230 kV Transmission Line	Metro Manila	Dec 2025
	Transmission Components: ▪ Navotas–Pasay (Submarine Cable Portion) 230 kV Transmission Line, SC-DC, 2-200 mm^2XLPE, 14 km; ▪ Navotas–Pasay (Overhead Line Portion) 230 kV Transmission Line, SP-DC, 2-410 mm^2 TACSR/AS, 1.3 km. Bulk Cost Estimate: 24,313 Million Pesos	
Daraga–Ligao 69 kV Transmission Line Upgrading	Albay	Dec 2025
	Substation Components: ▪ Daraga 69 kV Substation Expansion, 1-69 kV PCB and associated equipment; ▪ Ligao Switching Station, 1-69 kV PCB and associated equipment. Transmission Components: ▪ Daraga–Ligao 69 kV Transmission Line, ST-SC, 1-795 MCM ACSR/AS, 22 km. Bulk Cost Estimate: 550 Million Pesos	
Naga–Pili 69 kV Transmission Line Upgrading	Camarines Sur	Dec 2025
	Transmission Components: ▪ Naga–Pili 69 kV Transmission Line, SP-DC, 1-795 MCM ACSR/AS, 10.5 km. Bulk Cost Estimate: 250 Million Pesos	

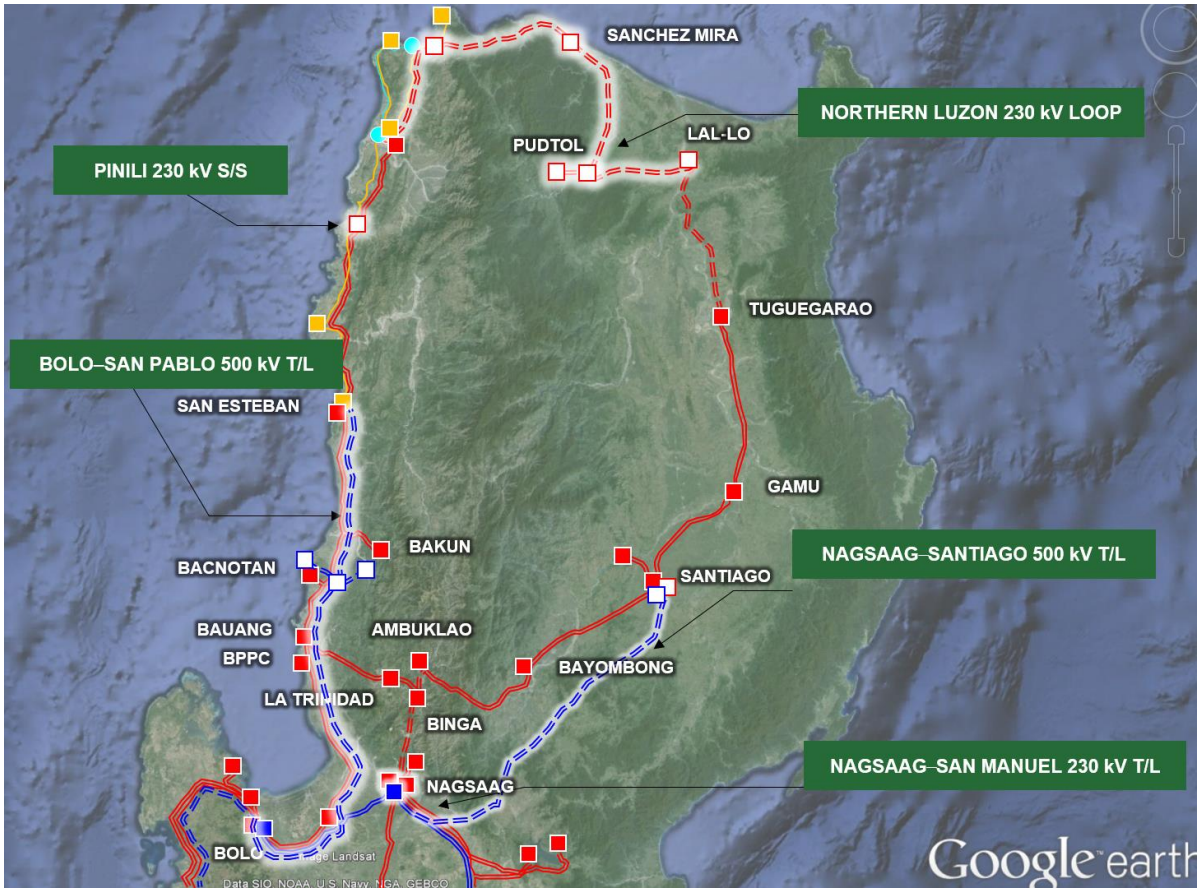


Figure 8.1.1: Proposed Luzon Transmission Outlook for 2025

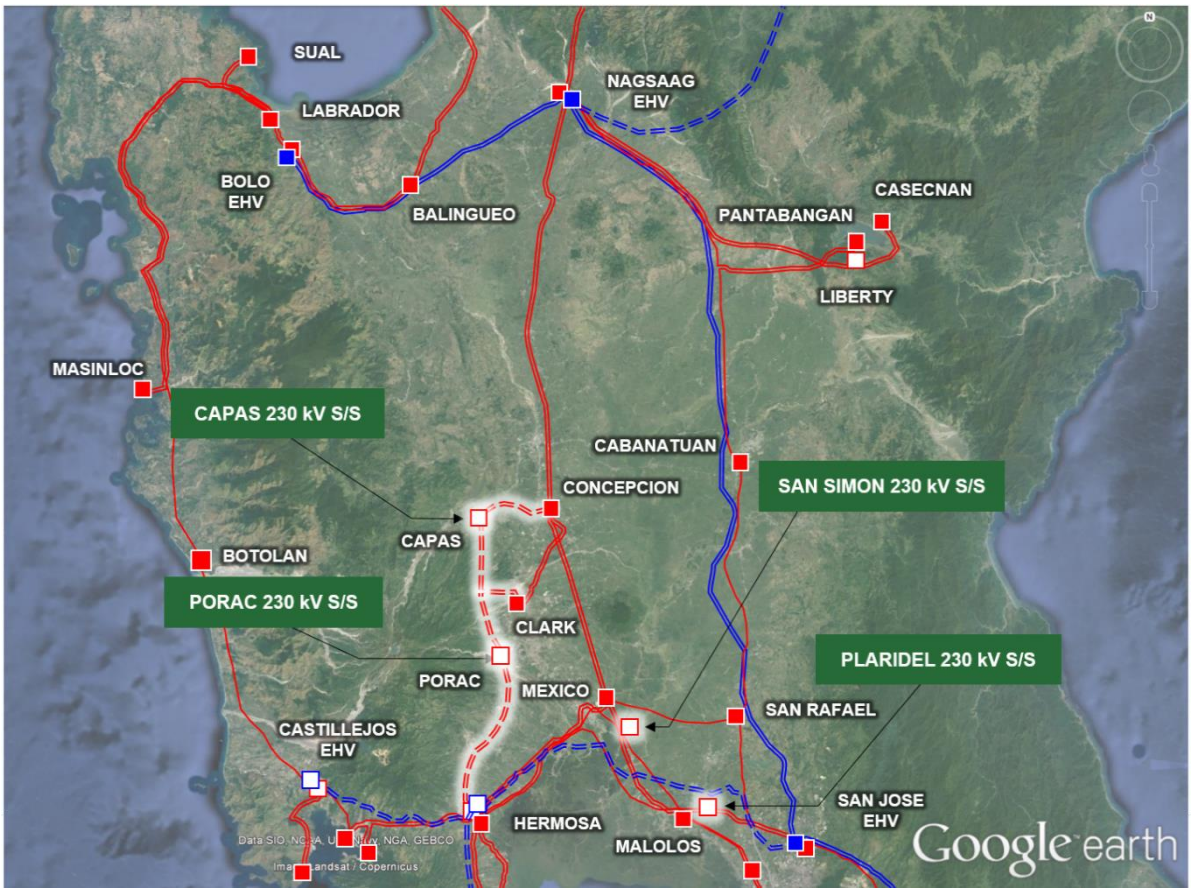


Figure 8.1.2: Proposed Luzon Transmission Outlook for 2025

Figure 8.1.3: Proposed Luzon Transmission Outlook for 2025

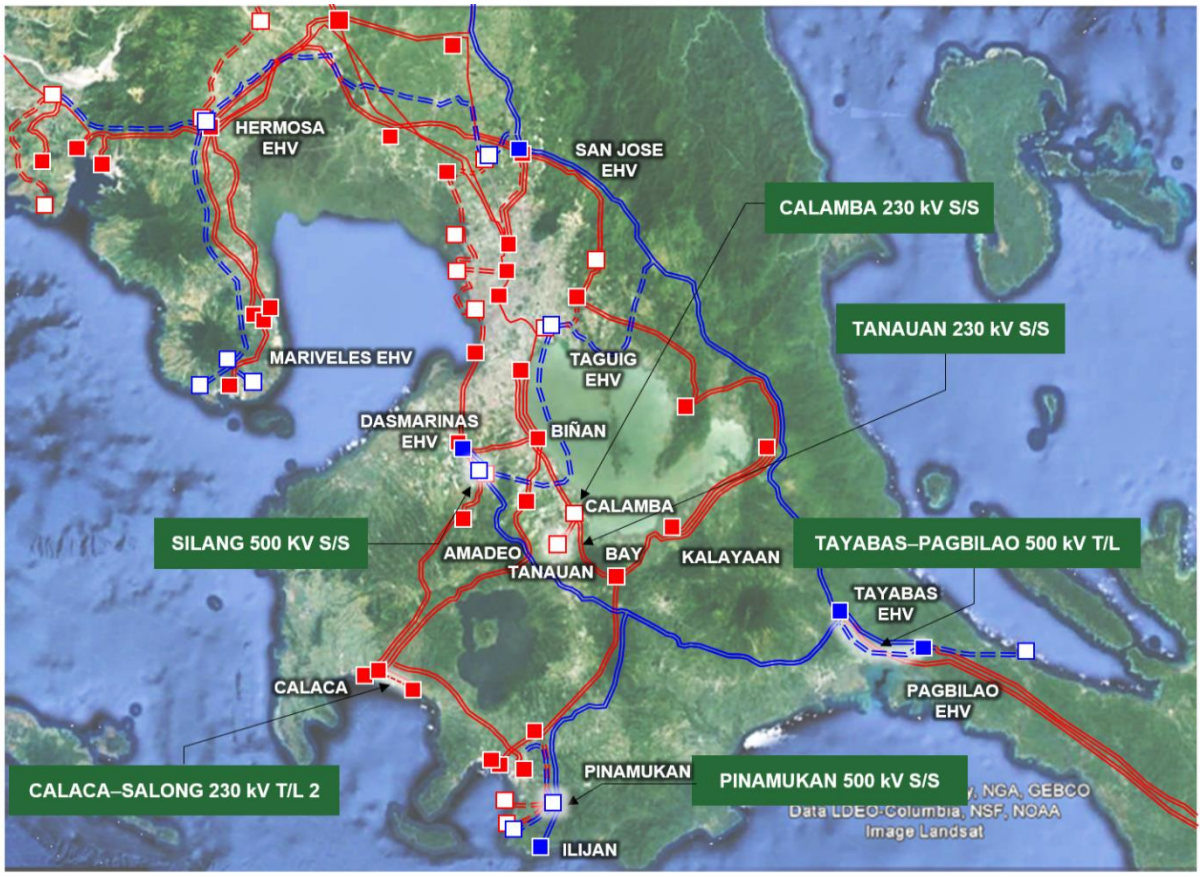


Figure 8.1.4: Proposed Luzon Transmission Outlook for 2025

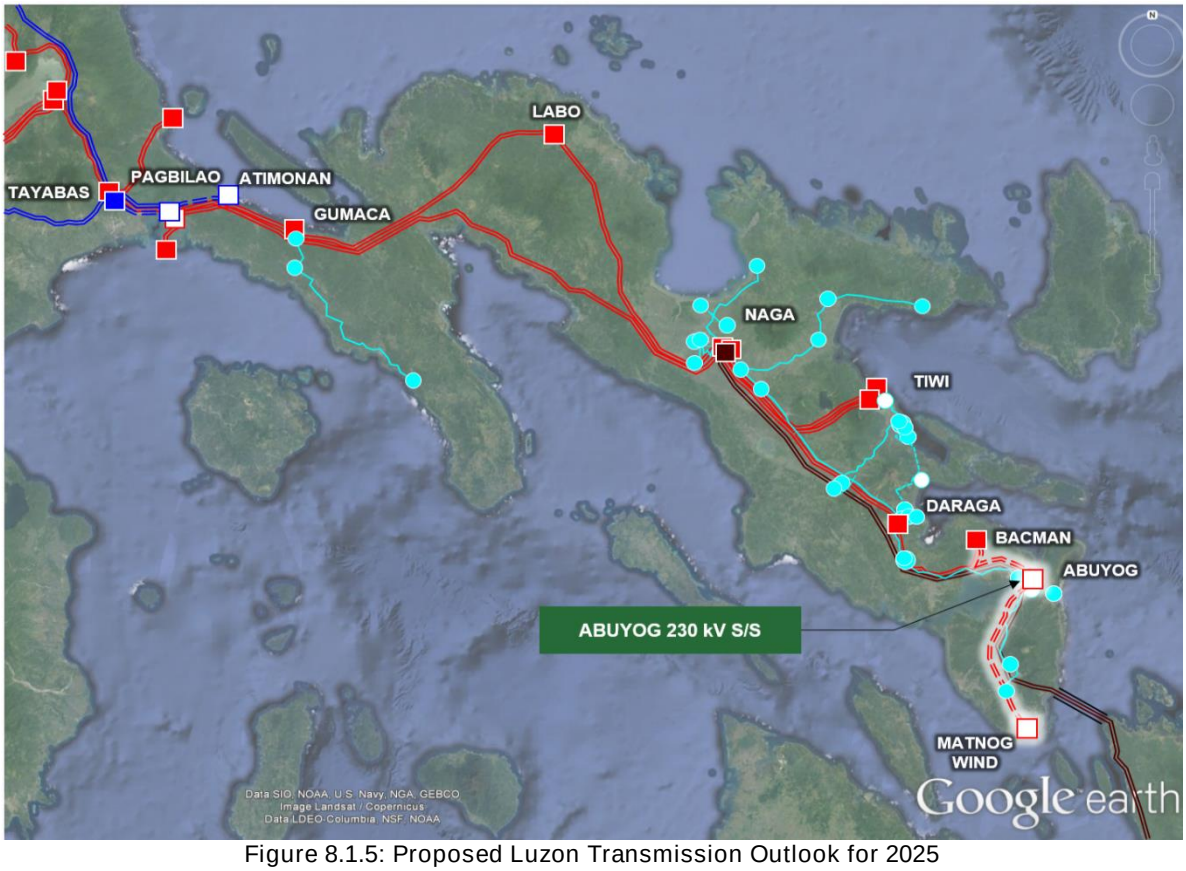
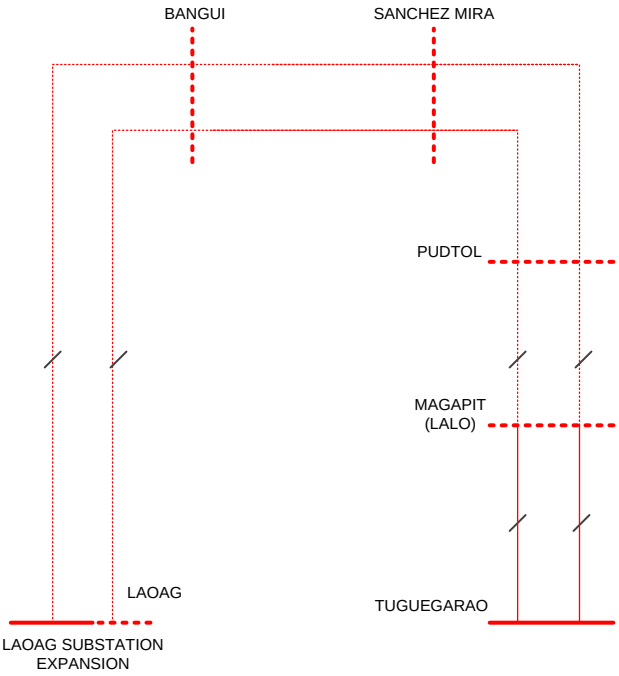


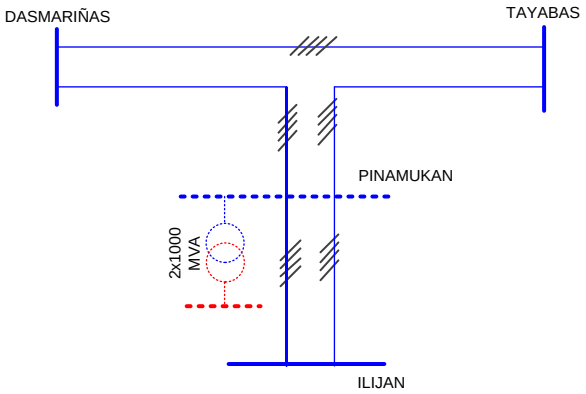
Figure 8.1.5: Proposed Luzon Transmission Outlook for 2025

8.1.1 Northern Luzon 230 kV Loop



The Northern Luzon 230 kV Loop aims to provide a new corridor to accommodate renewable energy and other power plants in the Northern part of Luzon. The Ilocos Region has been identified as among the areas with huge wind power generation potential. Meanwhile, Hydro generation potential is also identified in the Provinces of Kalinga, Apayao and Ifugao. The Project will also ensure the system reliability and operational flexibility in the Ilocos Region and Cagayan Valley through the 230 kV looping. The loads can continuously be served due to supply line redundancy and will ensure that any available generation capacity in the area can be delivered to the rest of the grid. The Project involves the development of three 230 kV substations. These substations are Bangui in Ilocos Norte, Sanchez Mira in Cagayan and Pudtol in Apayao. The project will also include expansion of Laoag and Lal-lo (Magapit) 230 kV Substation for the termination of the new 230 kV lines. Additional 230 kV lines, Laoag-Bangui, Bangui-Sanchez Mira, Sanchez Mira-Pudtol and Pudtol-Lal-lo 230 Line will be constructed to complete the 230 kV Loop.

8.1.2 Pinamukan 500 kV Substation

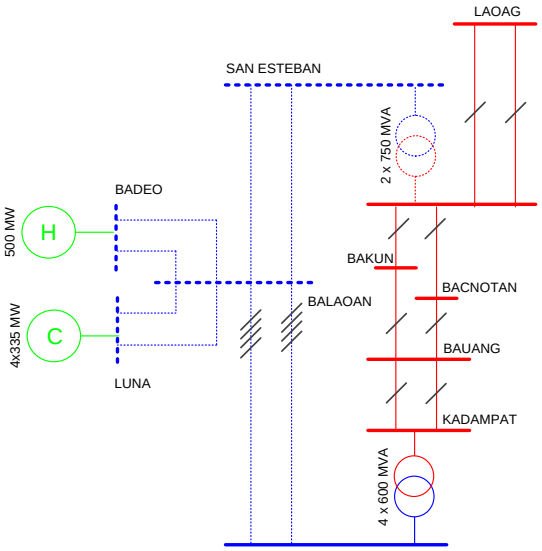


The Pinamukan 500 kV Substation Project aims to allow the connection of incoming bulk generation capacities in Batangas City Area which are mostly LNG-fired power plants. The proposed 500 kV Substation will connect to the 500 kV system through bus-in along the Ilijan–Dasmariñas and Ilijan–Tayabas 500 kV Lines.

In the long-term, this should be followed by the development of a new 500 kV backbone to Tuy 500 kV to increase the transmission capacity for the outgoing circuits and to form the southern 500 kV loop configuration.

8.1.3 Bolo–San Pablo 500 kV Transmission Line

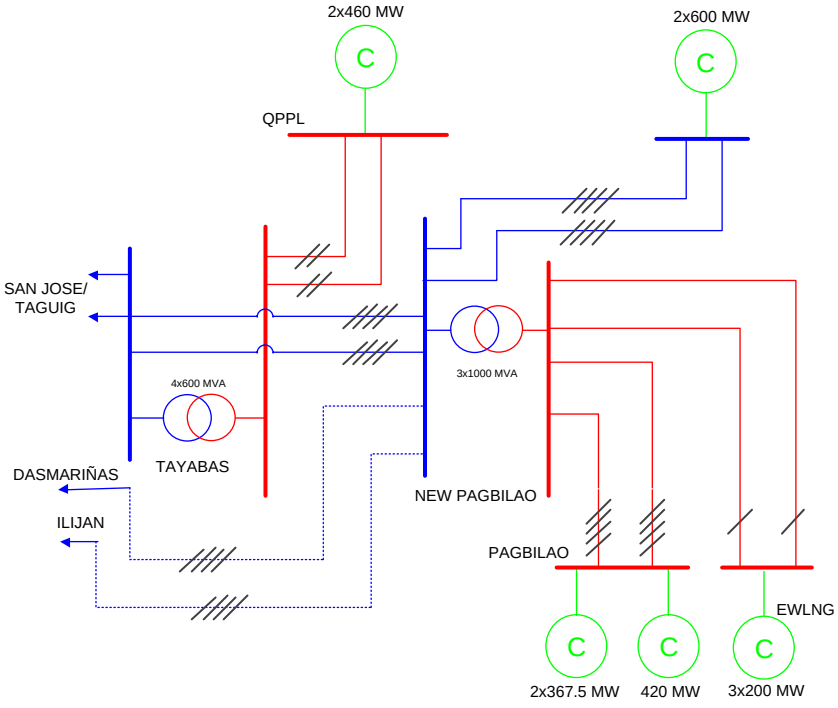
The Bolo–San Pablo 500 kV Transmission Line project aims to support the entry of large generation capacity in Ilocos Region and Mountain Province. This project will enable to accommodate the proposed 4x335 MW Luna Coal Plant in La Union and proposed 500 MW Pumped-Storage Hydro Power Plant in Benguet. Furthermore, this will also be a major transmission corridor that could accommodate the additional wind farm projects in Ilocos Area.



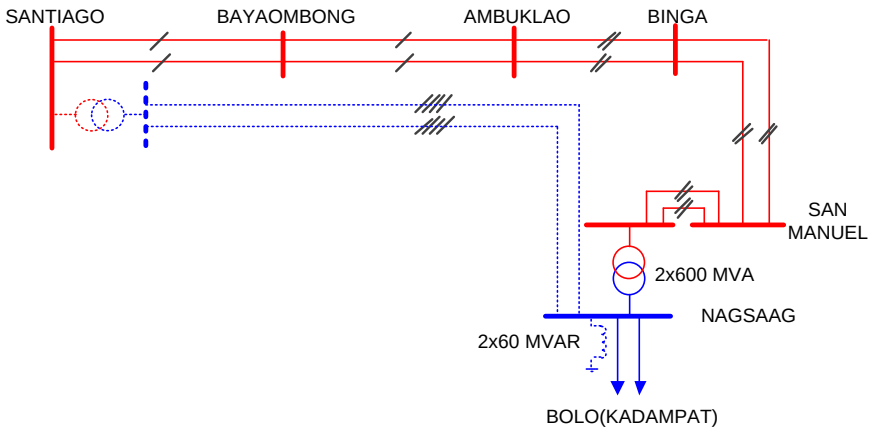
The project involves the development of a new San Pablo 500 kV Substation in San Esteban, Ilocos Sur with a 2-750 MVA 500/230 kV transformer capacity and a 500 kV collector substation in Balaoan, La Union. The bulk generation will be delivered to the 500 kV backbone through the 209 km double circuit Bolo–Balaoan–San Esteban 500 kV transmission line.

8.1.4 Pagbilao–Tayabas 500 kV Transmission Line

The Pagbilao–Tayabas 500 kV Transmission Line Project aims to accommodate further generation capacity additions in the Quezon province and will provide additional reliability in the Luzon 500 kV Grid. The proposed 1,200 MW Atimonan CFPP will connect to the Tayabas Substation making the substation a critical node which merges more than 3,500 MW generation. The project is needed to establish a by-pass line to Tayabas Substation such that the Pagbilao 500 kV Substation will already become part of the backbone loop. This will avoid the critical concentration of more than 3,500 MW power generation and will lessen the fault level issue at Tayabas 230 kV Substation. The project involves the expansion of the Pagbilao 500 kV Substation and construction of the 500 kV Line from Pagbilao Substation to Tayabas Substation.

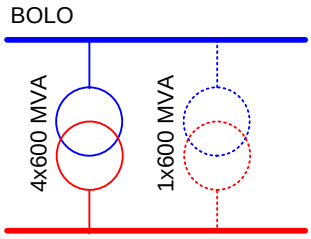


8.1.5 Santiago–Nagsaag 500 kV Transmission Line



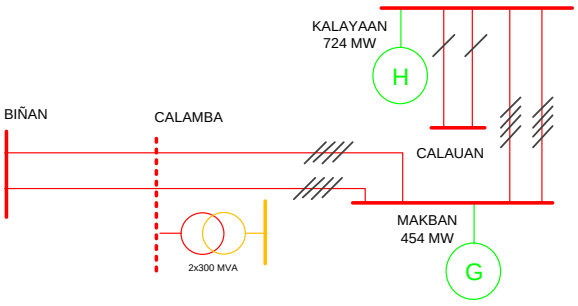
The Santiago–Nagsaag 500 kV Transmission Line Project aims to serve as a new transmission backbone to support the generation developments in Cagayan Valley and Cordillera, which include hydro power plants, wind farms and other conventional power plants. It will relieve the overloading that will be experienced during N-1 condition of the Santiago–Bayombong and Bayombong–Ambuklao 230 kV Lines. The Project involves the development of a New Santiago 500/230 kV Substation and 140 km 500 transmission line from New Santiago going to Nagsaag 500 kV Substation.

8.1.6 Bolo 5th Bank



The Bolo 5th Bank Project aims to maintain the N-1 contingency provision of Bolo 500 kV Substation. 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 the need for the Bolo 5th Bank. The project involves the installation of the 5th Bank Transformer and expansion of the 500 kV switchyard to accommodate the termination of the transformer.

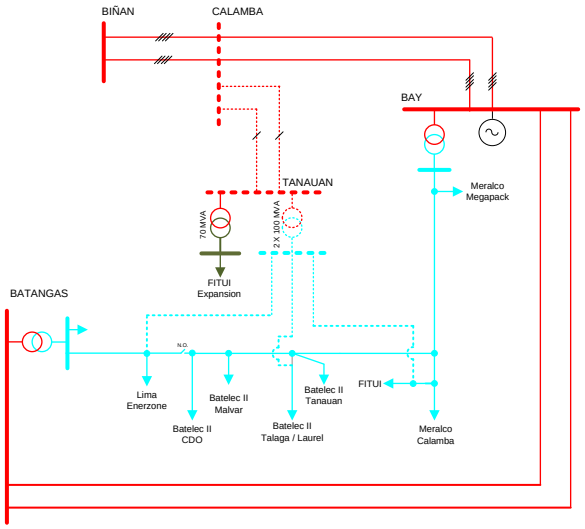
8.1.7 Calamba 230 kV Substation



The Calamba 230 kV Substation Project aims to cater the load growth in the Laguna Sector of MERALCO. This will address the single-outage contingency overloading in other adjacent 230 kV drawdown substations, Sta. Rosa and Calauan Substation, and the Calauan–Los Baños 115 kV distribution line. The Project will be located near the industrial parks in Laguna and Batangas and midway of Sta. Rosa and Calauan Substations for higher level of transmission reliability and flexibility of operation. The Project will be connected through bus-in scheme along Biñan–Bay (Makban) 230 kV Line.

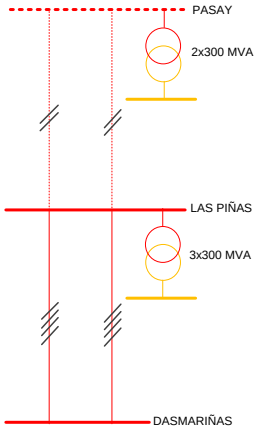
8.1.8 Tanauan 230 kV Substation

The Tanauan 230 kV Substation Project aims to cater the load growth of Batangas and Laguna Area particularly loads of MERALCO Calamba, BATELEC II and the industrial loads in Batangas. The project will relieve the overloading along the Bay–Calamba 69 kV Line and the Bay 2x100 MVA 230/69 kV transformer. This will also improve the power quality to the aforementioned loads. The Project involves the development of Tanauan 230 kV Substation and will be radially connected to the Calamba 230 kV Substation.



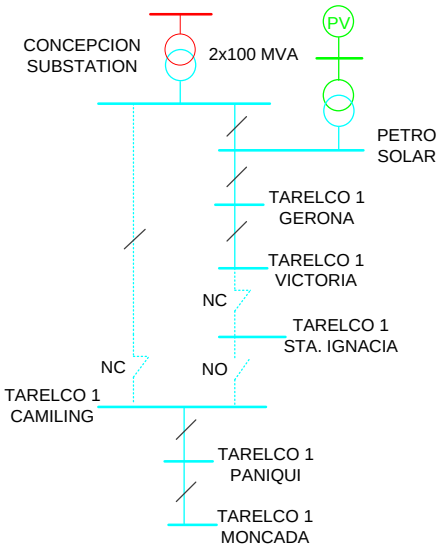
8.1.9 Pasay 230 kV Substation

The Pasay 230 kV Substation Project aims to cater the load growth of MERALCO's load sector 3 which is presently being served by Las Piñas and Muntinlupa Substations. The Las Piñas and Muntinlupa Substation have a space limitation for expansion thus the need for a new drawdown substation to cater load growth and provide adequate space for future expansion. The Project will be developed close to the load growth area in the Entertainment City in Pasay and will also support the loads in Makati City. It will be connected radially to the Las Piñas 230 kV Substation and eventually will form a 230 kV loop connection with Navotas 230 kV Substation.



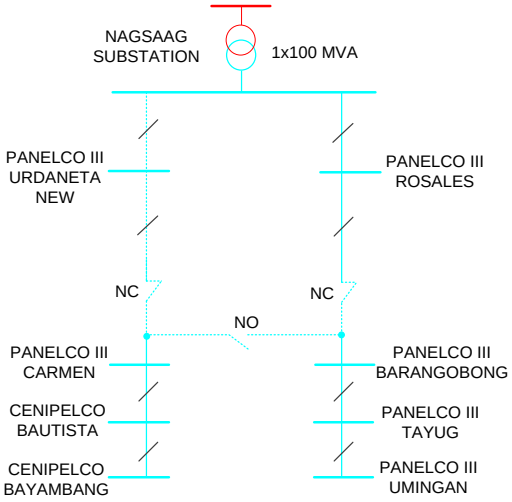
8.1.10 Concepcion–Sta. Ignacia 69 kV Transmission Line

The Concepcion–Sta. Ignacia 69 kV Transmission Line Project aims to cater the growing demand in Tarlac Area. The existing Concepcion–Paniqui 69 kV Transmission Line which delivers power to the loads of Tarlac I Electric Cooperative, Inc. (TARELCO I) will already be overloaded. The Concepcion–Sta. Ignacia 69 kV Transmission Line Project involves the construction of a new 69 kV transmission line from Concepcion Substation up to Sta. Ignacia, Tarlac. It will unload the existing Concepcion–Paniqui 69 kV transmission line by catering the loads of TARELCO Camiling, Paniqui and Moncada.



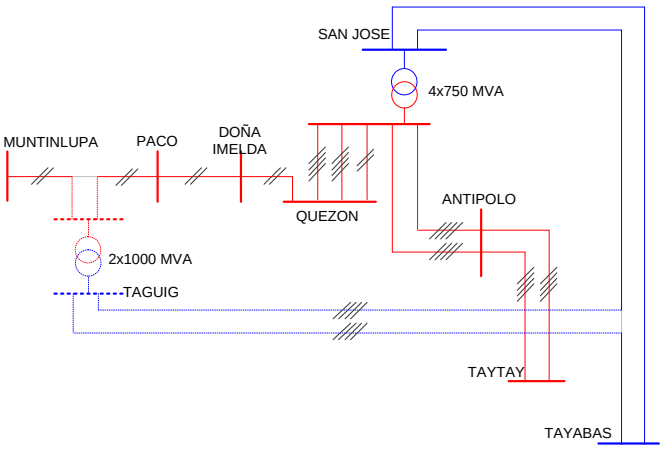
8.1.11 Nagsaag–Tumana 69 kV Transmission Line

The Nagsaag–Tumana 69 kV Transmission Line Project aims to cater the growing demand in Pangasinan. The existing Nagsaag–Umingan 69 kV Transmission Line which delivers power to the loads of Pangasinan III Electric Cooperative (PANELCO III) and Central Pangasinan Electric Cooperative (CENPELCO) will already be overloaded. The Nagsaag–Tumana 69 kV Transmission Line Project involves the construction of a new 69 kV transmission line from Nagsaag Substation going to the area of Tumana in Rosales, Pangasinan. The new transmission line will unload the Nagsaag–Umingan 69 kV Transmission Line by catering the loads of Pangasinan III Electric Cooperative, Inc. (PANELCO III) Urdaneta and Carmen, and Central Pangasinan Electric Cooperative, Inc. (CENPELCO) Bautista and Bayambang.

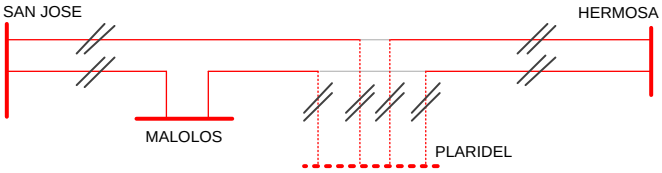


8.1.12 Taguig 500 kV Substation

The Taguig 500 kV Substation aims to provide another 500/230 kV drawdown substation to decongest San Jose EHV Substation and provide higher level of reliability to the 500 kV system of the Luzon Grid. The Project will also address the criticality of the existing 230 kV single-circuit line from Quezon to Muntinlupa during N-1 contingency and will address the severe low voltage of the Metro Manila 230 kV Substations due to the single-circuit configuration and heavy loading condition of the Quezon–Muntinlupa 230 kV Line. This is one of NGCP's major transmission network developments 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 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. The Project also involves the construction of 500 kV supply line that will be connected through cut-in along the existing San Jose–Tayabas 500 kV Line. A 230 kV Line will also be constructed from Taguig Substation and will be connected through bus-in scheme along Muntinlupa–Paco 230 kV Line.

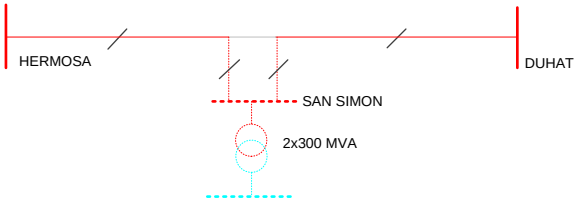


8.1.13 Plaridel 230 kV Substation



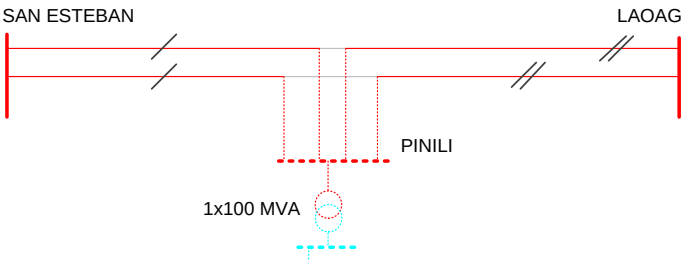
The Plaridel 230 kV Substation will serve as an additional drawdown substation to address the continuous load growth in MERALCO's Bulacan Sector. This project will provide N-1 contingency provision to the 230/69 kV transformers at San Rafael and Malolos Substations. The Plaridel 230 kV Substation will bus-in along the Hermosa–Malolos/San Jose 230 kV Line. Installation of 230/69 kV transformers and 69 kV switchyard will be implemented by MERALCO.

8.1.14 San Simon 230 kV Substation



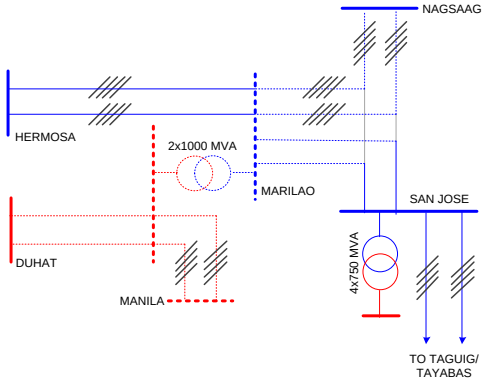
The San Simon 230 kV Substation Project will accommodate the further load growth of the steel plants and will also support the entry of other new industrial loads in the southeastern part of the province of Pampanga which is presently served by the existing Mexico 230 kV Substation and underlying 69 kV facilities. This will also serve as an alternate source substation for the loads connected at Mexico Substation. The San Simon 230 kV Substation will bus-in along the existing Hermosa–Duhat 230 kV Line and will involve the installation of 2x300 MVA 230/69 kV transformers. A 69 kV switchyard and 69 kV transmission facilities will also be implemented for the connection of the 69 kV loads. This new project development harmonizes the project scheme of Mexico–San Simon 69 kV Transmission Line Project and San Simon 230 kV Substation Project under the previous 2014-2015 TDP.

8.1.15 Pinili 230kV Substation



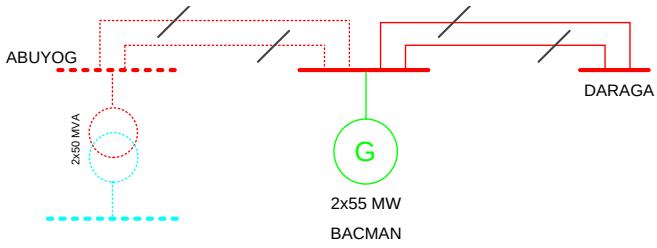
This Pinili 230 kV Substation will replace the existing Currimao 115 kV Substation as it can no longer be expanded due to space constraints. This project will accommodate the load growth and provide N-1 contingency for the loads of Ilocos Norte Electric Cooperative (INEC), Ilocos Sur Electric Cooperative (ISECO) and Abra Electric Cooperative (ABRECO). It can also be an alternate source of connection for the Ilocos Sur and Abra area as well as connection point for new renewable energy plants. The Pinili 115 kV Substation Project involves the construction a new 230/69 kV substation and it will be connected 'bus-in' to the San Esteban–Laoag 230 kV line and will be arranged in a breaker and a half scheme. It involves the installation of 100 MVA, 230/69-13.8 kV Power Transformer, 10-230 kV PCBs, 5-69 kV PCBs and its associated equipment.

8.1.16 Marilao 500 kV Substation



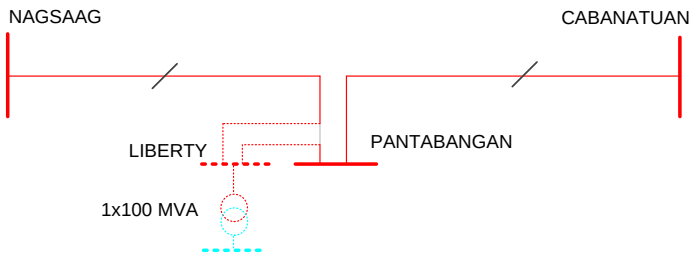
The Marilao 500 kV Substation aims to provide another drawdown substation to support the increasing demand in Metro Manila and will also address the further increase in bulk power injection to the 500 kV system coming from the new power plants in the grid. The project will also address the initial line 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 Substation. The Project will reduce the criticality of ring-bus configured San Jose 500 kV Substation as the Marilao Substation will now serve as the main node in the grid. The project involves the construction of Marilao 500 kV Substation to serve as new corridor of generation supply in the northern region. It includes the bus-in of the new substation along the Hermosa-San Jose 500 kV transmission line, transfer of Nagsaag 500 kV line from San Jose EHV substation to the new substation, and termination of 230 kV lines going to Duhat, Marilao, Navotas, Quezon and Hermosa Substations.

8.1.17 Abuyog 230 kV Substation



The Abuyog 230 kV Substation Project aims to establish a 230 kV drawdown substation closer to the loads in Sorsogon which will address the supply reliability issues, meet the long term projected demand and address the power quality issues at the load-end substations. Presently, 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 extended up to Bacman Geothermal Plant in Sorsogon and will be used as part of the supply facilities for the proposed Abuyog Substation. The Project involves the development of Abuyog Substation, expansion of Bacman 230 kV Substation and construction of 230 kV line from Bacman going to Abuyog Substation.

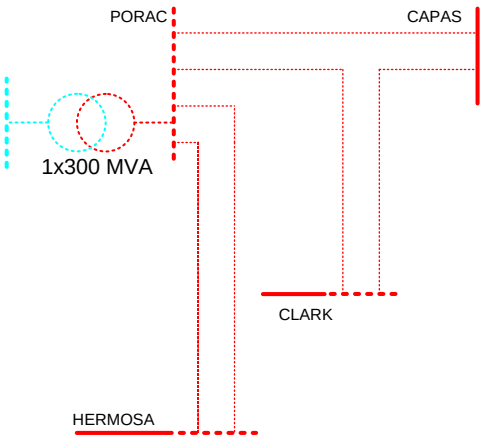
8.1.18 Liberty 230 kV Substation



The Liberty 230 kV Substation Project aims to establish an additional 230 kV drawdown substation in Nueva Ecija. This 230 kV drawdown will relieve the heavy loading of the existing 69 kV line from Cabanatuan going to Pantabangan Load End. This project will address the supply reliability issues, meet the long term projected demand and address the power quality issues at the load-end substations.The Liberty 230 kV Substation will initially cut-in along the Nagsaag–Pantabangan 230 kV Line with 100 MVA transformer capacity. Ultimately, this

substation will be linked to Nagsaag 230 kV Substation with the development of the Liberty–Nagsaag 230 kV Line.

8.1.19 Porac 230 kV Substation

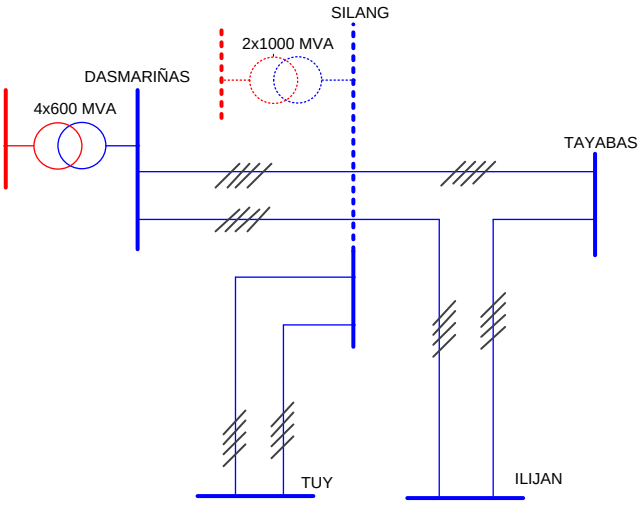


The Porac 230 kV Substation Project aims to support the load growth in Pampanga specifically the development of major loads such as Alviera. This project also aims to establish the 230 kV backbone loop from Hermosa in Bataan to Concepcion in Tarlac. This will provide a more direct access to the generation hub in Bataan. The Porac 230 kV Substation will draw its power from the Hermosa and Capas 230 kV Substations through the proposed Hermosa–Porac–Capas 230 kV Lines. The project includes the installation of a 230/69 kV switchyard with a transformer capacity of 300 MVA. The 230 kV backbone loop from Bataan to Tarlac will be completed with the implementation of the 64 km double circuit Hermosa– Porac–Capas 230 kV Line.

8.1.20 Capas 230 kV Substation

The Capas 230 kV Substation Project aims to support the load growth in Tarlac specifically the development of major loads such as Clark Green City. The Capas 230 kV Substation will draw its power from the Concepcion 230 kV Substation through the proposed Concepcion–Capas 230 kV Line. The project involves the installation of 2x300 MVA 230/69 kV transformer and 14-km double circuit 230 kV transmission line from Concepcion to Capas 230 kV Substation.

8.1.21 Silang 500 kV Substation

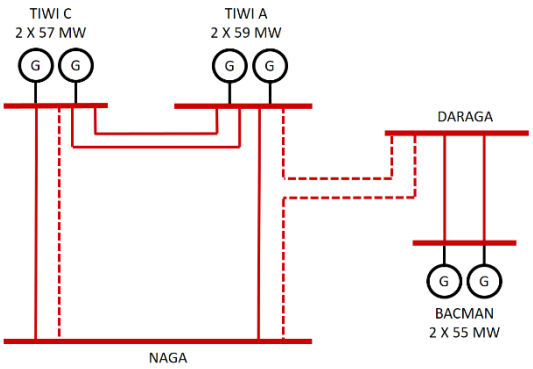


The Silang 500 kV Substation aims to complement the development of the Tuy 500 kV Substation which will support the entry additional generation capacities in Batangas Area. Due to space limitation at Dasmariñas 500 kV Substation, the Silang 500 kV Substation will be developed to terminate the 500 kV line emanating from Tuy 500 kV Substation. Furthermore, the project will address the anticipated overloading of the Dasmariñas 500/230 kV transformers.

The project involves the development of a new 500 kV Substation that will be

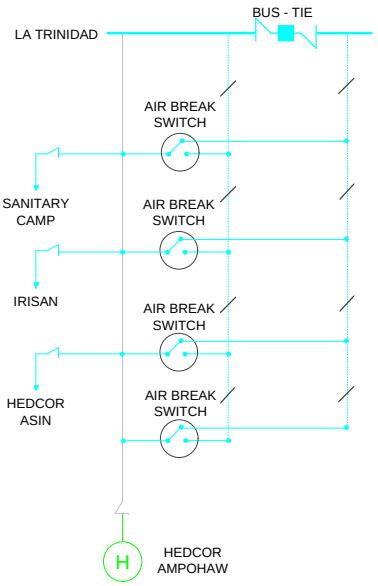
bus-in along Dasmariñas–Ilijan and Dasmariñas–Tayabas 500 kV Lines. The project will also involve the installation of 2x1000 MVA 500/230 transformers.

8.1.22 Tower Structure Upgrading of Bicol Transmission Facilities



The restoration project of Bicol transmission facilities offers the reconstruction of the affected transmission lines marred by Typhoon Nina, namely the Naga–Daraga–Tiwi A and Naga–Tiwi C 230 kV Transmission Lines. The project provides permanent solution to address the limitations of the emergency restoration that made use of provisional light-weight modular tower and steel pole structures. The project will involve the erection of 82 new steel tower structure, which are in conformity with the required design standards considering higher wind design criteria replacing the old and toppled structures.

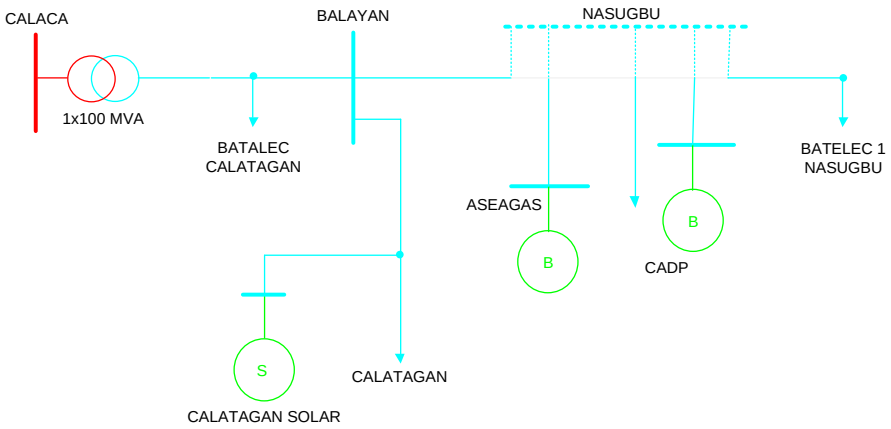
8.1.23 La Trinidad–Calot 69 kV Transmission Line



The La Trinidad–Calot 69 kV Transmission Line Project aims to improve the reliability and increase the transfer capacity of the 69 kV transmission line serving the loads of BENECO Lamut, BENECO Sanitary Camp, BENECO Irisan and power generations from HEDCOR Asin and HEDCOR Ampohaw. The project involves the construction of a 21 km, 69 kV, double circuit, steel tower/steel pole transmission line from La Trinidad Substation to Calot, Sablan, Benguet. It also involves the expansion of the 69 kV switchyard for the termination of the new La Trinidad-Calot 69 kV transmission line.

8.1.24 Nasugbu 69 kV Switching Station

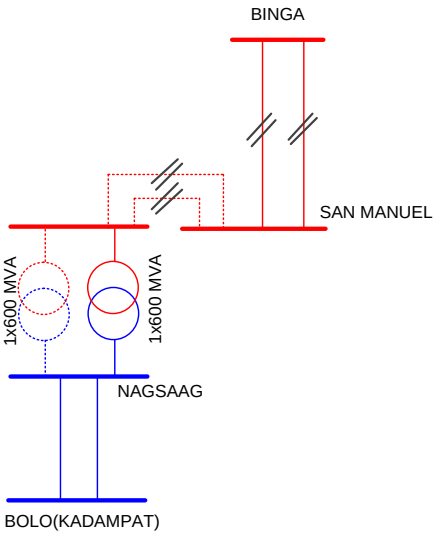
The Nasugbu 69 kV Switching Station aims to provide reliable connection to the existing loads and generator customers, including additional generation capacity in Nasugbu Area. The switching station will allow continuous transmission service even in case of fault in either one of the line segments.



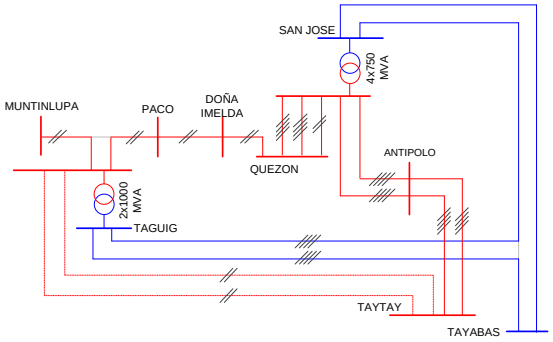
The project involves the installation of 8-69 kV PCBs that will enable isolation of one 69 kV line segments without interrupting the other segments.

8.1.25 San Manuel–Nagsaag 230 kV Transmission Line

The project aims to address the overloading of the San Manuel–Nagsaag 230 kV tie line, Pantabangan–Cabanatuan 230 kV Line, and the Nagsaag 500/230 kV transformer. During Maximum North condition and the hydro plants are maximized, outage of the San Manuel–Nagsaag 230 kV tie line will result in the overloading of the single circuit Pantabangan–Cabanatuan 230 kV line. Conversely, the outage of Pantabangan–Cabanatuan 230 kV line will result in overloading of the San Manuel–Nagsaag 230 kV tie line. Furthermore, during Maximum South condition and the hydro plants are minimized or completely not operating, the San Manuel 500/230 kV transformer will serve as a drawdown substation in the Central Luzon. The outage of one circuit of Nagsaag–San Jose 500 kV line will result in overloading of the 1x600 Nagsaag 500/230 kV transformer. The project involves the installation of additional 600 MVA 500/230 kV transformer at Nagsaag EHV Substation and construction of new San Manuel–Nagsaag 230 kV Tie-Line.

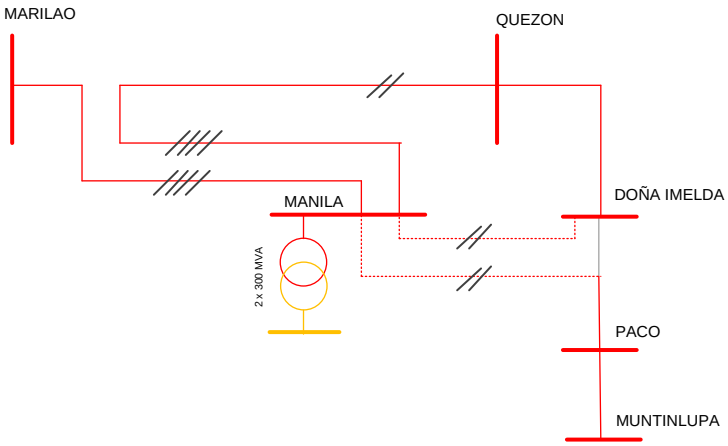


8.1.26 Taguig–Taytay 230 kV Line



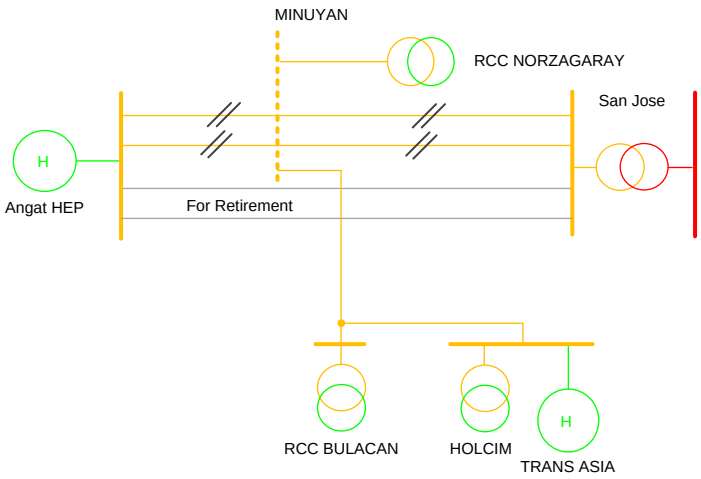
The project will address the overloading of the Taguig–Paco 230 kV Line segment during N-1 contingency event and under maximum south generation condition specifically with the incoming generating plants in the provinces of Batangas and Quezon. This project will provide additional outgoing circuits from 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 and the utilization of the new substation in Taguig will be optimized. It can be observed also that this project will form part of the 230 kV transmission loop surrounding the Laguna Lake. The project involves the construction of a 10 km double circuit 230 kV line from Taguig to Taytay Substation. The Taytay Substation will be expanded for up to two bays to allow the termination of the Taguig–Taytay 230 kV Line.

8.1.27 Navotas–Dona Imelda 230 kV Transmission Line



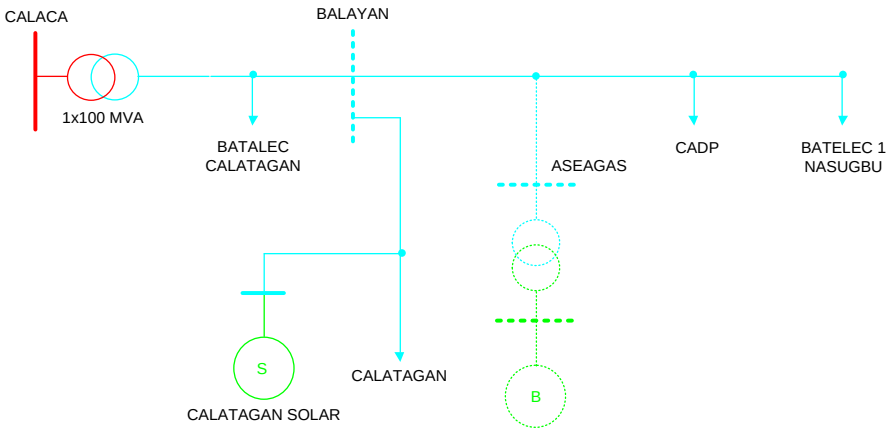
This project aims to provide additional transmission corridor that will complement the existing single circuit Quezon–Doña–Paco–Muntinlupa 230 kV line and will help address its criticality. Effectively, the Marilao–Navotas 230 kV Line and the Navotas–Doña Imelda 230 kV Line together with the existing 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. The project involves the construction of a 4.7 km, 230 kV XLPE cable and a 4.6 km, 230 kV steel pole, double-circuit line using 2-610 mm² TACSR/AS from the NGCP proposed Navotas 230 kV Substation going to the existing Doña Imelda 230 kV Substation. With its present configuration and space limitation, Doña Imelda Substation can accommodate only one additional 230 kV circuit termination while maintaining three units of 300 MVA online transformers. In this case, only one circuit from the proposed project will be terminated to Doña Imelda while the other circuit will be directly connected to the existing 230 kV line going to Paco Substation thereby by-passing Doña Imelda 230 kV Substation.

8.1.28 Minuyan 115 kV Switching Station



The Minuyan 115 kV Switching Station aims to provide reliable connection of the industrial loads (cement plants) in the area. 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 San Jose–Angat 230 kV Line and will involve installation of eight 115 kV PCBs.

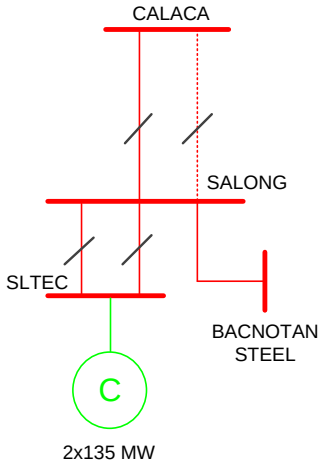
8.1.29 Balayan 69 kV Switching Station



The Balayan 69 kV 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. Presently, the Calaca–Balayan–Nasugbu/Calatagan 69 kV line is 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 69 kV switching station will involve installation of six 69 kV Power Circuit Breakers that will enable isolation of one 69 kV line segment without interrupting the other segments.

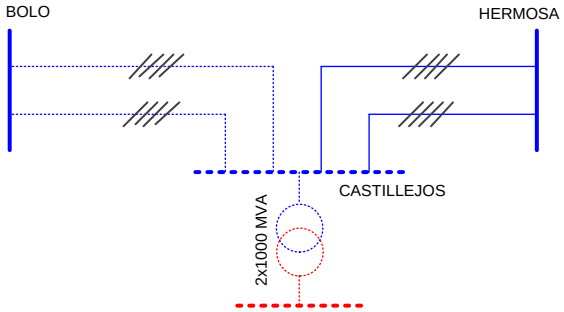
8.1.30 Calaca–Salong 230 kV Transmission Line 2

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. The Salong 230 kV Switching Station serves the 2x135 MW SLTEC Coal-Fired Power Plants and the Bacnotan Steel Plant. The Project involves the expansion of Salong 230 kV Substation for the termination of the Calaca–Salong 230 kV Line.



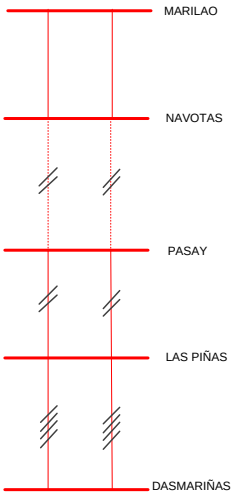
8.1.31 Western 500 kV Backbone – Stage 2

This Western 500 kV Backbone – Stage 2 Project will complete the reinforcement of the capacity of the western 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 transmission 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. This project will involve the construction of a 174 km double circuit 500 kV line from Bolo 500 kV Substation to Castillejos. It will also involve the implementation of the Castillejos 500 kV Substation which will serve as the new connection point for RP Energy CFPP. This could 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.



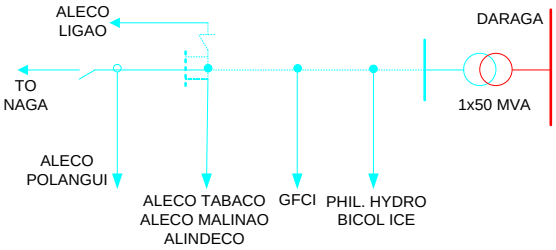
8.1.32 Navotas–Pasay 230 kV Transmission Line

The Navotas–Pasay 230 kV Line Project aims to provide additional reliability of supply in Metro Manila through a new transmission corridor. The project will be able to be serve as an additional corridor that will connect the northern and southern part of the grid. This will relieve the criticality of the Quezon–Doña Imelda–Paco-Muntinlupa 230 kV transmission corridor. The Project involves the construction of a combination of 1.3 km overhead and 14 km submarine cable 230 kV transmission line from Manila to Pasay 230 kV Substation. This Project will provide a new transmission corridor within Metro Manila by forming a new 230 kV loop.



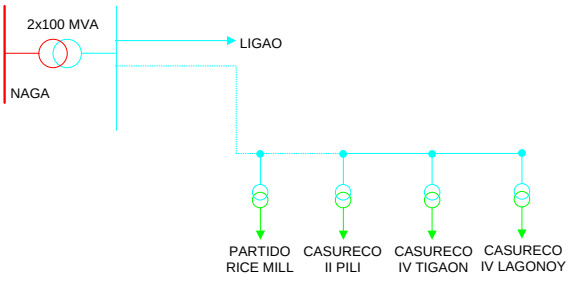
8.1.33 Daraga–Ligao 69 kV Transmission Line Upgrading

The Daraga–Ligao 69 kV Transmission Line Upgrading Project aims to cater the load growth and ensure the reliability of supply to the directly-connected and distribution utility customers in Albay. 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. The project involves the expansion of Daraga 69 kV Switchyard and construction of a 69 kV line from Daraga Substation up to Ligao area where a Ligao Switching Station will also be constructed.



8.1.34 Naga–Pili 69 kV Transmission Line Upgrading

The Naga-Pili 69 kV Transmission Line Upgrading Projects aims to cater the load growth of the north-eastern part of Camarines Sur. 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 adequate supply and reliable operation including the benefit of providing operational flexibility during contingency or maintenance in the 69 kV facility. The Project involves the construction of a 69 kV line from Naga Substation up to the area of Pili in Camarines Sur.



8.2 Proposed Transmission Outlook for 2030

From year 2026-2030, the indicative generation capacity addition will be around 8,000 MW. The province of Batangas will still be among the major bulk generation hubs in the Luzon Grid. To accommodate these generation capacities, the development of the Tuy 500 kV Substation (Stage 2) is required. This proposed project will also involve the energization of the 500 kV-designed Tuy–Silang 500 kV Transmission Line. This project will be complemented by the development of a new 500 kV transmission corridor from Pinamukan to Tuy 500 kV Substation. Meanwhile, the proposed hydro and wind farms in the Mountain Province will be addressed by the La Trinidad–Sagada 230 kV Transmission Line Project. The proposed hydro pumped-storage in Nueva Ecija will be addressed by the development of the Liberty–Nagsaag 230 kV Transmission Line Project. To accommodate additional generation import and export to the Visayas Grid, the Luzon–Visayas HVDC Bipolar Operation will also be implemented.

To address the forecasted load growth, the development of additional new drawdown substations will still need to be developed. These include the development of Saog 230 kV Substation in Bulacan, Malvar 230 kV Substation in Batangas, Iriga 230 kV Substation in Camarines Sur, Mamplasan 230 kV Substation in Laguna and San Agustin 230 kV Substation in Tarlac.

To maintain the reliability of transmission facilities, upgrading of old transmission facilities will be implemented. These include the upgrading of the Mexico–San Rafael–Cabanatuan–Liberty (Pantabangan) 230 kV transmission corridor and the Mexico–Clark 69 kV Transmission Line. In Metro Manila, additional transmission corridors will be implemented such as the Limay–Pasay and Pasay–Taguig. Lastly, the development of a new 230 transmission corridor from Silang to Las Piñas is required to provide N-1 contingency provision for the existing Dasmariñas–Las Piñas 230 kV Transmission Line.

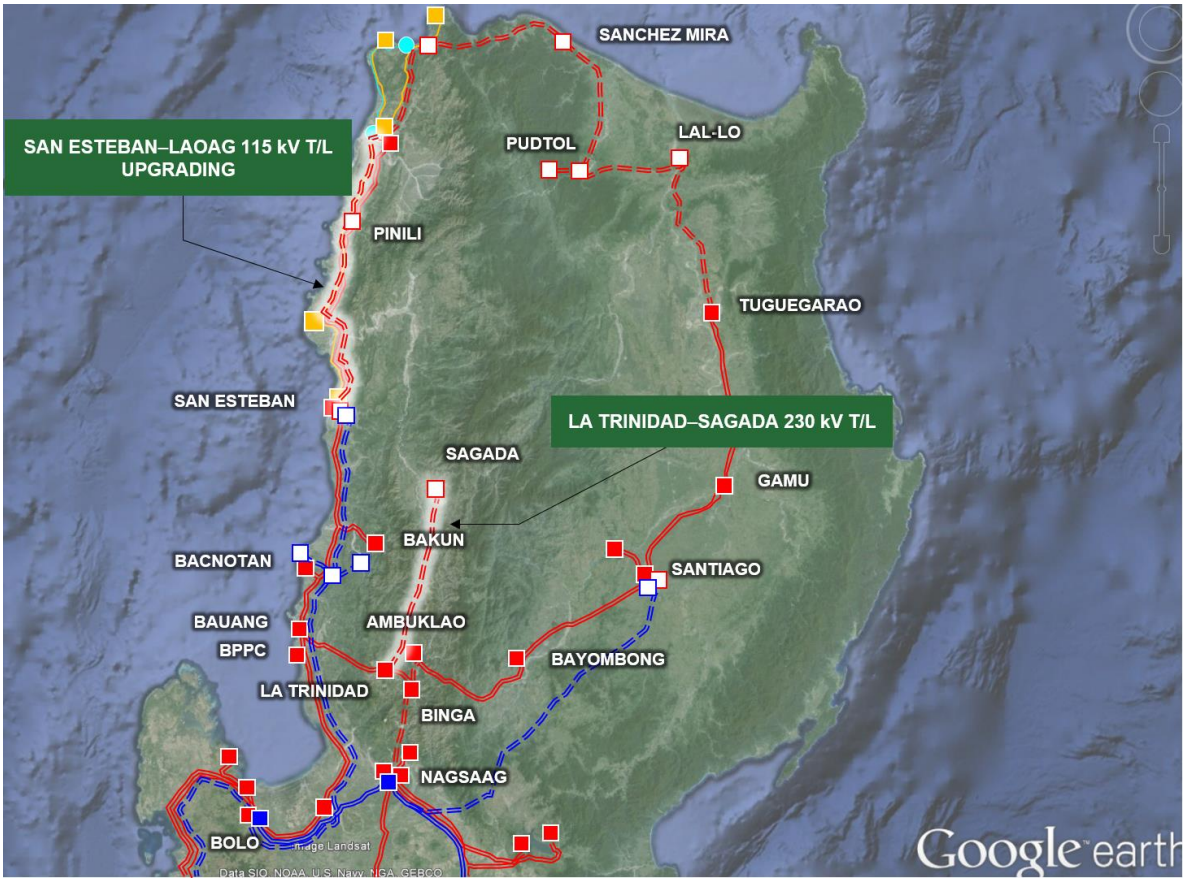


Figure 8.2.1: Proposed Luzon Transmission Outlook for 2030

Figure 8.2.2: Proposed Luzon Transmission Outlook for 2030

Figure 8.2.3: Proposed Luzon Transmission Outlook for 2030

Figure 8.2.4: Proposed Luzon Transmission Outlook for 2030

Figure 8.2.5: Proposed Luzon Transmission Outlook for 2030

Table 8.2: Proposed Luzon Transmission Outlook for 2030

Project Name/Driver(s)	Province(s) and Components	ETC
Generation Entry		
La Trinidad–Sagada 230 kV Transmission Line	Benguet	Dec 2027
	Substation Components: ▪ La Trinidad 69 kV Substation Expansion, 2-69 kV PCBs and associated equipment; ▪ Sagada Switching Station, 6-69 kV PCBs and associated equipment. Transmission Components: ▪ La Trinidad–Sagada 230 kV Transmission Line (to be initially energized at 69 kV), ST/SP-DC, 1-795 MCM ACSR, 93.25 km transmission line.	
Tuy 500/230 kV Substation (Stage 2)	Batangas	Dec 2027
	Substation Components: ▪ Tuy 500/230 kV Substation, 2x1000 MVA, 500/230 kV Power Transformer and accessories, 6-500 kV PCBs and associated equipment;	
Pinamukan–Tuy 500 kV Line	Batangas, Laguna	Oct 2029
	Substation Components: ▪ Pinamukan 500 kV Substation, 2-500 kV PCBs and associated equipment. ▪ Tuy 500 kV Substation, 4-500 kV PCBs and associated equipment. Transmission Components: ▪ Pinamukan–Tuy 500 kV Transmission Line, ST-DC, 4-795 MCM ACSR/AS, 60.0 km;	
Liberty–Nagsaag 230 kV Transmission Line	Nueva Ecija, Pangasinan	Dec 2029
	Substation Components: ▪ Liberty 230 kV Substation, 6-230 kV PCBs and associated equipment; ▪ Nagsaag 230 kV Substation Expansion, 3-230 kV PCBs and associated equipment. Transmission Components: ▪ Liberty–Nagsaag 230 kV Transmission Line, 4-795 MCM ACSR/AS, ST-DC, 68 kms.	
Luzon–Visayas HVDC Bipolar Operation	Camarines Sur and Leyte	Dec 2030
	Substation Components: ▪ Naga Converter/Inverter StationUpgrading ▪ Naga 500/230 kV Substation, 2–750 MVA, 500/230 kV Power Transformer and accessories, 4-500 kV PCBs and associated equipment ▪ Pagbilao 500 kV Substation, 4-500 kV PCBs and associated equipment. ▪ Ormoc Converter/Inverter Station Upgrading	
San Esteban–Laoag 115 kV Transmission Line Upgrading	Ilocos Norte, Ilocos Sur	Dec 2030
	Substation Components: ▪ San Pablo 230 kV Substation, 4-230 kV PCBs and associated equipment. ▪ New Bantay 230 kV Substation, 2x100 MVA, 230/115 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment. ▪ Laoag 230 kV Substation, 4-230 kV PCBs and associated equipment. Transmission Components: ▪ San Esteban–Laoag 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR/AS, 115 km.	
Load Growth		
Saog 230 kV Substation	Metro Manila	Dec 2027
	Substation Components: ▪ Saog 230 kV Substation, 10-230 kV PCBs and associated equipment. Transmission Components: ▪ *Saog 'bus-in' to Marilao*–Navotas 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR/AS, 2 km;	

Project Name/Driver(s)	Province(s) and Components	ETC
Malvar 230 kV Substation	Batangas	Dec 2028
	Substation Components: ▪ Malvar 230 kV Substation (New), 1x100 MVA, 230/69-13.8 kV Power Transformer and accessories, 9-230 kV PCBs and 9-69 kV PCBs and associated equipment. Transmission Components: ▪ Extension from the bus-in point (Batangas side) to Malvar Substation, 230 kV, ST-DC, 4-795 MCM ACSR/AS, 5.0 km; ▪ Extension from the bus-in point (Bay side) to Malvar Substation, 230 kV, ST-DC, 4-795 MCM ACSR/AS, 5.0 km.	
Iriga 230 kV Substation	Camarines Sur	Dec 2028
	Substation Components: ▪ Iriga 230 kV Substation (New), 1x100 MVA, 230/69-13.8 kV Power Transformer and accessories, 8-230 kV PCBs and 3-69 kV PCBs and associated equipment. Transmission Components: ▪ *Iriga 'bus-in' to Naga*–Tiwi C 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR/AS, 2 km; ▪ 69 kV line extension, ST-SC, 1-336.4 MCM ACSR, 2.0 km.	
San Agustin 230 kV Substation	Tarlac	Apr 2030
	Substation Components: ▪ San Agustin Substation, 1x100 MVA 230/69 kV Power Transformer and accessories, 9-230 kV PCBs and associated equipment, 2-69 kV PCBs and associated equipment. Transmission Components: ▪ *San Agustin 'bus-in' to San Manuel*–Concepcion 230 kV Transmission Line, ST-DC, 2-410 mm^2 TACSR/AS, 2 km.	
Liberty–Baler 230 kV Transmission Line	Nueva Ecija, Aurora	Apr 2035
	Substation Components: ▪ Baler 230 kV Substation, 1–50 MVA, 230/69-13.8 kV Power Transformer and accessories, 5-230 kV PCBs and associated equipment, 3-69 kV PCBs and associated equipment Transmission Components: • Liberty–Baler 230 kV Transmission Line, 1-795 MCM ACSR ST-DC, 56.5 km.	
Mamplasan 230 kV Substation	Laguna	Dec 2030
	Substation Components: ▪ Mamplasan 230 kV Substation, 10-230 kV PCBs and associated equipment. Transmission Components: ▪ Mamplasan 230 kV bus-in Transmission Line, ST-DC, 2-795, 2 km.	
System Reliability		
Silang–Las Piñas 230 kV Transmission Line	Cavite, Metro Manila	Dec 2026
	Substation Components: ▪ Las Piñas 230 kV Substation (Expansion), 4-230 kV PCBs GIS and associated equipment. ▪ Silang 230 kV Substation, 4-230 kV PCBs GIS and associated equipment. Transmission Components: ▪ Dasmariñas–Las Piñas 230 kV Transmission Line, 4-795 MCM ACSR SP-DC, 32 km.	
Pasay–Taguig 230 kV Transmission Line	Metro Manila	Dec 2026
	Transmission Components: Pasay–Taguig 230 kV Transmission Line, 2-410 mm^2 TACSR SP-DC, 16 km.	
Silang–Taguig 500 kV Transmission Line	Cavite, Metro Manila	Dec 2027
	Substation Components: ▪ Silang 500 kV Substation, 4-500 kV PCBs, 2x30 MVAR 500 kV Shunt Reactor and associated equipment; ▪ Taguig 500 kV Substation (Expansion), 4-500 kV PCBs and associated equipment. Transmission Components: ▪ Silang–Taguig 500 kV Transmission Line, ST-DC, 4-410mm^2 TACSR, 50 km;	

Project Name/Driver(s)	Province(s) and Components	ETC
Mexico–Clark 69 kV Transmission Line Upgrading	Pampanga	Apr 2028
	Transmission Components: ▪ Mexico–Clark Line 69 kV Transmission Line, ST-DC 2-795 MCM ACSR, 18 km.	
Liberty–Cabanatuan–San Rafael–Mexico 230 kV Transmission Line Upgrading	Nueva Ecija, Pampanga, Bulacan	Apr 2030
	Transmission Components: ▪ Liberty–Cabanatuan–San Rafael–Mexico 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR, 140 km.	
Naga – Presentacion 230 kV Transmission Line	Camarines Sur	Dec 2030
	Substation Components: ▪ Naga 69 kV Substation, 2-69 kV PCBs and associated equipment. Transmission Components: Naga–Presentacion 230 kV Transmission Line, 1-795 MCM ACSR ST-DC, 71 km (initially energized at 69 kV)	
Limay–Pasay 230 kV Transmission Line	Bataan, Metro Manila	Dec 2030
	Substation Components: ▪ Limay 230 kV Substation, 4-230 kV PCBs and associated equipment. ▪ Pasay 230 kV Substation, 2-230 kV PCBs GIS and associated equipment. Transmission Components: ▪ Limay–Pasay 230 kV Transmission Line, SubCable-DC, 2-2,000 mm^2 XLPE, 42 km.	

8.3 Proposed Transmission Outlook for 2035

For year 2031-2035, the development of Fort Bonifacio Global City (FBGC) and San Mateo 230 kV Substation is needed to meet the forecasted increase in demand in the area. In addition, the transmission corridor in Metro Manila will be further strengthened by providing redundancy for FBGC–Taguig 230 kV Transmission Line and upgrading the Taguig–Muntinlupa 230 kV Transmission Line from single circuit to double circuit.

Outside Metro Manila, new 230 kV Substations were identified to address the demand in the area. These substations are the Baler 230 kV Substation in Aurora, Magalang 230 kV Substation in Pampanga and Presentacion 230 kV Substation in Camarines Sur.

To harness the bulk hydro generation capacities in the upstream of Apayao, the development of Kabugao 500/230 kV Substation is required and it will be linked to Santiago 500 kV Substation through the Santiago–Kabugao 500 kV Transmission Line.

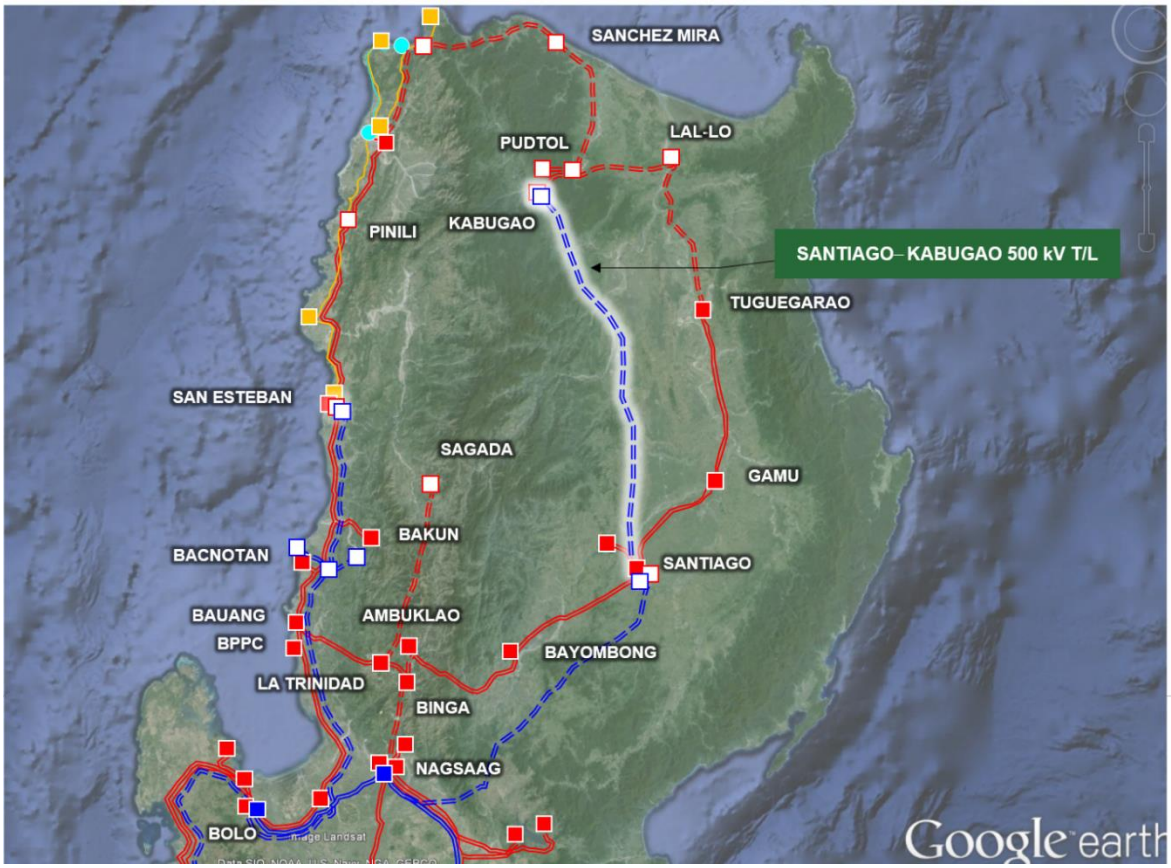


Figure 8.3.1: Proposed Luzon Transmission Outlook for 2035

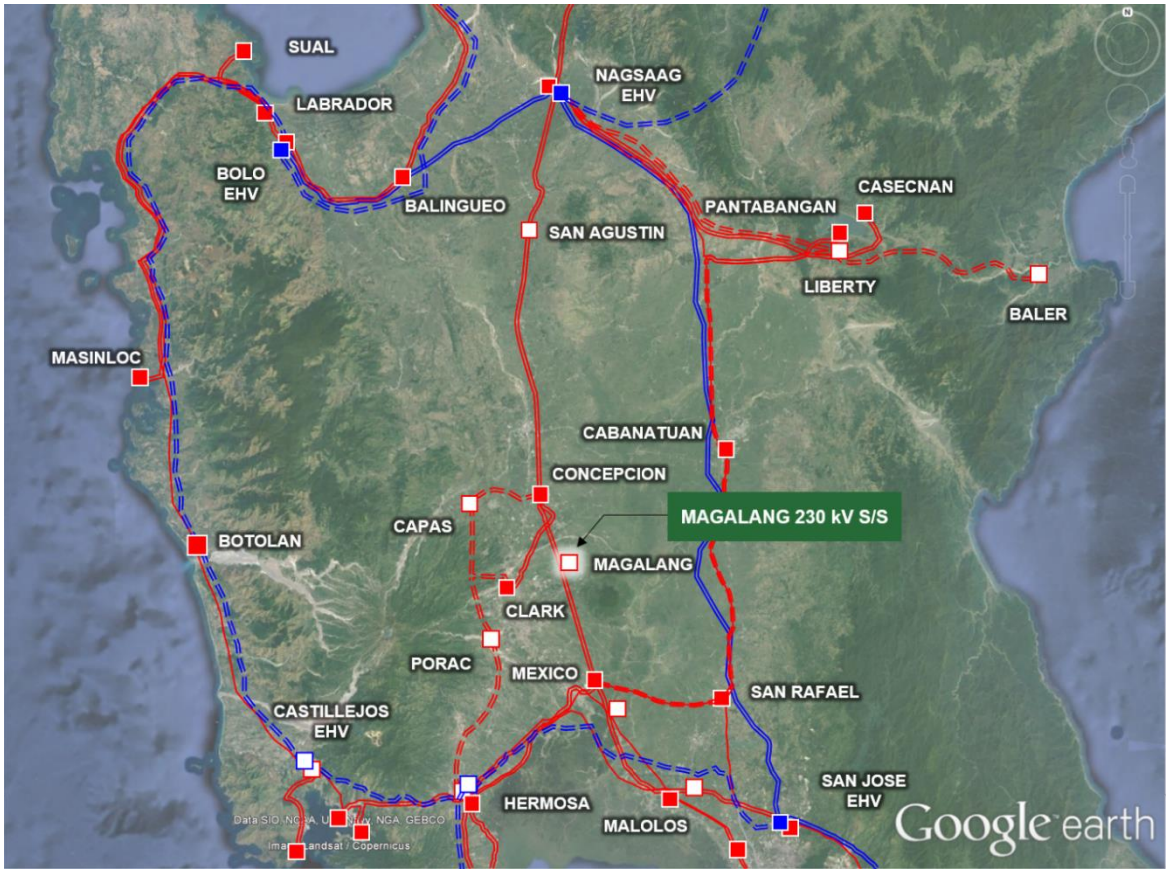


Figure 8.3.2: Proposed Luzon Transmission Outlook for 2035

Figure 8.3.3: Proposed Luzon Transmission Outlook for 2035

Figure 8.3.4: Proposed Luzon Transmission Outlook for 2035

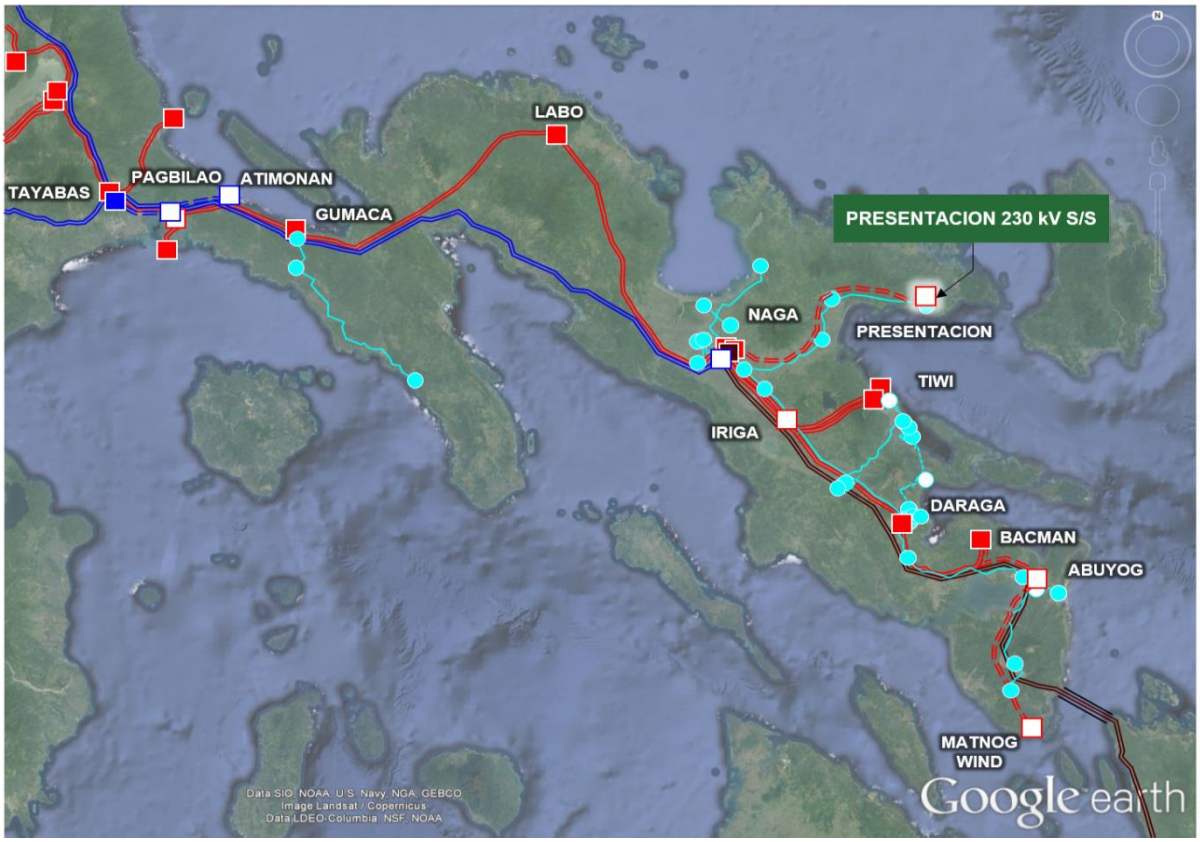


Figure 8.3.5: Proposed Luzon Transmission Outlook for 2035

Table 8.3: Proposed Luzon Transmission Outlook for 2035

Project Name/Driver(s)	Province(s) and Components	ETC
Generation Entry		
Santiago–Kabugao 500 kV Transmission Line	Apayao, Isabela	Dec 2035
	Substation Components: ▪ Kabugao 500 kV Substation, 2x750 MVA, 500/230-13.8 kV Power Transformer and accessories, 6-500 kV PCBs and associated equipment, 2-230 kV PCB and associated equipment. ▪ Santiago 500 kV Substation, 4-500 kV PCBs and associated equipment. Transmission Components: ▪ Santiago–Kabugao 500 kV Transmission Line, ST-DC, 4-795 MCM ACSR, 171 km.	
Load Growth		
Magalang 230 kV Substation	Pampanga	Jun 2032
	Substation Components: ▪ Magalang 230 kV Substation, 1x300 MVA 230/69 kV Power Transformer and accessories, 8-230 kV PCBs, and associated equipment. Transmission Components: ▪ *Magalang 'bus-in' to* Concepcion–Mexico 230 kV Transmission Line, ST-DC, 2-410 mm^2 TACSR/AS, 5 km;	
FBGC 230 kV Substation	Metro Manila	Dec 2032
	Substation Components: ▪ FBGC 230 kV Substation, 8-230 kV PCBs (GIS) and associated equipment. Transmission Components: ▪ *Valenzuela 'cut-in' to Taguig*–Paco 230 kV Transmission Line, SP-SC, 2-610 mm^2 TACSR/AS, 2 km.	
San Mateo 230 kV Substation	Metro Manila	Dec 2033
	Substation Components: ▪ San Mateo 230 kV Substation, 10-230 kV PCBs and associated equipment. Transmission Components: ▪ *San Mateo 'cut-in' to San Jose* - Antipolo 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR, 2 km.	
Presentacion 230 kV Substation	Camarines Sur	Dec 2035
	Substation Components: ▪ Naga 230 kV Substation, 4-230 kV PCBs and associated equipment ▪ Presentacion 230 kV Substation, 2x50 MVA 230/69 kV Power Transformer and accessories, 6-230 kV PCBs and associated equipment, 3-69 kV PCBs and associated equipment	
System Reliability		
Taguig–FBGC 230 kV Transmission Line	Metro Manila	Dec 2033
	Transmission Components: ▪ Taguig–FBGC 230 kV Transmission Line, SP-SC, 2-410 mm^2 TACSR/AS, 7.0 km.	
Taguig–Muntinlupa 230 kV Transmission Line	Metro Manila	Dec 2035
	Substation Components: ▪ Sucat 230 kV Substation, 1-230 kV PCB and associated equipment. Transmission Components: ▪ Taguig–Muntinlupa 230 kV Transmission Line, SP-SC, 2-410 mm^2 TACSR/AS, 11 km.	
Alaminos 500 kV Switching Station	Laguna	Dec 2035
	Substation Components: ▪ Alaminos 500 kV Substation, 12-500 kV PCBs, 2x30 MVAR 500 kV Shunt Reactor and associated equipment.	

8.4 Proposed Transmission Outlook for 2040

From year 2035 to 2040, the bulk of projects will be on providing reliability to the transmission network. On the 500 kV network, the Bataan–Cavite 500 kV Transmission Line and the the Baras 500 kV Switching Station will be implemented. In the northern part of Luzon Grid, transmission backbone for the province of Aurora will be developed through the Santiago–Dinadiawan–Baler transmission line project. The Sagada–San Esteban 230 kV Transmission Line will provide transmission corridor in Mountain Province Area by completing the La Trinidad–Sagada San Esteban transmission loop. Another transmission corridor will also be developed through the Capas–Kadampat 230 kV Line.

To accommodate additional generation capacities, the development of the Kalinga 500 kV Substation to cater the proposed Hydro Plants in the area. In Sorsogon, the Matnog 230 kV Substation will be developed to cater the wind farm projects.

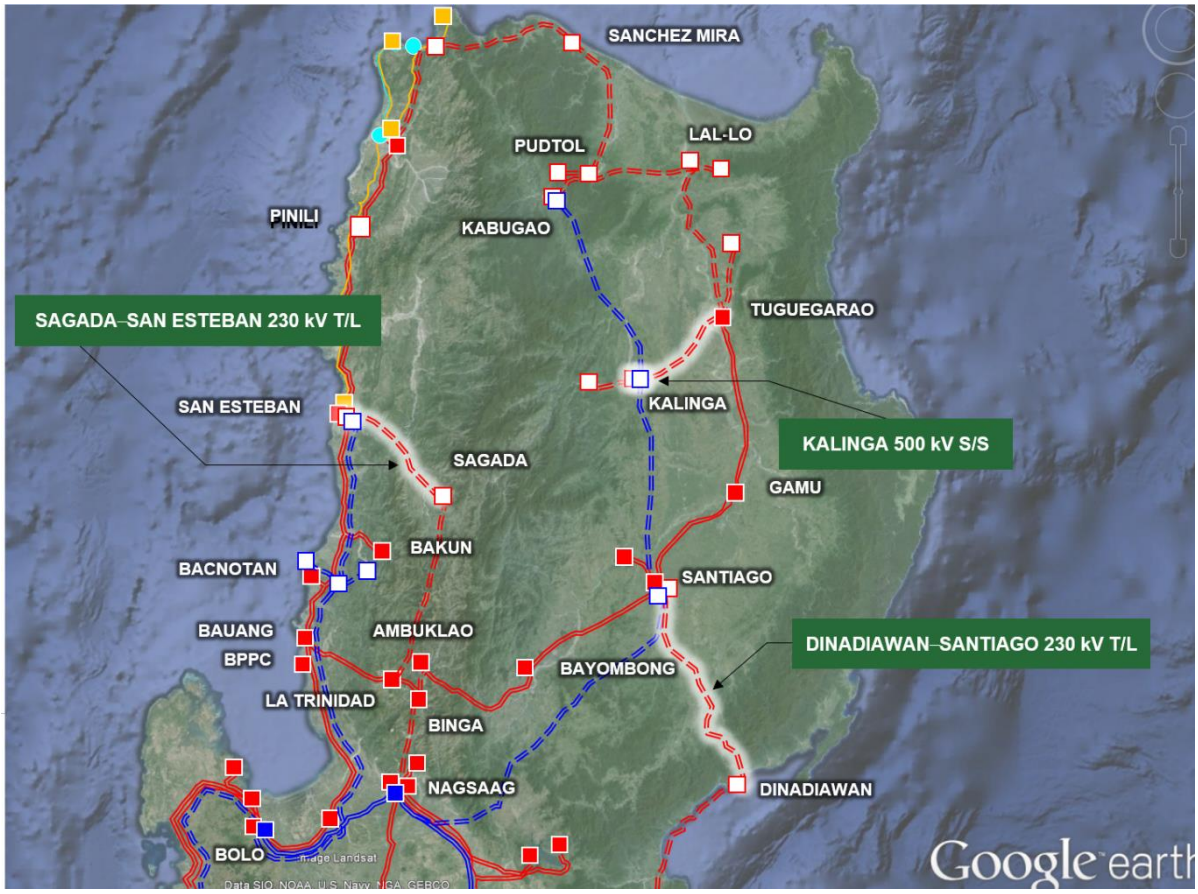


Figure 8.4.1: Proposed Luzon Transmission Outlook for 2040

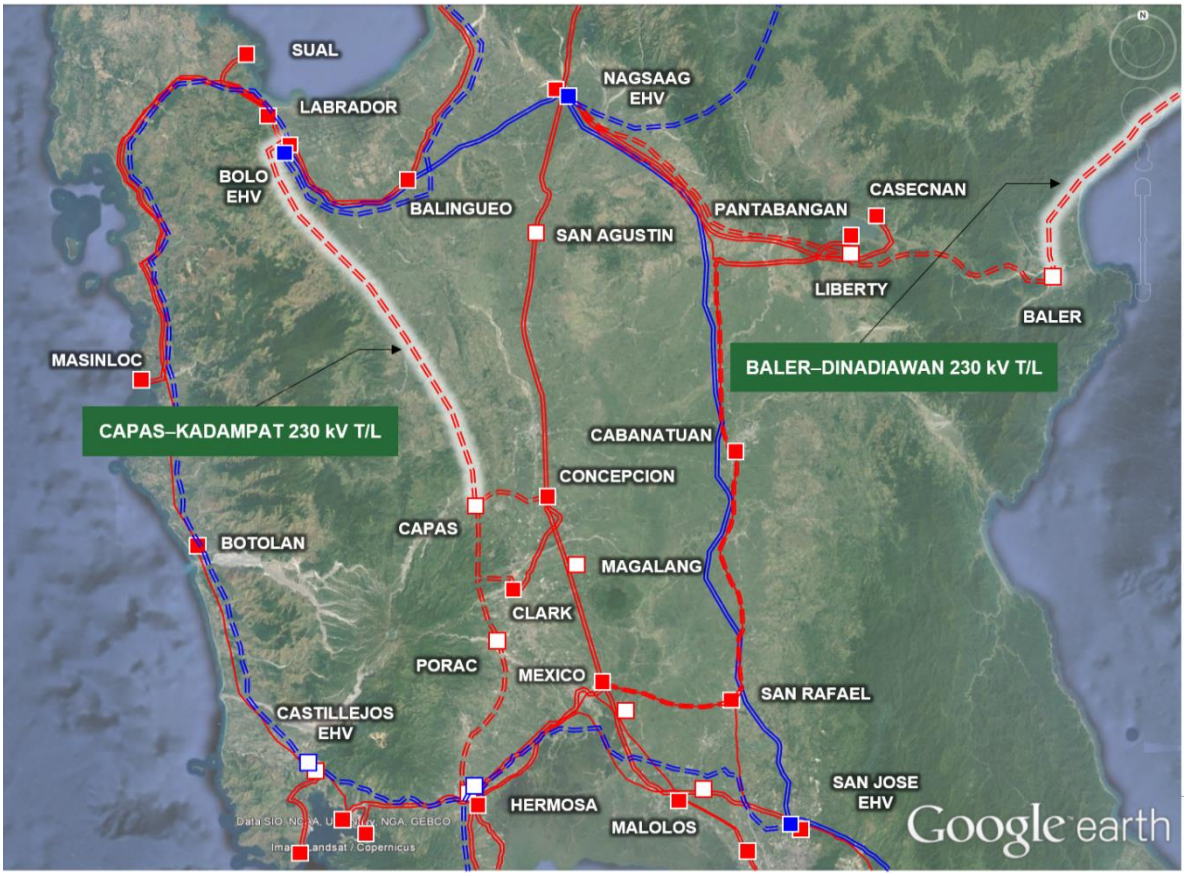


Figure 8.4.2: Proposed Luzon Transmission Outlook for 2040

Figure 8.4.3: Proposed Luzon Transmission Outlook for 2040

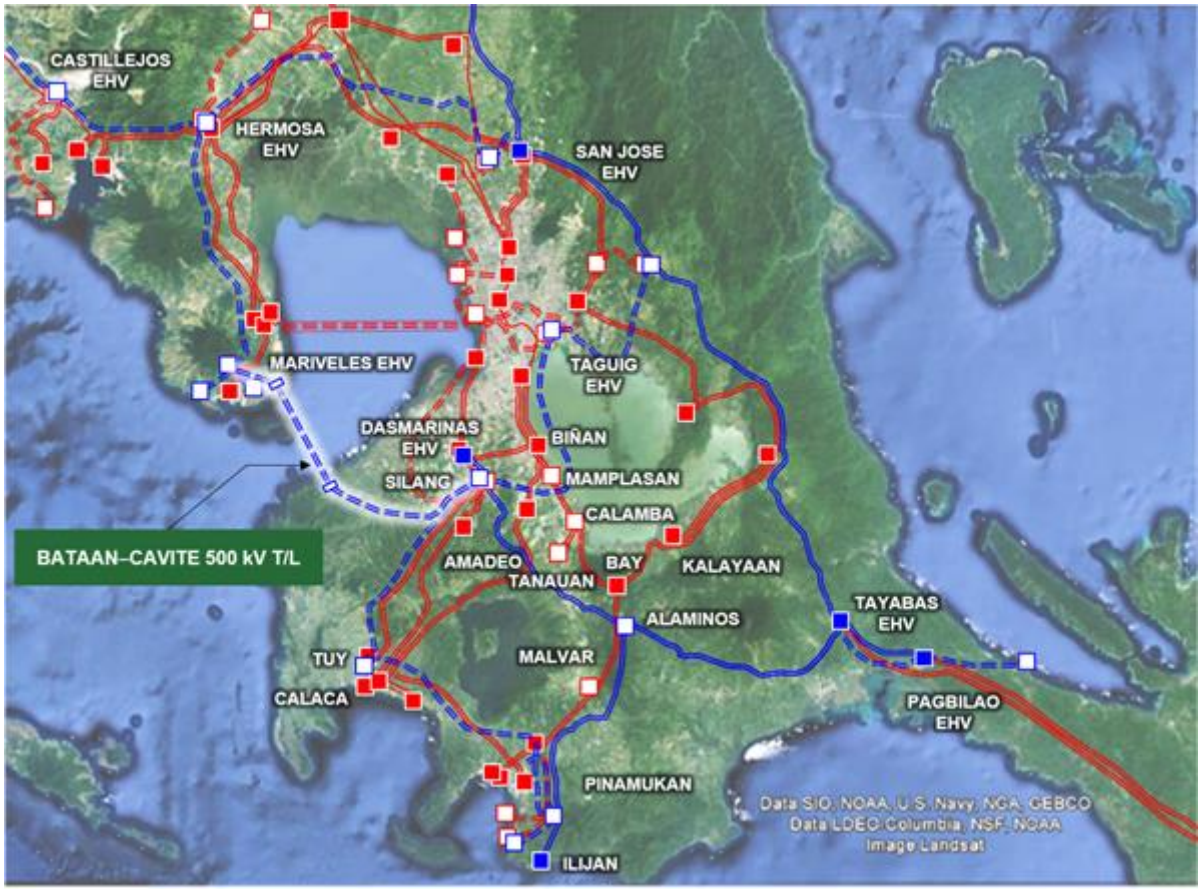


Figure 8.4.4: Proposed Luzon Transmission Outlook for 2040

Figure 8.4.5: Proposed Luzon Transmission Outlook for 2040

Table 8.4: Proposed Luzon Transmission Outlook for 2040

Project Name/Driver(s)	Province(s) and Components	ETC
Generation Entry		
Matnog 230 kV Substation	Sorsogon	May 2039
	Substation Components: ▪ Matnog 230 kV Substation, 2x50 MVA, 230/69 kV Power Transformer and accessories, 6-230 kV PCBs and associated equipment ▪ Abuyog 230 kV Substation, 4-230 kV PCB and associated equipment. Transmission Components: ▪ Abuyog - Matnog 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR, 38 km.	
Kalinga 500 kV Substation	Kalinga	Dec 2040
	Substation Components: ▪ Kalinga 500 kV Substation, 2x750 MVA, 500/230 kV Power Transformer; 10-500 kV PCBs and associated equipment; 6-230 kV PCBs and associated equipment Transmission Components: ▪ Kalinga 500 kV bus-in Transmission Line, ST-DC, 4-795 MCM ACSR, 2 km.	
System Reliability		
Baras 500 kV Switching Station	Rizal	Dec 2038
	Substation Components: ▪ Baras 500 kV Substation, 10-500 kV PCBs and associated equipment.	
Sagada–San Esteban 230 kV Transmission Line	Mountain Province, Ilocos Sur	Dec 2040
	Substation Components: ▪ Sagada 230 kV Substation, 2x100 MVA, 230/69 kV Power Transformer and accessories, 6-230 kV PCBs and associated equipment, 6-69 kV PCB and associated equipment. ▪ San Esteban 230 kV Substation, 4-230 kV PCB and associated equipment. Transmission Components: ▪ Sagada–San Esteban 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR, 60 km.	
Santiago–Dinadiawan 230 kV Transmission Line	Isabela, Aurora	Dec 2040
	Substation Components: ▪ New Santiago 230 kV Substation, 4-230 kV PCBs and associated equipment; ▪ Dinadiawan 230 kV Substation, 1x50 MVA 230/69-13.8 kV Power Transformer and accessories, 5-230 kV PCBs and associated equipment; 3-69 kV PCBs and associated equipment; Transmission Components: ▪ Santiago–Dinadiawan 230 kV Transmission Line, ST-DC, 1-795 MCM ACSR/AS, 100.0 km;	
Baler–Dinadiawan 230 kV Transmission Line	Isabela, Aurora	Dec 2040
	Substation Components: ▪ Baler 230 kV Substation, 4-230 kV PCBs and associated equipment. ▪ Dinadiawan 230 kV Substation, 4-230 kV PCBs and associated equipment; Transmission Components: ▪ Baler–Dinadiawan 230 kV Transmission Line, ST-DC, 1-795 MCM ACSR/AS, 52.6 km.	
Capas–Kadampat 230 kV Transmission Line	Tarlac, Pangasinan	Dec 2040
	Substation Components: ▪ Capas 230 kV Substation, 4-230 kV PCBs and associated equipment. ▪ Kadampat 230 kV Substation, 4-230 kV PCBs and associated equipment; Transmission Components: ▪ Capas–Kadampat 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR/AS, 80 km.	
Bataan–Cavite 230 kV Transmission Line	Bataan, Cavite	Dec 2040
	Substation Components: ▪ Mariveles 500 kV Substation, 4-500 kV PCBs and associated equipment; 2x90 MVAR 500 kV Shunt Reactors ▪ Silang 500 kV Substation, 4-500 kV PCBs and associated equipment; Transmission Components: ▪ Mariveles OHTL ST-DC, 4-795 MCM ACSR, 9 km ▪ SubCable-DC, 2-2,500 mm^2 XLPE, 22 km ▪ Cavite OHTL ST-DC, 4-795 MCM ACSR, 38 km	

Project Name/Driver(s)	Province(s) and Components	ETC
Upgrading of Bicol Transmission Facilities	Camarines Sur, Albay, Sorsogon	Dec 2040
	<u>Transmission Components:</u> Naga–Daraga–BacMan 500 kV Transmission Line, ST-DC, 4-795 MCM ACSR/AS, 120 km. (initially energized at 230 kV)	

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, most of which have already materialized. 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 stages. The first stage is the additional submarine cable between Negros and Panay. As presented in Chapter 7, this project was already energized in October 2016 and addresses 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.

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. Other bulk generation additions such as the proposed coal-fired power plant of Salcon Power Corporation and Ludo Power Corporation 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 Line Project. Large capacities of wind and hydro are also being proposed in Panay that will trigger the installation of the second circuit 230 kV submarine cable between Negros and Panay.

Another major submarine cable project to be implemented within the next 10 years is the Cebu-Bohol 230 kV Interconnection Project. Presently, Bohol Island has power deficiency issue due to limited power sources in the island. In 2017, the maximum demand in Bohol reached 81 MW. Almost 90% of the island's supply 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 and recent earthquake incident which affected 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 up to 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		
Cebu-Negros-Panay 230 kV Backbone Project - Stage 2	Cebu	Jul 2019
	Substation Components: ▪ Cebu 230 kV S/S, 3x300 MVA 230/138 kV Power Transformer and accessories, 8-230 kV PCBs (GIS) and 2-138 kV PCB and associated equipment; Transmission Components: ▪ Extension of Bato-Cebu 230 kV Lines, ST-DC, 2x610 mm^2 TACSR OHTL, 0.75 km; ▪ Extension of Cebu-Lapulapu 230 kV Lines, SP-DC, 4x795 MCM ACSR, 0.425 km. ▪ Extension of Colon/Quiot-Cebu 138 kV Lines, 138 kV Underground Cables, Double Circuit of 180 MW capacity, 0,250 km Bulk Cost Estimate: 2,209 million Pesos	
Panay–Guimaras 138 kV Interconnection Project	Panay	Jan 2021
	Substation Components: ▪ PEDC 138 kV S/S, 1x100 MVA, 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs, 8-69 kV PCBs and associated equipment; ▪ Zaldivar 138 kV S/S, 2x100 MVA, 138/69-13.8 kV Power Transformer and accessories, 6-138 kV PCBs, 1-69 kV PCB and associated equipment. Transmission Components: ▪ Ingore–PEDC 138 kV T/L, ST-DC, 1-795 MCM ACSR, 2 km; ▪ Zaldivar CTS – Zaldivar SS 138 kV T/L, ST-DC, 2-795 MCM ACSR, 1km; ▪ Zaldivar 69 kV bypass line, ST-SC, 1-336.4 MCM ACSR, 0.7 km; ▪ PECO Baldoza 69 kV line transfer, SP-SC, 1-336.4 MCM ACSR, 0.07 km; ▪ PPC & PECO 69 kV line transfer, SP-SC, 1-336.4 MCM ACSR, 0.09 km; ▪ Banuyao 69 kV line transfer, SP-SC, 1-336.4 MCM ACSR, 0.8 km. Bulk Cost Estimate: 2,424 million Pesos	
Negros–Panay 230 kV Interconnection Line 2 Project	Negros and Panay	Jul 2025
	Substation Components: ▪ Barotac Viejo S/S Expansion, 3-230 kV PCBs and associated equipment, 1-70 MVAR, 230 kV shunt reactor, associated submarine cable termination equipment. Submarine Cable Components: ▪ E. B. Magalona CTS Expansion, associated submarine cable termination equipment; ▪ Barotac Viejo S/S - E. B. Magalona CTS, 230 kV T/L, Single Circuit, 3-1,600 mm^2 XLPE submarine cables, 22 km Bulk Cost Estimate: 3,500 million Pesos	

Project Name/Driver(s)	Province(s)	ETC
Load Growth		
Nabas-Caticlan-Boracay Transmission Project	Aklan	Feb 2021
	Stage 1: <u>Substation Components:</u> ▪ Boracay 138 kV S/S (New), 3x100 MVA 138/69/13.2 kV Power Transformer and accessories, 5x50 MVA 69/13.2 kV Power Transformer and accessories, 8-138 kV PCB, 15-69 kV PCB and associated equipment. <u>Power Cable Components:</u> ▪ Caticlan-Boracay Power Cable, XLPE Submarine Cable System, Double circuit of 180 MW capacity at 138 kV, 2 km; ▪ Manocmanoc LES-Boracay S/S, SP-SC, 1-336.4 MCM ACSR, 1 km; ▪ Caticlan CTS (New), Cable Sealing End Stage 2: <u>Substation Components:</u> ▪ Nabas 138 kV S/S, 4-138 kV PCB and associated equipment. <u>Transmission Components:</u> ▪ Nabas-Caticlan 138 kV T/L, Combination of ST/SP-DC, 1-795 MCM ACSR, 14 km. and Underground Cable System of 180 MW capacity at 138 kV, 8 km ▪ Unidos CTS (New), Cable Sealing End Bulk Cost Estimate: 7,095 million Pesos	
Amlan–Dumaguete 138 kV Transmission Project	Negros Oriental	Dec 2021
	<u>Substation Components:</u> ▪ Amlan 138 kV S/S, 3-138 kV PCBs and associated equipment; ▪ Dumaguete 138 kV S/S (New), 2x50 MVA, 138/69-13.8 kV Power Transformer and accessories, 6-138 kV PCBs, 6-69 kV PCBs and associated equipment. <u>Transmission Components:</u> ▪ Amlan–Dumaguete 138 kV T/L, ST-DC, 1-795 MCM ACSR, 25 km. Bulk Cost Estimate: 2,495 million Pesos	
Laray 230 kV Substation Project	Cebu	May 2022
	<u>Substation Components:</u> ▪ Laray 230 kV S/S (New), 3-100 MVA 138/69-13.8 kV Power Transformer and accessories, 11-230 kV PCB (GIS) (138 kV energized), 7-69 kV PCB (GIS) and associated equipment. <u>Transmission Components:</u> ▪ OHTL from Laray to Tapping Point along Magdugo-Colon 230 kV Lines (138 kV energized), ST/SP-DC, 2-610 mm^2 TACSR, 4-795 MCM ACSR, 23 km Bulk Cost Estimate: 5,029 million Pesos	
Babatngon–Palo 230 kV Transmission Line Project	Southern Leyte	Dec 2022
	<u>Substation Components:</u> ▪ Babatngon 138 kV S/S, 3-138 kV PCBs and associated equipment; ▪ Palo 138 kV S/S (New), 2x50 MVA, 138/69-13.8 kV Power Transformer and accessories, 6-138 kV PCBs, 8-69 kV PCBs and associated equipment. <u>Transmission Components:</u> ▪ Babatngon–Palo 230 kV T/L (138 kV energized), ST-DC, 4-795 MCM ACSR, 20 km. Bulk Cost Estimate: 3,061 million Pesos	
Silay 230 kV Substation Project	Silay, Negros Occidental	Sept 2024
	<u>Substation Components:</u> ▪ Silay Substation, 2x300 MVA, 230/69-13.8 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 6-69 kV PCBs and associated equipment Bulk Cost Estimate: 900 million Pesos	
Unidos 138 kV Substation Project	Unidos, Panay	Sept 2025
	<u>Substation Components:</u> ▪ Unidos Substation, 2x100 MVA, 138/69-13.8 kV Power Transformer and accessories, 10-138 kV PCBs and associated equipment, 6-69 kV PCBs and associated equipment Bulk Cost Estimate: 400 million Pesos	

Project Name/Driver(s)	Province(s)	ETC
Sogod 230 kV Substation Project	Sogod, Cebu	Sept 2025
	Substation Components: ▪ Sogod Substation, 2x300 MVA, 230/69-13.8 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 6-69 kV PCBs and associated equipment. Bulk Cost Estimate: 900 million Pesos	
Iloilo 230 kV Substation Project	Iloilo, Panay	Dec 2025
	Substation Components: ▪ Iloilo 230 kV S/S, 2x300 MVA, 230/69-13.8 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 6-69 kV PCBs and associated equipment ▪ Barotac Viejo 230 kV S/S (Expansion), 4-230 kV PCBs and associated equipment; Transmission Components: ▪ Barotac Viejo-Iloilo 230 kV T/L, ST-DC, 4-795 MCM ACSR, 45 km. Bulk Cost Estimate: 3,021 million Pesos	
System Reliability		
Cebu–Bohol 230 kV Interconnection Project	Cebu, Bohol	Dec 2021
	Substation Components: ▪ Dumanjug 230 kV S/S, 6-230 kV PCBs and associated equipment, 2x40 MVAR Reactor; ▪ Corella 230 kV S/S, 2x300 MVA, 230/138kV Power Transformer, 8-230 kV PCBs, 2-138 kV PCBs and associated equipment, 2x40 MVAR 230 kV Reactor. Transmission Components: ▪ Dumanjug S/S–Sibonga CTS, ST-DC, 4-795 MCM ACSR, 20 km; ▪ Loon CTS-Corella S/S, ST-DC, 4-795 MCM ACSR, 17 km. Submarine Cable Components: ▪ Sibonga CTS–Loon CTS, Single circuit submarine cable system of 400 MW capacity at 230 kV, 30km; Bulk Cost Estimate: 8,139 million Pesos	
Calbayog–Allen 138 kV Transmission Line Project	Samar, Northern Samar	Dec 2021
	Substation Components: ▪ Calbayog 69 kV S/S, 1-69 kV PCB and associated equipment. Transmission Components: ▪ Calbayog-Allen 138 kV T/L (69 kV energized), ST/SP-DC1 1-795 MCM ACSR, 78 km. Bulk Cost Estimate: 935 million Pesos	
Visayas Substation Upgrading Project - 1	Cebu, Leyte, Samar,	Dec 2021
	Cebu: Substation Components: ▪ Daanbantayan 230 kV S/S, 1x100 MVA 230/69-13.8 kV Power Transformer and accessories, 3-69 kV PCBs and associated equipment. Leyte: Substation Components: ▪ Tabango 230 kV S/S, 1x50 MVA 230/69-13.8 kV Power Transformer and accessories; ▪ Maasin 138 kV S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories. Samar: Substation Components: ▪ Calbayog 138 kV S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV PCB, 2-69 kV PCBs and associated equipment. Bulk Cost Estimate: 1,185 million Pesos	
Barotac Viejo–Natividad 69 kV Transmission Line Project	Iloilo	Dec 2022
	Transmission Components: ▪ Barotac Viejo–Natividad 69 kV T/L, SP-SC, 1-336.4 MCM ACSR, 7km. Bulk Cost Estimate: 57 million Pesos	

Project Name/Driver(s)	Province(s)	ETC
Babatngon–Sta. Rita 138 kV Transmission Line Upgrading	Leyte, Samar	Dec 2023
	Substation Components: ▪ Sta. Rita 138 kV S/S, 2x50 MVA 138/69-13.8 kV Power Transformer and accessories, 10-138 kV PCB, 2-69kV PCB and associated equipment. Transmission Components: ▪ Babatngon-Paranas 138 kV T/L (portion along San Juanico Strait), ST-DC, 2-795 MCM ACSR, 1.8 km. Bulk Cost Estimate: 459 million Pesos	
Visayas Substation Upgrading Project - 2	Cebu, Negros, Panay	Dec 2024
	Cebu: Substation Components: ▪ Calong-calong 138 kV S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment. ▪ 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 ▪ 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: Substation Components: ▪ Kabankalan 138 kV S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs, 1-69 kV PCB and associated equipment; ▪ Mabinay 138 kV S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs, 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: Substation Components: ▪ San Jose 138 kV S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs, 1-69 kV PCB and associated equipment; ▪ Panitan 138 kV S/S, 2x50 MVA 138/69-13.8 kV Power Transformer and accessories, 4x138 kV PCBs, 2-69 kV PCBs and associated equipment. ▪ 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 Bulk Cost Estimate: 1,300 million Pesos	
Tabango–Biliran 69 kV Transmission Line Project	Leyte	Jul 2025
	Substation Components: ▪ Tabango 69 kV S/S, 2-69 kV PCB and associated equipment; ▪ Biliran 69 kV S/S, 2-69 kV PCB and associated equipment. Transmission Components: ▪ Tabango-Biliran 69 kV T/L, ST-DC, 1-795 MCM ACSR, 48 km. Bulk Cost Estimate: 58 million Pesos	
Laray–Naalad 230 kV Energization Project	Cebu	Sep 2025
	Substation Components: ▪ Naalad 230 kV Switching Station, 10-230 kV PCBs and associated equipment ▪ Energization of Laray to 230 kV, 2x300 MVA, 230/69-13.8 kV Power Transformer and accessories Transmission Components: ▪ Laray-Naalad 230 kV T/L, ST-DC, 4-795 MCM ACSR, 10 km; Bulk Cost Estimate: 900 million pesos	
Cordova–Laray 230 kV Transmission Line Project	Cebu	Sep 2025
	Substation Components: ▪ Cordova 230 kV S/S, 2x300 MVA, 230/69-13.8 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 8-138 kV PCBs and associated equipment Transmission Components: ▪ Cordova-Laray 230 kV T/L, ST-DC, 4-795 MCM ACSR, 18 km; ▪ Cordova-Laray 230 kV Underground Cables, 3-1600mm^2 XLPE (To co-locate with the Cebu-Cordova Bridge) Bulk Cost Estimate: 7,500 million pesos	

Project Name/Driver(s)	Province(s)	ETC
Taft–Bobolosan 138 kV Transmission Line Project	Northern and Eastern Samar	Dec 2025
	Substation Components: ▪ Bobolosan 69 kV S/S, 2-69 kV PCBs and associated equipment; ▪ Taft 69 kV S/S, 2-69 kV PCB and associated equipment. Transmission Components: ▪ Bobolosan-Taft 138 kV T/L (69 kV energized), ST/SP-DC1, 1-795 MCM ACSR, 50 km. Bulk Cost Estimate: 65 million Pesos	
Bayawan–Sipalay 138 kV Transmission Line	Negros Occidental and Negros Oriental	Dec 2025
	Transmission Components: ▪ Bayawan–Sipalay 138 kV T/L (69 kV energized), ST/SP-DC1, 1-795 MCM ACSR, 60 km. Bulk Cost Estimate: 62 million Pesos	
Siaton–Bayawan 138 kV Transmission Line	Negros Occidental and Negros Oriental	Dec 2025
	Transmission Components: ▪ Siaton–Bayawan 138 kV T/L (69 kV energized), ST/SP-DC, 1-795 MCM ACSR, 55 km. Bulk Cost Estimate: 55 million Pesos	

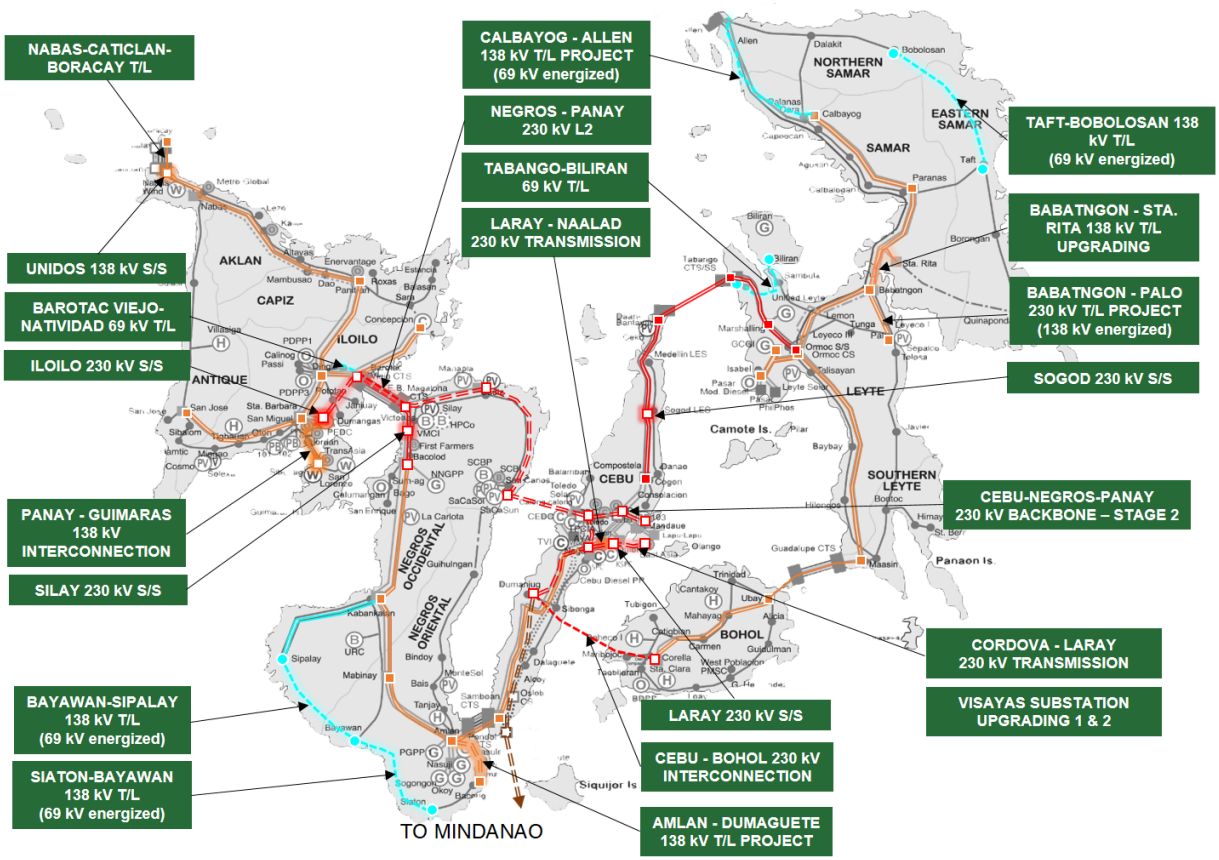
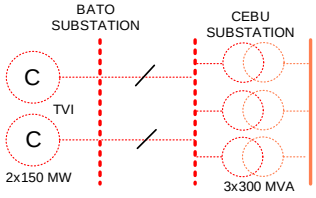


Figure 9.1: Proposed Visayas Transmission Outlook for 2025

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

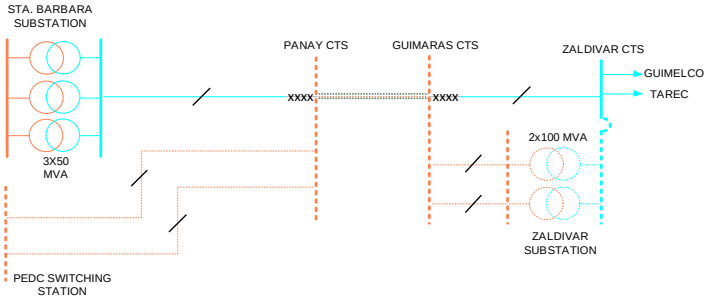


Therma Visayas, Inc. is developing a 300 MW coal-fired power plant in Toledo City, Cebu and is intended to supply additional power to the load centers in Metro Cebu. However, the existing transmission system between the area of Toledo and the major drawdown substations in Metro Cebu has limited capacity to effectively accommodate the entire generation capacity of the new power plant. Hence, there will be power curtailment.

In order to ensure the effective full generation dispatch of the new power plant, a new transmission corridor, which includes high-capacity transmission line and new substation facilities, is being proposed towards Metro Cebu. The transmission line portion was previously classified as connection assets and will be implemented by the power plant proponent. On the other hand, the substation portion is classified as transmission asset, hence, the object of this project. It can be noted also that the transmission line which will be developed from Magdugo to Cebu will serve as an integral part of 230 kV backbone in the Visayas.

The project involves the construction of 230 kV facilities in the existing Cebu 138 kV Substation to facilitate the connection of the proposed transmission line from Toledo.

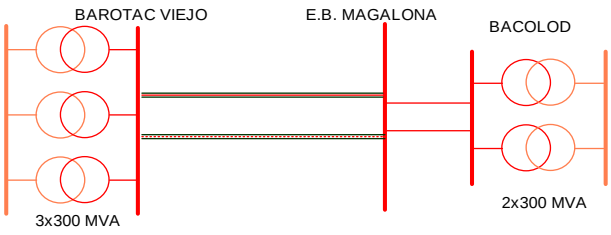
9.1.2 Panay–Guimaras 138 kV Interconnection Project



The development of new power plants in Guimaras Island will result in increased power transmission towards Panay. Currently, the existing submarine cable interconnection between Panay and Guimaras is only energized at 69 kV and has limited capacity to accommodate the transmission of excess power from Guimaras.

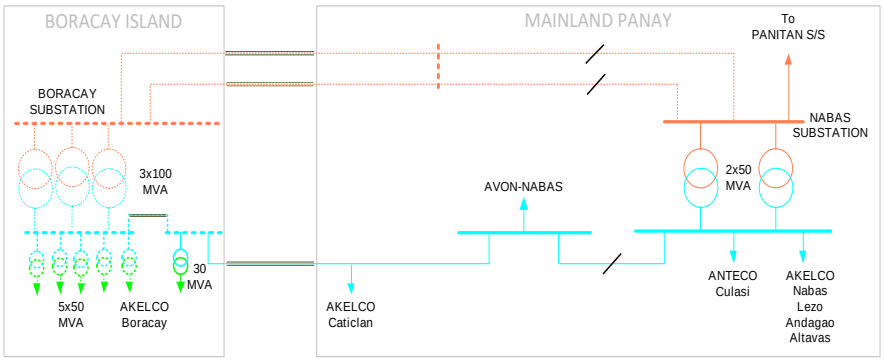
In order to ensure the full dispatch of the San Lorenzo Wind Plant and other prospective generators in the area, it is proposed to energize the Panay-Guimaras Interconnection at 138 kV. The project will also involve the construction of a 2 km overhead line from the cable terminal station in Panay towards PEDC substation, as well as the expansion and upgrading works at Zaldivar S/S and PEDC S/S.

9.1.3 Negros–Panay 230 kV Interconnection Line 2 Project



The project aims to address the need to increase the interconnection capacity to cater the incoming large generators in Panay, particularly the Aklan Hydro. This entails additional circuit of 230 kV submarine cable between Negros and Panay to allow for the full dispatch of the power plants in the island of Panay

9.1.4 Nabas–Caticlan–Boracay Transmission Project



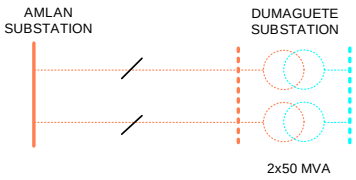
In line with the developments in the tourism industry in Boracay Island, the power requirement is expected to increase. The power requirement of Caticlan and Boracay Island is supplied by Nabas S/S via a single circuit 69 kV overhead transmission line and submarine cable. These 69 kV transmission facilities are not enough to cater the forecasted demand.

The project aims to upgrade the existing 69 kV system into a 138 kV system that will provide the required transmission and substation capacity. The project will be implemented in two stages, stage 1 will be the construction of Boracay S/S with 5x50 MVA, 69/13.2 kV transformers, construction of Manocmanoc–Boracay 69 kV overhead transmission line and laying of the new double circuit Caticlan–Boracay 138 kV submarine cable (initially energized at 69 kV) to be connected to the existing Caticlan 69 kV CTS. Stage 2 will be the construction of the Nabas–Caticlan 138 kV OHTL, underground cable in Caticlan and installation of 3x100 MVA 138/69 kV power transformer in Boracay S/S.

The capacity of the submarine cable from Boracay to Caticlan was changed from 100 MW to 200 MW because based on the latest load forecast for Boracay, demand in the area will reach 100 MW by year 2026. Additionally, to comply with the N-1 provision, double circuit submarine cable is now considered.

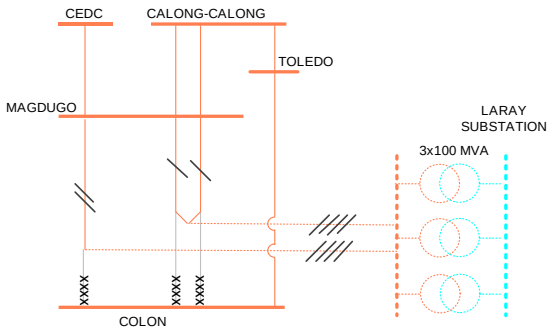
9.1.5 Amlan–Dumaguete 138 kV Transmission Project

The power requirement in the southern part of Negros Oriental is being served by 69 kV line which draws power from Amlan S/S. However, the 69 kV line will not be sufficient to cater the projected increase in the power demand in the area.



In order to accommodate the future power requirement in the southern part of Negros Oriental, a new drawdown substation is proposed in the vicinity of Dumaguete City. The project will provide alternative source of power to Negros Oriental Electric Cooperative II (NORECO II), 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. The new substation will be linked to Amlan S/S via 138 kV transmission line.

9.1.6 Laray 230 kV Substation Project

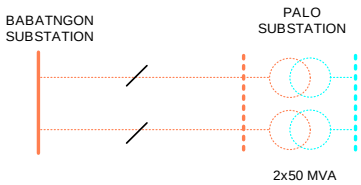


In line with the continuing economic and infrastructure developments within Metro Cebu, the power requirement in the area is projected to further increase. However, the existing substation capacity is not enough to cater the projected demand of Metro Cebu, hence, there will be power curtailment.

The project aims to provide alternative connection point to power consumers in Metro Cebu, thus, will accommodate the projected increase in the power demand. It will be tapped to the Magdugo - Colon 138 kV Line via 230 kV transmission lines that will be initially energized at 138 kV. The Magdugo - Colon 138 kV transmission lines shall be disconnected from Colon Substation, hence, Laray Substation will be directly linked to Magdugo Substation, bypassing Colon Substation.

The project will form part of the planned 230 kV transmission loop in Cebu, complementary to the proposed Laray–Naalad 230 kV Energization Project.

9.1.7 Babatngon–Palo 230 kV Transmission Line Project

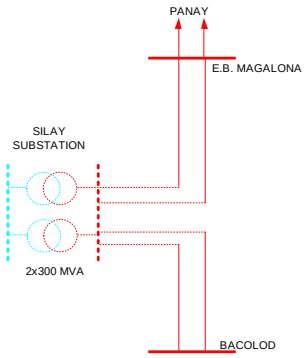


Large part of the power customers in the eastern Leyte area is being served through 69 kV lines which draw power from Babatngon S/S and Ormoc S/S in the north and Maasin S/S in the south. However, due to long distances and mountainous terrain, the quality and reliability of transmitting power along the 69 kV transmission lines cannot be ensured.

In order to improve the quality of power and enhance the reliability of the transmission backbone in Leyte, it is proposed to construct a transmission corridor along the eastern part of Leyte. The project will involve the construction of a new drawdown substation in Palo which will be linked to Babatngon S/S via 230 kV designed transmission lines energized at 138 kV. The proposed substation will serve Don Orestes Romualdez Electric Cooperative, Inc. (DORELCO) and LEYECO II and provide alternate power supply source during N-1 contingency event.

The project will form part of the planned 230 kV transmission loop in Leyte, complementary to the proposed Marshalling-Babatngon and Palo-Javier 230 kV Transmission Lines.

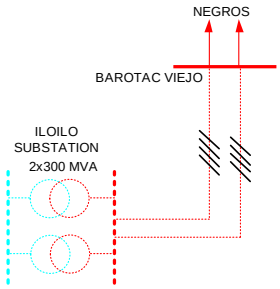
9.1.8 Silay 230 kV Substation Project



Large part of the power consumers in Northern Negros currently draws power from Bacolod and E.B. Magalona Substations. However, the existing substation capacity is not enough to cater the projected increase in demand of the area.

The project aims to provide alternative connection point to power consumers in Northern Negros, thus, will accommodate the projected increase in the power demand. The new substation will bus-in to the existing 230 kV transmission lines from E.B Magalona to Bacolod and will be located in the area of Silay.

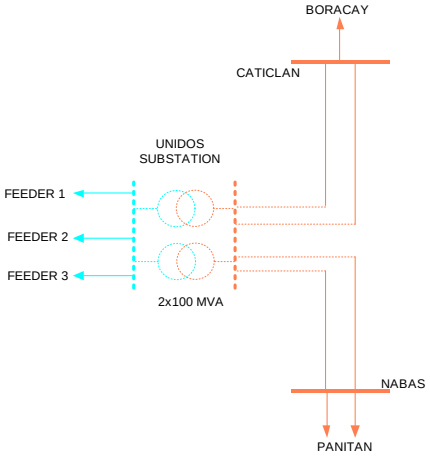
9.1.9 Iloilo 230 kV Substation Project



In line with the continuing economic and infrastructure developments within Southern Panay, the power requirement in the area is projected to increase. However, the existing substation capacity is not enough to cater the projected demand of the area, hence, there will be power curtailment.

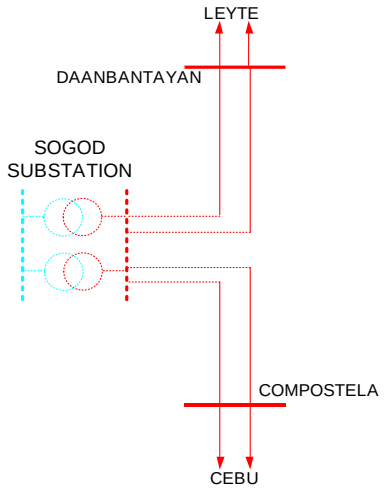
The project aims to provide alternative connection point and substation capacity to power consumers in Southern Panay, thus, providing adequate transmission capacity. The new substation will be connected to the existing Barotac Viejo Substation through 230 kV overhead transmission lines.

9.1.10 Unidos 138 kV Substation Project



Power consumers in northwesthern part of Panay which is under AKELCO's operation currently draw power from Nabas Substation. However, the existing substation capacity is not enough to cater the projected demand of the area. This limitation will already be addressed by this project which will provide alternative connection point to power consumers in Northwestern part of Panay. The new substation will bus-in to the existing 138 kV transmission lines from Nabas to Caticlan and will be located in the area of Unidos.

9.1.11 Sogod 230 kV Substation Project

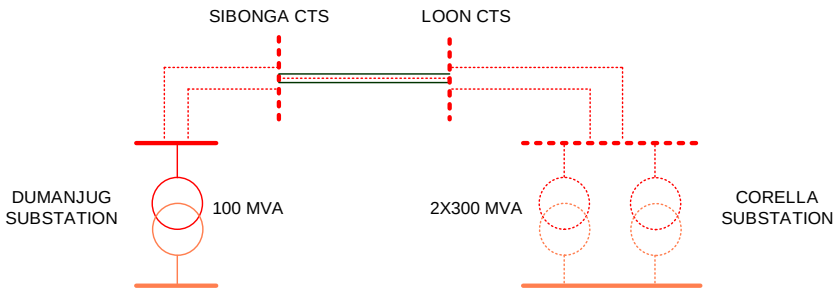


Power consumers in Northern Cebu draw power from Compostela and some from Daanbantayan Substation. With the continuing economic and infrastructure developments within the area, the projected power requirement will not be adequately served by the existing substation capacity.

The project aims to provide alternative connection point to power consumers particularly for Northern Cebu, thus, will accommodate the projected increase in the power demand.

The new substation will bus-in to the Daanbantayan–Compostela 230 kV Transmission Line and will be located in Sogod, Cebu.

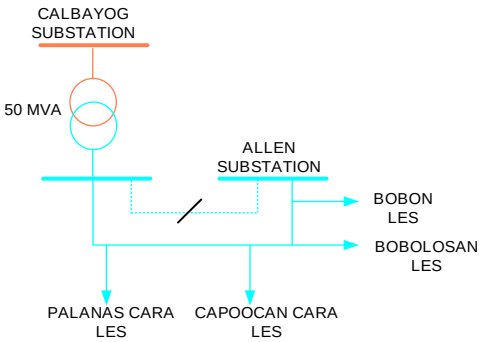
9.1.12 Cebu–Bohol 230 kV Interconnection Project



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.

Originally, Sibonga 230 kV S/S was conceptualized as the termination point of 2 km OH line going to Sibonga CTS, However, further site assessments resulted in the need to change the substation location from Sibonga 230 kV S/S to Dumanjug 230 kV S/S.

9.1.13 Calbayog-Allen 138 kV Transmission Line Project



The power consumers in the northern part of Samar draws power from Calbayog substation via the existing Calbayog-Palanas Cara and Palanas Cara-Catarman-Allen-Bobolosan 69 kV transmission lines, which traverse the mountainous area of Calbayog and Catarman. Such terrain poses frequent and extended outage of the 69 kV lines in Northern Samar which result in power curtailment.

In order to improve the reliability of power delivery towards the northern part of Samar, a 138 kV transmission line (69 kV energized) is proposed which will link Calbayog S/S and the load-end substation in Allen. The project aims to form a loop, thus, will provide single outage contingency to the transmission lines serving Northern Samar.

9.1.14 Visayas Substation Upgrading Project – 1

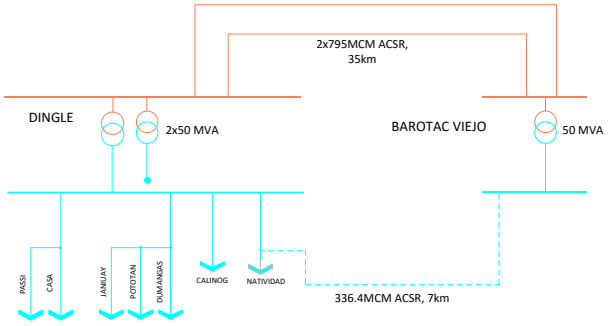
To accommodate the projected demand and avoid overloading of the transformer, there is a need to upgrade the substation capacity of Tabango Substation.

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

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

9.1.15 Barotac Viejo-Natividad 69 kV Transmission Line Project

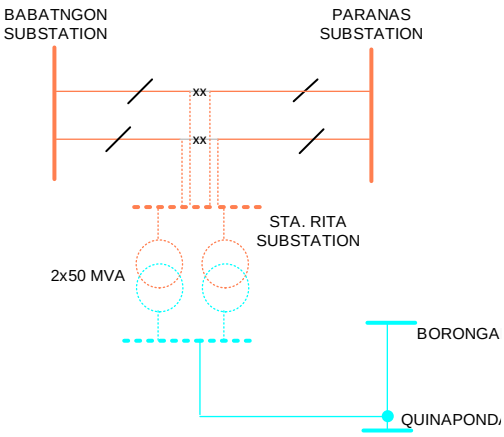
This project aims to extend the 69 kV line serving Natividad to Barotac Viejo and form a 69 kV loop between Dingle and Barotac Viejo Substations. This provides N-1 to the 69 kV feeder serving ILECO II and ILECO III and allows for the operational flexibility and reliability for both cooperatives.



9.1.16 Babatngon–Sta. Rita 138 kV Transmission Line Upgrading Project

Portion of the existing Babatngon-Paranas 138 kV Transmission Line utilizes smaller conductor size which offers limited capacity of 100 MW or equivalent only to half of the capacity designed for the entire 138 kV line. As such, the capacity of the Babatngon-Paranas 138 kV Line cannot be maximized.

In order to achieve the maximum capacity, portion of the 138 kV line will be reinforced with a conductor of higher capacity. 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.

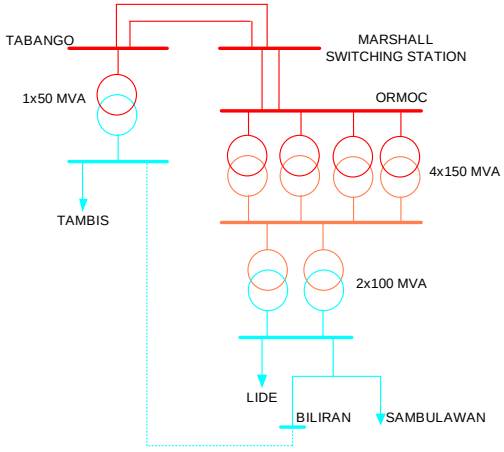


9.1.17 Visayas Substation Upgrading Project – 2

To comply with the N -1 contingency criterion of the PGC, an additional 50 MVA transformer needs to be installed at Dingle and San Jose Substations. Considering the 10-year projected demand of the distribution utilities being served by Panit-an Substation, the existing 2x30 MVA, 138/69-13.8 kV transformer needs to be upgraded to 2x50 MVA 138/69/13.8kV transformer 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. To increase substation capacity in Colon, Calong-calong and Compostela substations, additional 100 MVA power transformer in Colon Substation and additional 50 MVA transformer at Calong-calong and Compostela substations are needed.

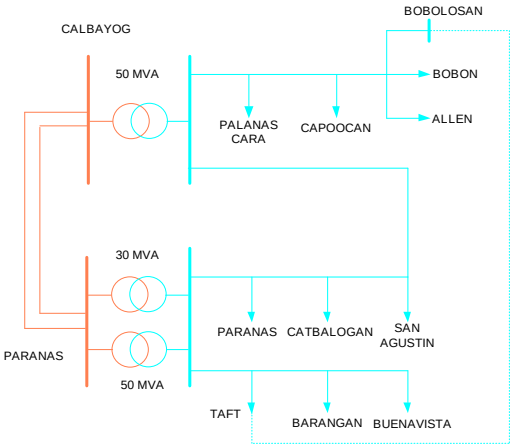
9.1.18 Tabango–Biliran 69 kV Transmission Line Project

In line with the frequent and extended outage of the 69 kV lines in the area coupled with the rugged terrain which restricts movement and prolongs fault clearance, construction of a 69 kV line from Tabango to Biliran is needed to form a loop and provide single outage contingency (N-1) capability to the transmission lines serving Northern Leyte and Biliran Island.



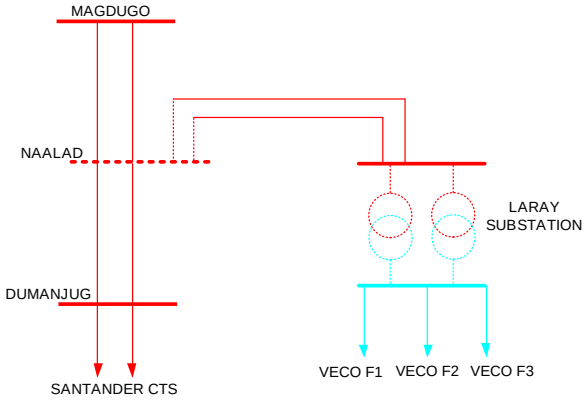
9.1.19 Taft–Bobolosan 138 kV Transmission Line Project

This project aims to extend the 69 kV line from Bobolosan to Taft. A 138 kV (69 kV energized) transmission line is proposed to form a 69 kV loop between Northern and Eastern Samar. This allows for the operational flexibility and reliability for NORSAMELCO and ESAMELCO.



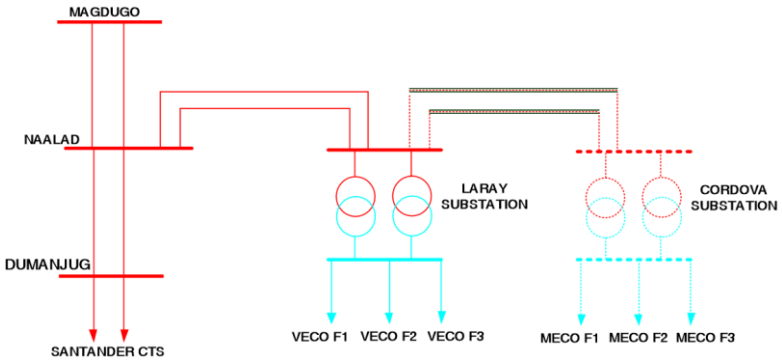
9.1.20 Laray–Naalad 230 kV Energization Project

As part of the long-term plan to establish a 230 kV transmission loop in Central Cebu, energization of Laray Substation to 230 kV is needed. Transmission lines from Laray will be extended and connected along the Dumanjug – Magdugo 230 kV Line which is part of the MVIP through the Naalad 230 kV Switching Station. Completion of the loop will improve the reliability of the power transmission line system in Metro Cebu.



9.1.21 Cordova-Laray 230 kV Transmission Line Project

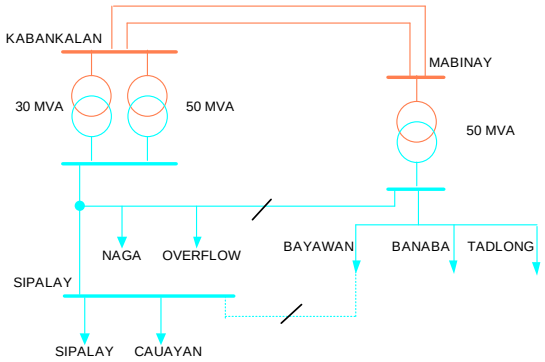
Power consumers in Mactan and Cordova are being served by 69 kV lines which draw power from Lapu-lapu Substation. Contingency on the substation will result in power curtailment in the area.



The project aims to provide alternative substation capacity to power consumers in Mactan and Cordova. This allows for the operational flexibility and reliability for MECO. Additionally, this will accommodate the projected increase in the power demand of the area and is part of the future 230 kV transmission loop in Metro Cebu. The new substation will be connected via 230 kV underground transmission lines that will co-locate with the future Cebu-Cordova bridge that is being developed by the Metro Pacific Tollways Development Corporation (MPTDC). Estimated time of completion of the bridge is in year 2022.

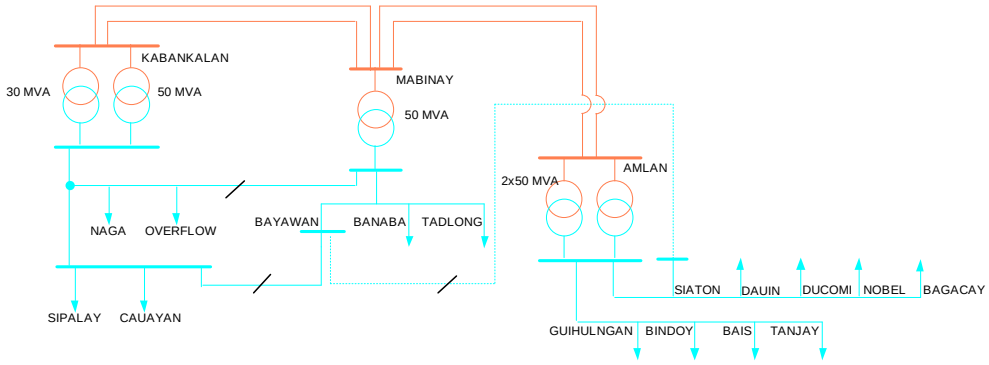
9.1.22 Bayawan–Sipalay 138 kV Transmission Line Project

This project aims to extend the 69 kV line from Sipalay to Bayawan. A 138 KV transmission line (69 kV energized) is proposed to form a 69 kV loop between the loads served by Mabinay and Kabankalan Substations. This allows for the demand to be shifted to either substation during contingency, allowing for more operational flexibility and reliability for NOCECO, NORECO I and NORECO II.



9.1.23 Siaton–Bayawan 138 kV Transmission Line Project

This project aims to extend the 69 kV line from Bayawan to Siaton. A 138 kV transmission line (69 kV energized) is proposed to form a 69 kV loop between the loads served by Mabinay and Kabankalan Substations. This is expected to improve the voltage and allow the demand of NORECO I and NORECO II to be shifted between Mabinay, Amlan and the future Dumaguete Substation.



9.2 Proposed Transmission Outlook for 2030

With the implementation of projects that will strengthen the Visayas Backbone, future developments in terms of commercial and industrial sector in Visayas that would increase the power supply requirements are being expected. To anticipate these developments, the main backbone will be extended towards Western Panay and Northern Samar. The interconnection of the 230 kV Backbone from Panay to Leyte will be unified by linking the CNP 230 kV Backbone to the Cebu-Ormoc 230 kV Line. This will be realized upon completion of the Umapad-Compostela 230 kV Transmission Line Project. More generations are expected to come in Panay that will need major reinforcements of the 230 kV lines. While Northern Samar has no proposed generation addition yet, the need to extend the 138 kV line from Calbayog to Catarman will provide reliability as the demand in the island increases.

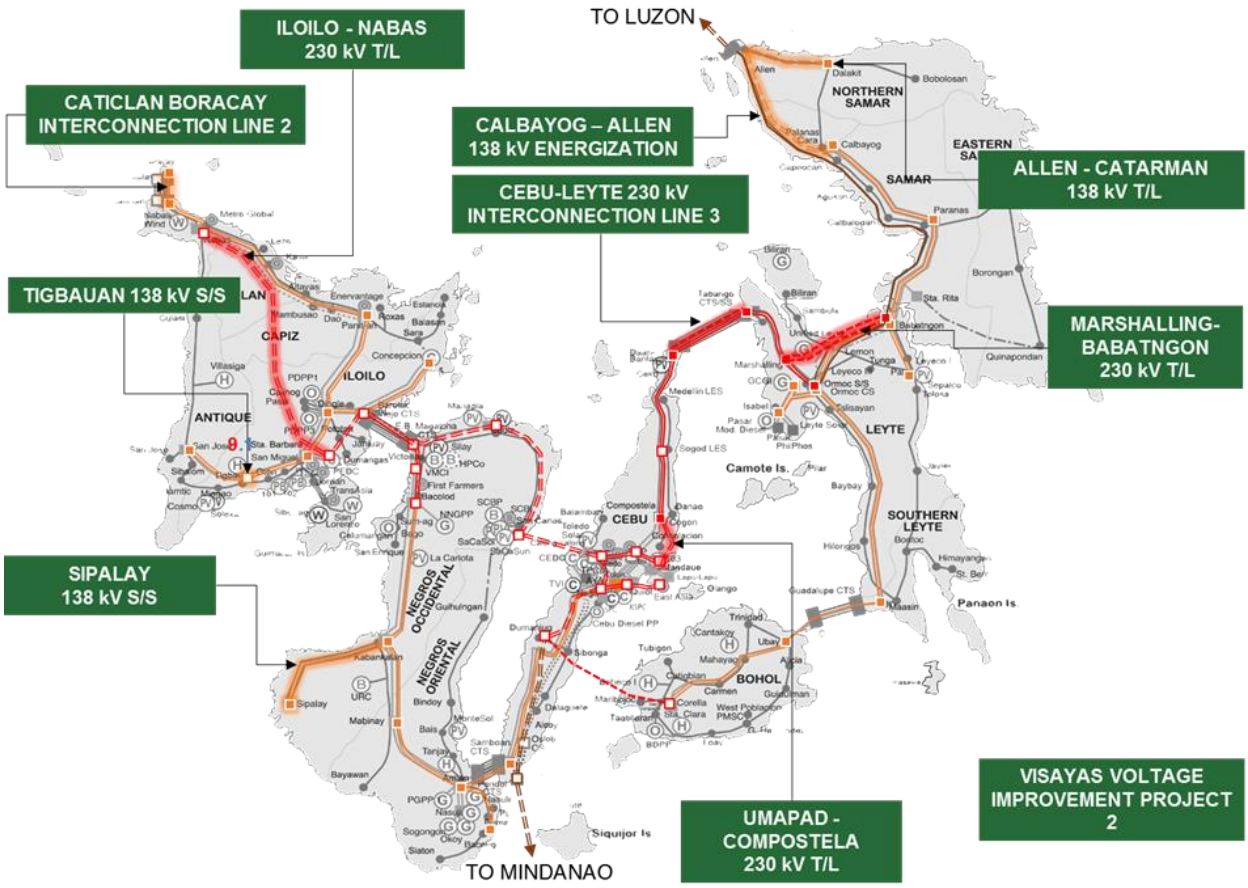


Figure 9.2: Proposed Visayas Transmission Outlook for 2030

Shown in Table 9.2 is the list of proposed transmission projects for Visayas by 2030.

Table 9.2: Proposed Transmission Outlook for 2030

Project Name/Driver(s)	Province(s) and Components	ETC
Generation Entry		
Iloilo–Nabas 230 kV Transmission Line Project	Iloilo, Aklan	Sep 2028
	Transmission Components: ▪ Iloilo–Nabas T/L, ST-DC, 4-795 MCM ACSR, 180 km. Substation Components: ▪ Nabas S/S: 2x300 MVA, 230/138 kV Power Transformer and accessories.	
Tigbauan 138 kV Substation Project	Iloilo	Dec 2029
	Substation Components: ▪ Tigbauan 138 kV S/S, 2x100 MVA 138/69 kV Power Transformer and accessories.	
Load Growth		
Sipalay 138 kV Substation Project	Negros	Dec 2029
	Substation Components: ▪ Sipalay S/S: 2x100 MVA, 138/69 kV Power Transformer and accessories. Transmission Components: ▪ Kabankalan–Sipalay: 1-410 mm^2 TACSR, 67 km.	

Project Name/Driver(s)	Province(s) and Components	ETC
Allen–Catarman 138 kV Transmission Line Project	Samar	Dec 2030
	Transmission Components: ▪ Allen–Catarman T/L, ST/DC, 1-795 MCM ACSR, 40 km. Substation Components: ▪ Catarman: 2x100 MVA, 138/69 kV Power Transformer and accessories.	
Marshalling-Babatngon 230 kV Transmission Line Project	Leyte	Jul 2030
	Transmission Components: ▪ Marshalling–Babatngon T/L, ST-DC, 4-795 MCM ACSR, 65 km. Substation Components: ▪ Babatngon: 2x300 MVA, 230/138 kV Power Transformer and accessories.	
Calbayog-Allen 138 kV Energization	Leyte	Dec 2030
	Substation Components: ▪ Allen: 2x100 MVA, 138/69 kV Power Transformer and accessories.	
Power Quality		
Visayas Voltage Improvement Project 2	Negros, Leyte, Panay	Dec 2030
	Substation Components: ▪ Bacolod 138 kV S/S: 4x50 MVAR Capacitor; ▪ Maasin 138 kV S/S: 4x20 MVAR Capacitor; ▪ Panit-an 138 kV S/S: 2x20 MVAR Capacitor.	
Reliability		
Umapad-Compostela 230 kV Transmission Line Project	Cebu	Sep 2030
	Transmission Components: ▪ Umapad-Compostela T/L, ST-DC, 4-795 MCM ACSR, 20 km.	
Cebu-Leyte 230 kV Interconnection Line 3 Project	Cebu, Leyte	Sep 2030
	Transmission Components: ▪ Cebu-Leyte S/C: Submarine Cable,400 MW capacity, 1 km	

9.3 Proposed Transmission Outlook for 2035

To further improve the reliability of power supply to the Visayas grid, looping projects will be constructed, the San Jose-Nabas 138 kV T/L Project aims to loop the 138 kV system in Panay, on the other hand the Cebu-Bohol 230 kV Line 2, Bohol-Leyte 230 kV Interconnection Project and the Palo-Javier 138 kV T/L Project aim to form a loop among Cebu, Bohol and Leyte sub-grids.

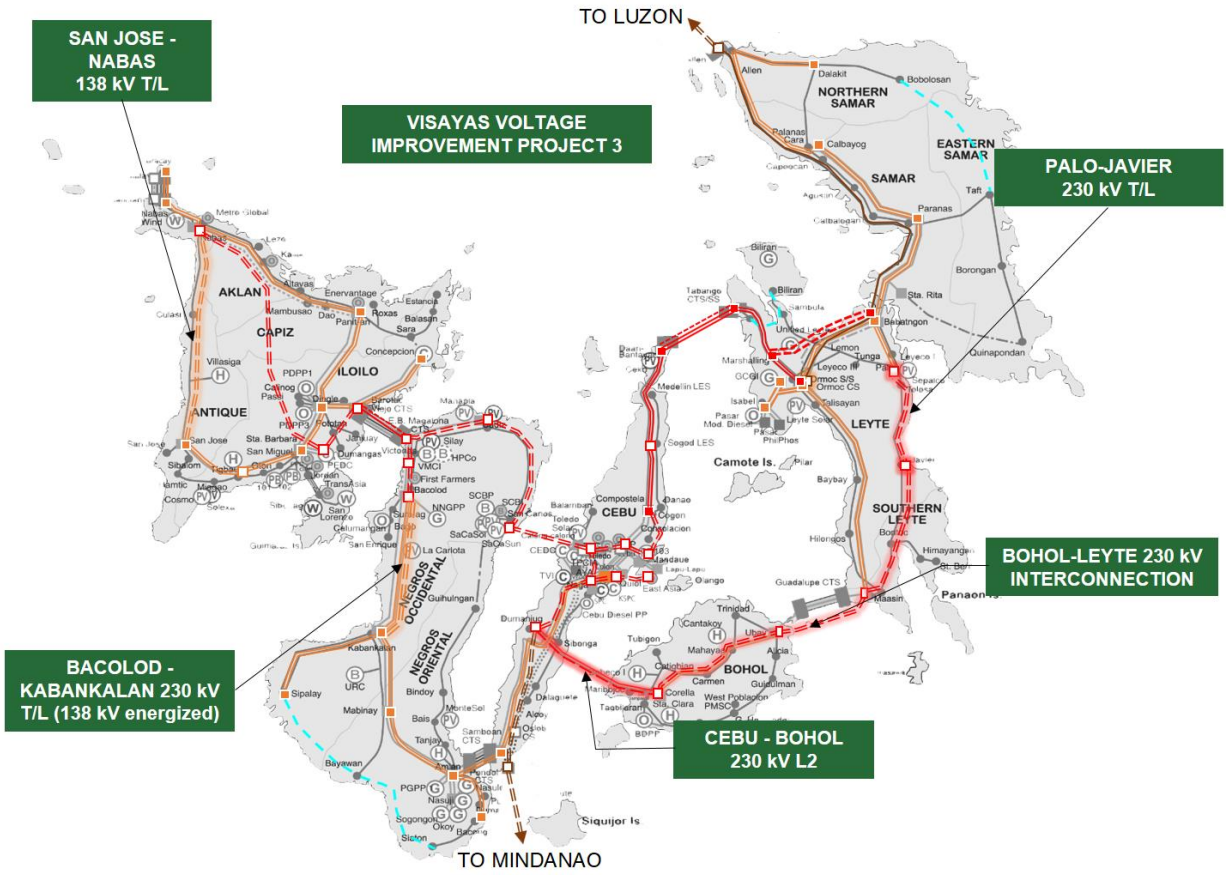


Figure 9.3: Proposed Visayas Transmission Outlook for 2035

Shown in Table 9.3 is the list of proposed transmission projects for Visayas by the 2035.

Table 9.3: Proposed Transmission Outlook for 2035

Project Name/Driver(s)	Province(s) and Components	ETC
Generation Entry		
Bacolod-Kabankalan 230 kV Transmission Line Project	Negros Occidental	Sep 2033
	Transmission Components: ▪ Bacolod-Kabankalan T/L (138 kV energized),ST-DC, 2-795 MCM ACSR, 62 km.	
Reliability		
San Jose-Nabas 138 kV Transmission Line Project	Panay	Dec 2033
	Transmission Components: ▪ San Jose-Nabas T/L, 1-795 MCM, ACSR, 125 km.	
Palo-Javier 230 kV Transmission Line Project	Leyte	Sep 2034
	Transmission Components: ▪ Palo-Javier T/L, ST-DC, 4-795 MCM ACSR, 45 km. Substation Components: ▪ Javier S/S: 2x150 MVA, 230/69 kV Power Transformer and accessories.	
Cebu-Bohol 230 kV Interconnection Line 2 Project	Cebu, Bohol	Dec 2035
	Transmission Components: ▪ Cebu-Bohol Line 2, 1 ckt. XLPE submarine cable of 400 MW capacity at 230 kV, 30 km.	
Bohol-Leyte 230 kV Interconnection Project	Bohol, Leyte	Dec 2035
	Transmission Components: ▪ Corella-Tugas CTS, 4-795 MCM ACSR, ST-DC, 95 km;	

Project Name/Driver(s)	Province(s) and Components	ETC
	▪ Tugas CTS-Maasin, 2 ckts XLPE submarine cable of 400 MW capacity per ckt; ▪ Maasin-Javier T/L, 4-795 MCM ACSR, ST-DC, 120 km.	
Power Quality		
Visayas Voltage Improvement Project 3	Negros	Jul 2035
	<u>Substation Components:</u> ▪ Silay 138 kV S/S: 3x50 MVAR Capacitor.	

9.4 Proposed Transmission Outlook for 2040

By 2040, the grid will be looking at a more secure, more robust and stronger transmission system. A looped transmission system with sufficient redundancy is the key to a more robust and resilient grid. With the gradual expansion of the 230 kV backbone in Visayas, the looping of the 230 kV system will further ensure system security and reliability of the Visayas Grid. This will also provide grid resiliency during natural calamities by providing alternative transmission corridors. Furthermore, Samar's 138 kV system will also be further extended and looped to improve supply, power quality, security and reliability.

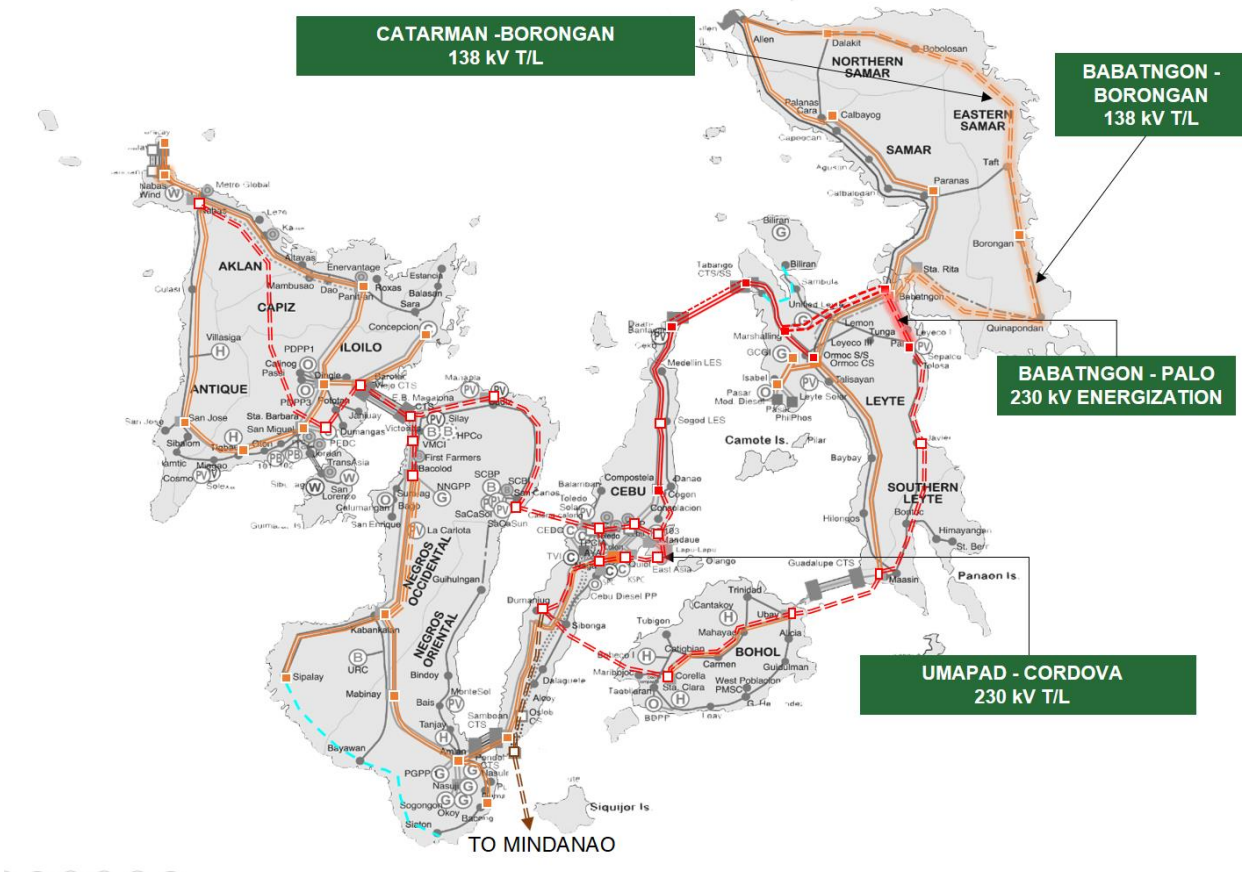


Figure 9.4: Proposed Visayas Transmission Outlook for 2040

Shown in Table 9.4 is the list of proposed transmission projects for Visayas by the 2040.

Table 9.4: Proposed Transmission Outlook for 2040

Project Name/Driver(s)	Province(s) and Components	ETC
Load Growth		
Babatngon – Borongan 138 kV Transmission Line Project	Samar	Dec 2038
	Substation Components: ▪ Babatngon 138 kV SS, 4-138 kV PCBs and associated equipment; ▪ Borongan 138 kV SS, 2x100 MVA, 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 6-69 kV PCBs and associated equipment. Transmission Components: ▪ Babatngon–Borongan: ST-DC, 1-795 MCM ACSR, 185 km.	
Catarman – Borongan 138 kV Transmission Line Project	Samar	Sep 2040
	Transmission Components: ▪ Catarman–Borongan T/L, ST/DC, 1-795 MCM ACSR, 118 km. Substation Components: ▪ Catarman 138 kV S/S, 2x100 MVA, 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 6-69 kV PCBs and associated equipment, 3x30 MVAR Reactor; ▪ Borongan 138 kV S/S, 2-138 kV PCBs and associated equipment, 2x20 MVAR Reactor.	
Reliability		
Umapad – Cordova 230 kV Transmission Line Project	Cebu	Dec 2038
	Transmission Components: ▪ Cordova–Lapu-lapu CTS, ST-DC, 4-795 MCM ACSR, 12 km. ▪ Lapu-lapu CTS–Umapad, 2 ckts XLPE submarine cable of 400 MW per ckt capacity, 1 km. Substation Components: ▪ Umapad 230 kV S/S, 4-230 kV PCBs and associated equipment; ▪ Cordova 230 kV S/S, 4-230 kV PCBs and associated equipment; ▪ Lapu-lapu 230 kV CTS, Cable end sealing equipment.	

The power supply deficiency being experienced in Mindanao for the past years especially during dry season had been averted by the entry of bulk generation capacity additions from a number of coal-fired power plant projects. In the integration of these power plant projects to the Mindanao Grid, new transmission backbones were developed.

Further, the proponents of the coal-fired power plant projects have plans to expand their capacity in the future which could reach a total of 600 MW to 1,200 MW of power generation capacity in each site. With such aggressive plans for expansion of power plants in the island and with the implementation of the interconnection between Mindanao and Visayas, there would be more opportunities for power exchange. This major interconnection project, which is the final link to interconnect the Philippine Grid, is further discussed in Chapter 11.

Meanwhile, to cater the other requirements of the Mindanao Grid, reinforcements of the existing 138 kV substations, extension of some of the existing 138 kV transmission lines, and looping of some of the 69 kV transmission system are necessary for load growth and system reliability improvement in concerned areas.

In terms of transmission system configuration, Mindanao is relatively a robust grid. However, security issues in the island remain a serious concern, thus NGCP is still facing major challenges in implementing its operations and construction of key transmission projects. Notably, another vital issue in the Mindanao grid is the looming low voltage issue in Zamboanga City. Due to a long distance and radial configuration of transmission line supplying power to the area relative to the continuous increase in demand, there will be an impending low voltage in the area which cannot be resolved by power mitigating transmission facility. In this case, a power plant should be constructed in the area to balance the essential reactive requirement of the system.

10.1 Proposed Transmission Projects up to 2025

Shown in Table 10.1 is the list of transmission projects planned for Mindanao Grid for 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
Load Growth		
Villanueva–Butuan 230 kV Transmission Line	Misamis Oriental, Agusan del Norte	Dec 2022
	Substation Components: ▪ Butuan 230 kV Substation (New): 4-230 kV PCBs and associated equipment; ▪ Villanueva 230 kV Substation (Expansion): 4-230 kV PCBs and associated equipment. Transmission Components: ▪ Viillanueva–Butuan 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR/AS, 99 km. Bulk Cost Estimate: 4,193 Million Pesos	

Mindanao Substation Expansion 3 Project	Mindanao	Dec 2023
	Substation Components: ▪ Pitogo 138 kV Substation, 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs, 1-69 kV PCB and associated equipment. ▪ Placer 138 kV Substation, 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-69 kV PCB and associated equipment. ▪ San Francisco 138 kV Substation, 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs, 1-69 kV PCB and associated equipment. ▪ Matanao 138 kV Substation, 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs, 1-69 kV PCB and associated equipment. Bulk Cost Estimate: 1,420 Million Pesos	
System Reliabillity		
Kabacan 138 kV Substation	North Cotabato	Dec 2021
	Substation Components: ▪ Kabacan 138 kV Substation (New), 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 11-138 kV PCBs, 3-69 kV PCBs and associated equipment; ▪ Kidapawan 138 kV Substation: 2-138 kV PCBs and associated equipment; ▪ Gen. Santos 138 kV Substation: 4-138 kV PCBs and associated equipment. Transmission Components: ▪ Kabacan-Kidapawan 138 kV Transmission Line, ST-DC, 1-795 MCM ACSR/AS, 53 km; ▪ Kabacan-Villarica 69 kV Transmission Line, SP-SC, 1-336.4 MCM ACSR/AS, 40 km. Bulk Cost Estimate: 4,168 Million Pesos	
Nasipit Substation Bus-In (formerly Villanueva-Jasaan-Butuan 138 kV Transmission Line)	Agusan Del Norte	Dec 2021
	Substation Components: ▪ Nasipit 138 kV Substation: 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 8-138 kV PCBs, 2-69 kV PCBs and associated equipment. Transmission Components: ▪ Bus-In to Nasipit 138 kV Transmission Line: ST-DC, 1-795 MCM ACSR/AS, 4 km. ▪ Swinging of TM 2 138 kV Transmission Line: 1-795 MCM ACSR/AS, 0.5 km Bulk Cost Estimate: 1,172 Million Pesos	
San Francisco–Tandag 138 kV Transmission Line	Agusan Del Sur, Surigao Del Sur	Dec 2023
	Substation Components: ▪ San Francisco 138 kV Substation: 1-138 kV PCBs and associated equipment; ▪ Tandag 138 kV Substation (New): 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 3-138 kV PCBs, 3-69 kV PCBs and associated equipment; ▪ Madrid 138 kV Substation (New): 2-69 kV PCBs and associated equipment. Transmission Components: ▪ San Francisco–Tandag 138 kV Transmission Line: ST-DC1, 1-795 MCM ACSR/AS, 95 km; ▪ Madrid –Tandag 69 kV Transmission Line, SP-SC, 1-336.4 MCM ACSR/AS, 54 km. Bulk Cost Estimate: 3,864 Million Pesos	
Maco–Mati 138 kV Transmission Line	Compostela Valley, Davao Oriental	Dec 2023
	Substation Components: ▪ Maco 138 kV Substation: 1-138 kV PCB and associated equipment; ▪ Mati 138 kV Substation: 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 3-138 kV PCBs, 3-69 kV PCBs and associated equipment. Transmission Components: ▪ Maco–Mati 138 kV Transmission Line: ST-DC1, 1-795 MCM ACSR/AS, 48 km. Bulk Cost Estimate: 2,075 Million Pesos	
Opol Substation Bus-in (formerly Balo-i-Tagoloan-Opol 138 kV Transmission Line)	Lanao del Norte and Misamis Oriental	Dec 2025
	Substation Components: ▪ Opol 138 kV Substation: 1x75 MVA 138/69–13.8 kV Power Transformer and accessories, 3-138 kV PCBs, 3-69 kV PCBs and associated equipment. Transmission Components: ▪ Opol Substation Bus-in to Balo-i-Tagoloan 138 kV Transmission Line: ST-DC, 1-795 MCM ACSR/AS, 7 km. Bulk Cost Estimate: 559 Million Pesos	

Sultan Kudarat–Tacurong 230 kV Transmission Line	Maguindanao, Sultan Kudarat	Dec 2025
	Substation Components: ▪ Tacurong 138 kV Substation, 2-138 kV PCBs and associated equipment; ▪ Sultan Kudarat 138 kV Substation Expansion, 2-138 kV PCBs and associated equipment. Transmission Components: ▪ Sultan Kudarat–Tacurong 138 kV Transmission Line, ST-DC1, 2-795 MCM ACSR/AS, 101 km. Bulk Cost Estimate: 1,872 Million Pesos	
Eastern Mindanao 230 kV Transmission Line Project	Agusan del Norte, Agusan del Sur, Compostela Valley	Dec 2025
	Substation Components: ▪ Butuan 230 kV Substation (Expansion): 4-230 kV PCBs and associated equipment; ▪ San Francisco 230 kV Substation (New): 4-230 kV PCBs and associated equipment; ▪ Bislig 230 kV Substation (New): 4-230 kV PCBs and associated equipment; ▪ Nabunturan 230 kV Substation (New): 4-230 kV PCBs and associated equipment. Transmission Components: ▪ Butuan-San Francisco 230 kV Transmission Line: SP/ST-DC, 2-795 MCM ACSR/AS, 92.9 km; ▪ San Francisco-Bislig 230 kV Transmission Line: SP/ST-DC, 2-795 MCM ACSR/AS, 92.9 km; ▪ Bislig-Nabunturan 230 kV Transmission Line, ST-DC: 2-795 MCM ACSR/AS, 96.8 km. Bulk Cost Estimate: 4,563 Million Pesos	

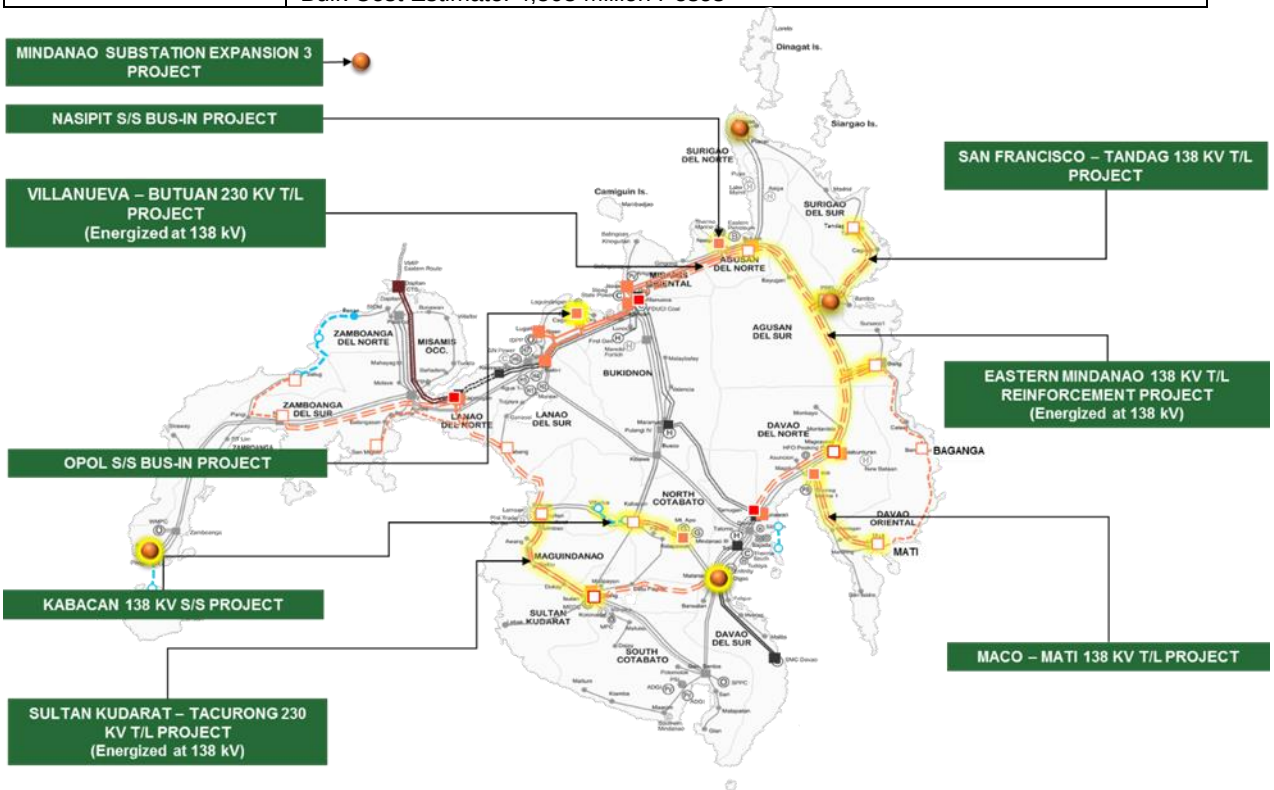
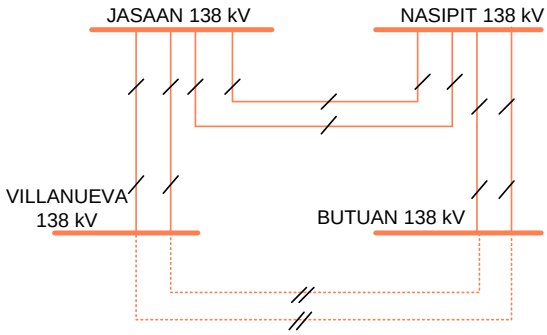


Figure 10.1: Proposed Mindanao Transmission Outlook for 2025

10.1.1 Villanueva–Butuan 230 kV Transmission Line

Overloading of the remaining line of the existing Villanueva – Jasaan 138 kV double circuit transmission line will occur during single outage contingency (N-1) condition. More so, low voltage in Butuan and other nearby substations will be experienced. This is due to the increasing demand in the area.



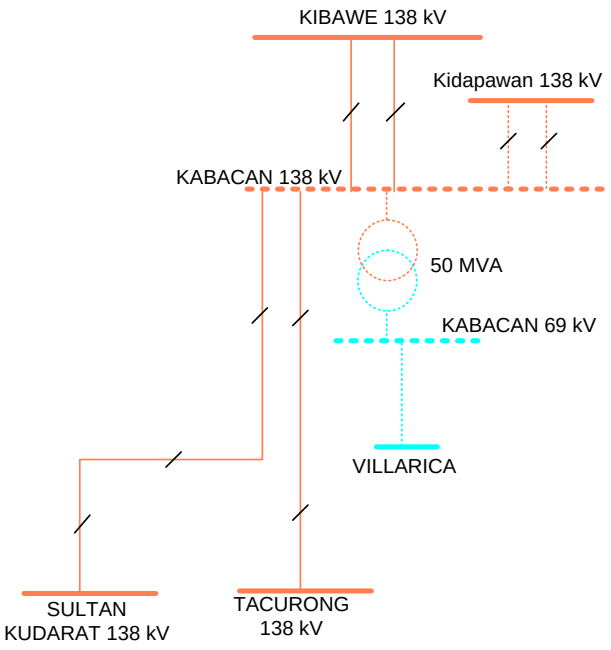
The project involves the installation of new double-circuit, 99 kms, 230 kV Transmission Line from Villanueva Substation to Butuan Substation. This project will serve as initial step in developing higher transmission capacity corridor to meet the increasing demand in the North Eastern Mindanao Area (NEMA). In addition, Villanueva – Butuan 230 kV TL Project also aims to improve the reliability of the transmission system and address the power quality problem in NEMA. This 230 kV designed transmission line will be initially energized at 138 kV.

10.1.2 Mindanao Substation Expansion Project 3

Starting year 2023, the existing transformers in Pitogo, Placer, San Francisco and Matanao Substations will exceed their capacity during N-1 contingency condition. Installation of additional transformer in each of these substations is necessary to maintain continuous normal state operation during the outage of one of the transformers. This development will also comply with the single outage contingency criterion requirement of the Philippine Grid Code.

10.1.3 Kabacan 138 kV Substation

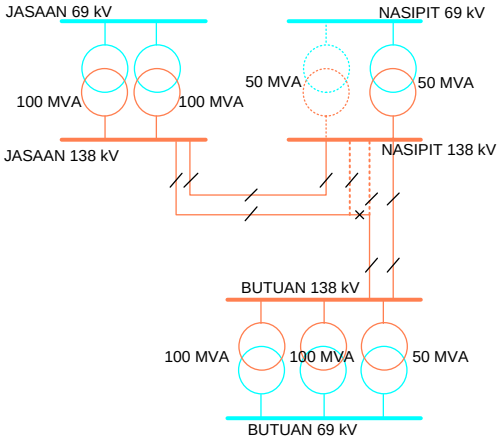
Security remains a serious concern in Mindanao. The Kibawe-Kabacan, Kabacan-Sultan Kudarat and Kabacan-Tacurong 138 kV Lines are integral parts of the Mindanao Grid. These lines traverse unrestrained regions with prevalent presence of militant groups and lawless elements. Thus, transmission facilities are exposed to a high risk of sabotage and terrorist attack. Outage of any of these line segments will result in voltage collapse and rotational power interruptions in Sultan Kudarat, Maguindanao, North Cotabato and South Cotabato provinces.



The project involves the bus-in connection of the existing lines to the proposed substation, installation of a new 50 MVA power transformer, construction of a new 53 km Kabacan-Kidapawan 138 kV Transmission Line, and construction of a new 40 km Kabacan-Villarica 69 kV Transmission Line. These new developments aim to provide flexibility and additional reliability to the transmission system to ensure the continuity of power supply in the concerned areas particularly during outage of any of the abovementioned lines. Additionally, the proposed project includes installation of four new PCB in Gen. Santos Substation which is necessary to allow the entry of the 105 MW Coal-Fired Power Plant Phase 2 of Sarangani Energy Corporation.

10.1.4 Nasipit Substation Bus-In

Outage of the existing Nasipit-Butuan 138 kV Single Circuit Transmission Line will result in a low voltage in Butuan, Placer and San Francisco Substations.



The project aims to improve the reliability and power quality of the transmission system in the North Eastern Mindanao Area. The project involves the bus-in of the existing Jasaan-Butuan 138 kV Single Circuit Transmission Line to Nasipit Substation, installation of a new 50 MVA power transformer and replacement of defective power circuit breakers in Nasipit Substation.

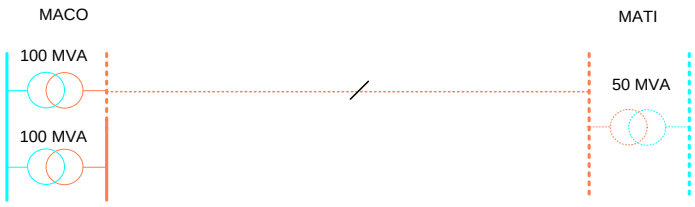
10.1.5 San Francisco–Tandag 138 kV Transmission Line

With the existing transmission line configuration, outage of the San Francisco-Tandag 69 kV Transmission Line or Placer-Madrid 69 kV Transmission Line will shut down the connected loads due to the absence of alternative transmission facility.

Solution to the problem comprises the looping of the 69 kV transmission network in Agusan del Sur area allowing switching of loads during line outages and the extension of the 138 kV transmission system from the San Francisco Substation to the new Tandag Substation. The Project will solve the power quality and reliability problems in the area.

10.1.6 Maco–Mati 138 kV Transmission Line

Presently, the existing Maco-Mati 69 kV Transmission Line is in radial configuration. It has no alternate line to deliver power to customer upon its outage. Likewise, the existing Maco Substation has no N-1 capability. It has only one existing 50 MVA power transformer. Low voltage problem is also anticipated due to the rapid development and increasing power requirement of Mati City.

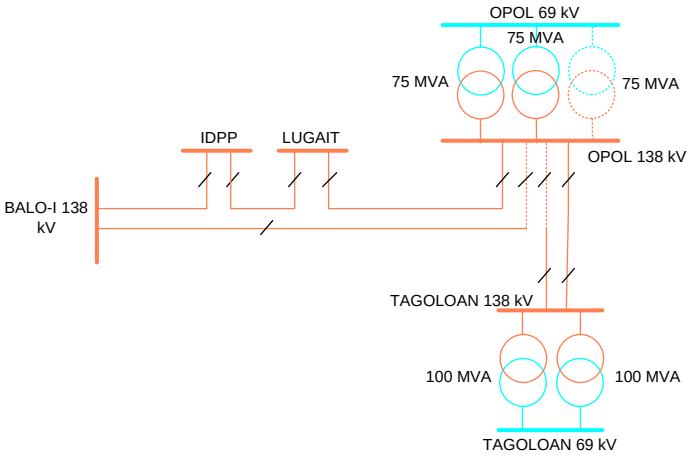


The project involves the extension of the 138 kV transmission system from the existing Maco Substation to the new Mati Substation and the installation of a new 50 MVA power transformer in the new substation. These developments will address the anticipated low voltage in the area

and offers continuous and reliable power delivery during normal or single-outage (N-1) contingency conditions.

10.1.7 Opol Substation Bus-in Project

Presently, Opol Substation is in cut-in configuration scheme along the Lugait – Tagoloan 138 kV Transmission Line and currently serving the nearby loads, in which have significant increase in demand. Outage of the existing Opol-Tagoloan 138 kV Transmission Line segment will result in low voltage at Opol Substation.

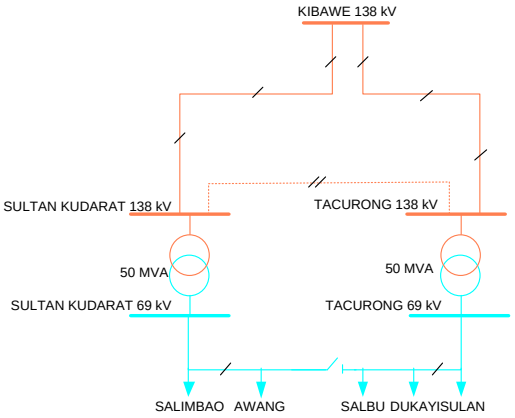


Given the rapid growth in demand in succeeding years, the existing Opol Substation will no longer be complying with the standards prescribed in the PGC during single-outage contingency (N-1) condition.

The project will accommodate the increasing demand. It will also improve the reliability and power quality of the transmission system in northern Mindanao. It comprises the bus-in of the existing Balo-i–Tagoloan 138 kV Single Circuit Transmission Line to Opol Substation, installation of a new 75 MVA power transformer, setting up of associated circuit breakers and secondary equipment.

10.1.8 Sultan Kudarat-Tacurong 230 kV Transmission Line Project

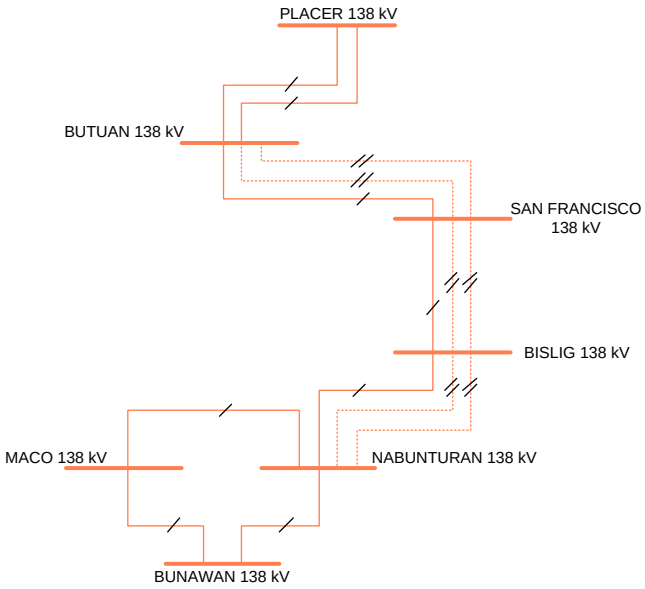
Load end costumers connected to Tacurong and Sultan Kudarat Substations are assured of continuous power supply even during outage of either Kibawe-Sultan Kudarat 138 kV Line or Kibawe-Tacurong 138 kV Line. The project will mitigate the voltage issue in the affected area.



The project will ensure a reliable and flexible power transmission by providing a new corridor for Tacurong and Sultan Kudarat Substations. It will contribute to the economic development in the area. It will also complement the Lala-Malabang-Sultan Kudarat 230 kV Transmission Line Project.

The project will initially be energized at 138 kV level. It will comprise of more than one hundred kilometers of transmission line, four power circuit breakers and associated equipment.

10.1.9 Eastern Mindanao 230 kV Transmission Line Project



The existing 138 kV single circuit transmission line serving the substations of Butuan, San Francisco, Bislig and Nabunturan in eastern Mindanao will already be lacking the single-outage contingency provision. The area will also be exposed to power quality difficulties due to the possible entry of huge mining loads in this part of the island.

The project will strengthen the existing transmission system ensuring stability, reliability and efficient transmission of power in the area maintaining the continuous supply of power in eastern Mindanao. It will also contribute for the voltage improvement in the area. This project will serve as initial step in establishing a higher transmission corridor in the North Eastern Mindanao Area, which will be initially energized at 138 kV level.

Implementation of the project will require a total of 282.68 km of new 230 kV transmission lines, required PCBs and associated equipment.

10.2 Proposed Transmission Outlook for 2030

To further improve the reliability of power supply to the Mindanao Grid, looping projects will be constructed. The Lala–Malabang–Sultan Kudarat 230 kV Transmission Line Project will complete the loop of the 230 kV transmission system of Mindanao. Likewise, the Siom–Sindangan–Salug 69 kV Transmission Line Project will loop the 69 kV transmission system in Zamboanga Del Norte.

Moreover, installation of 230 kV drawdown transformers in Matanao Substation is required to ensure adequate supply facilities in the long term and improve the voltage profile in Davao Del Sur.

Finally, the implementation of Zamboanga–Basilan and Davao–Samal interconnection projects would significantly boost the supply reliability to support the load growth in Basilan and Samal islands, which will receive power from the grid thru Pitogo Substation in Zamboanga City and Bunawan Substation in Davao City, respectively.

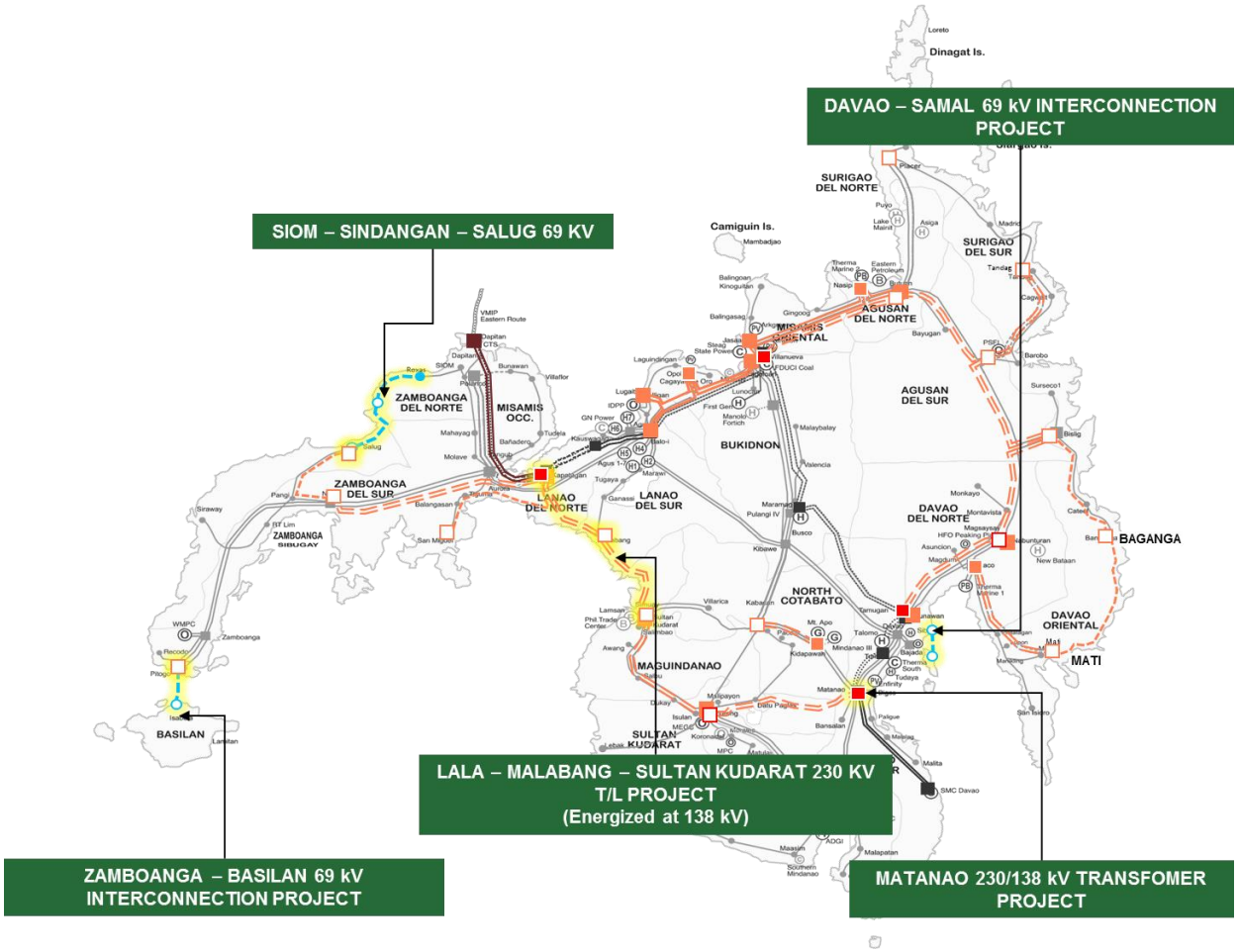


Figure 10.2: Proposed Mindanao Transmission Outlook for 2030

Table 10.2: Proposed Mindanao Transmission Outlook for 2030

Project Name/Driver(s)	Province(s) and Components	ETC
Load Growth		
Matanao 230/138 kV Transformer	Davao Del Sur	Dec 2030
	Substation Components: ▪ Matanao 230 kV Substation: 2x300 MVA 230/138-13.8 kV Power Transformer and accessories, 4-230 kV PCBs, 4-138 kV PCBs and associated equipment.	
System Reliability		
Lala–Malabang–Sultan Kudarat 230 kV Transmission Line	Lanao Del Norte, Lanao del Sur, Maguindanao	Dec 2030
	Substation Components: ▪ Lala 230 kV Substation: 4-230 kV PCBs and associated equipment; ▪ Malabang 230 kV Substation (New): 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 8-230 kV PCBs, 3-69 kV PCBs and associated equipment; ▪ Sultan Kudarat 230 kV Substation: 3-230 kV PCBs and associated equipment. Transmission Components: ▪ Lala–Malabang–Sultan Kudarat 230 kV Transmission Line: ST-DC, 2-795 MCM ACSR/AS, 115 km.	
Siom–Sindangan–Salug 69 kV Transmission Line	Zamboanga Del Norte	Dec 2030
	Substation Components: ▪ Siom 69 kV Substation (Expansion): 2-69 kV PCBs and associated equipment; ▪ Sindangan 69 kV Substation (New): 2-69 kV PCBs and associated equipment; ▪ Salug 69 kV Substation (Expansion): 2-69 kV PCBs and associated equipment.	

Project Name/Driver(s)	Province(s) and Components	ETC
	Transmission Components: ▪ Siom–Sindangan–Salug 69 kV Transmission Line: SP-SC, 1-336.4 MCM ACSR/AS, 115 km.	
Interconnection		
Davao–Samal 69 kV Interconnection	Davao del Norte	Dec 2030
	Transmission Components: ▪ Davao-Samal 69 kV Transmission Line, 3-core, 300mm^2 Submarine Cable, 8.5 km.	
Zamboanga–Basilan 69 kV Interconnection	Zamboanga del Sur, Basilan	Dec 2030
	Transmission Components: ▪ Zamboanga-Basilan 69 kV Transmission Line, 3-core, 300mm^2 Submarine Cable, 30 km.	

10.3 Proposed Transmission Outlook for 2035

The development in Eastern Mindanao, mainly in CARAGA and Davao Oriental, is expected to escalate within this period which will entail reinforcement of existing single circuit lines and extension of needed lines. The San Francisco–Tandag 138 kV Transmission Line 2 Project aims to improve the reliability of the looped network and provide adequate line capacity to sustain the growing mining loads in CARAGA. The Maco–Mati 138 kV Transmission Line 2 project intends to amplify the single circuit network and the Bislig–Baganga 138 kV Transmission Line Project will provide the necessary transmission facility extension in Davao Oriental.

The objective of the projected grid expansion in Western Mindanao for this period is to obtain power flow reliability in Maguindanao and Zamboanga del Norte. The Sultan Kudarat–Tacurong Transmission Line 2 Project aims to improve the power transfer capacity and reliability in Maguindanao Area. The Naga–Salug 138 kV Transmission Line intends to extend the 138 kV transmission network in the western coast of Zamboanga del Norte to support the expected load growth in the area and form a more reliable looped network.

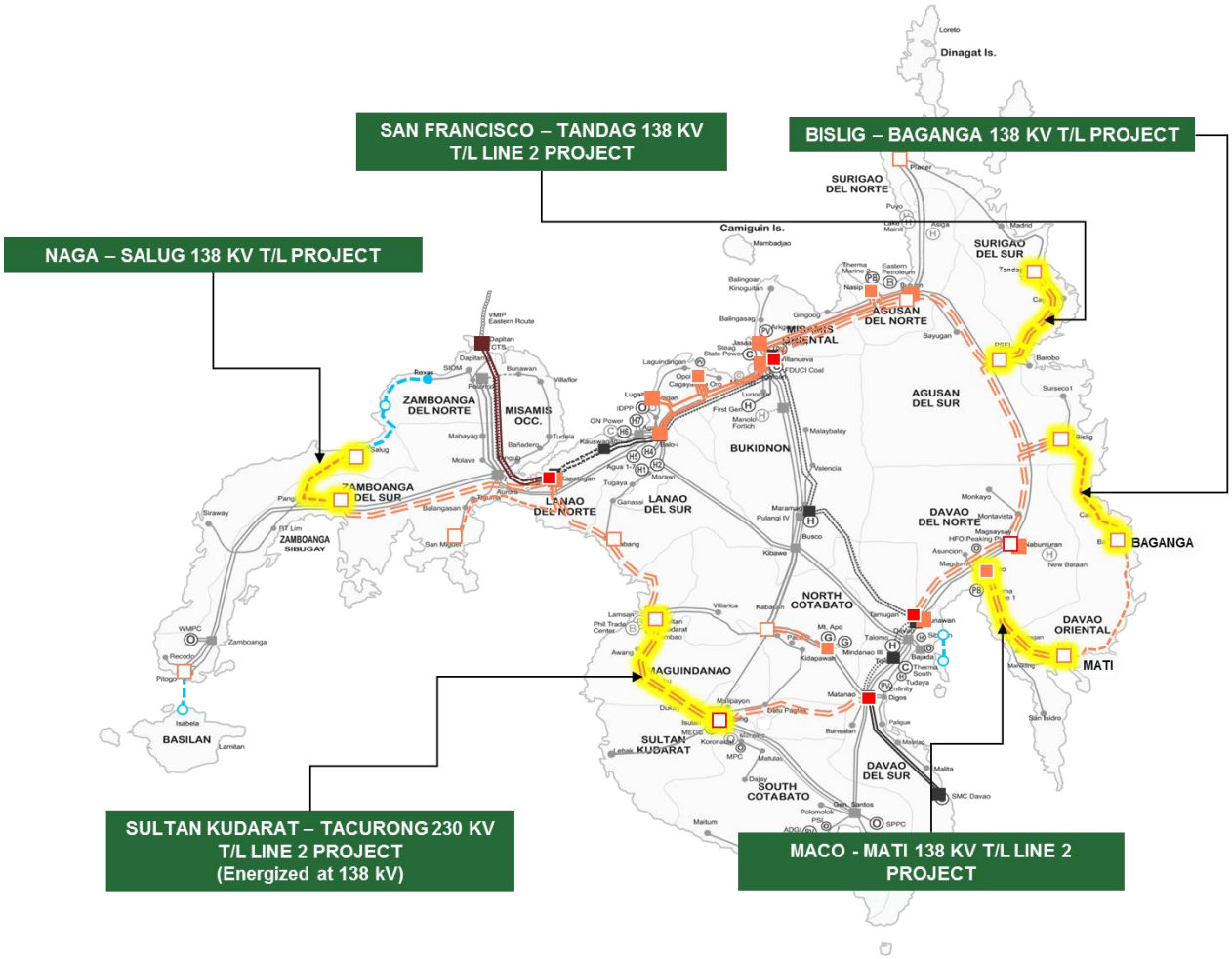


Figure 10.3: Proposed Mindanao Transmission Outlook for 2035

Table 10.3: Proposed Mindanao Transmission Outlook for 2035

Project Name/Driver(s)	Province(s) and Components	ETC
System Reliability		
Bislig-Baganga 138 kV Transmission Line	Davao Oriental, Surigao del Sur	Dec 2035
	Transmission Components: ▪ Bislig–Baganga: 138 kV Transmission Line, ST-SC, 1-795 MCM ACSR, 85 km Substation Components: ▪ Bislig 138 kV Substation Expansion, 2-138 kV PCBs and associated equipment; ▪ Baganga 138 kV Substation (New), 1-50 MVA 138/69-13.8 kV Power Transformer and accessories, 3-138 kV PCBs, 2-69 kV PCBs and associated equipment.	
San Francisco-Tandag 138 kV Transmission Line 2	Surigao del Sur, Agusan del Sur	Dec 2035
	Transmission Components: ▪ San Francisco–Tandag: 138 kV Transmission Line, 1-795 MCM ACSR, 95 km Substation Components: ▪ San Francisco 138 kV Substation Expansion, 2-138 kV PCBs and associated equipment; ▪ Tandag 138 kV Substation Expansion, 2-138 kV PCB and associated equipment.	

Project Name/Driver(s)	Province(s) and Components	ETC
Naga-Salug 138 kV Transmission Line	Zamboanga del Sur, Zamboanga del Norte	Dec 2035
	Transmission Components: ▪ Naga–Salug: ST-SC, 138 kV Transmission Line, 1-795 MCM ACSR, 60 km Substation Components: ▪ Naga 138 kV Substation Expansion, 2-138 kV PCBs and associated equipment; ▪ Salug 138 kV Substation (New), 1-50 MVA 138/69-13.8 kV Power Transformer and accessories, 3-138 kV PCBs, 3-69 kV PCBs and associated equipment.	
Sultan Kudarat-Tacurong 230 kV Transmission Line 2	Maguindanao, Sultan Kudarat	Dec 2035
	Transmission Components: ▪ Sultan Kudarat–Tacurong: 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR, 110 km Substation Components: ▪ Sultan Kudarat 230 kV Substation Expansion, 1-230 kV PCBs and associated equipment; ▪ Tacurong 230 kV Substation Expansion, 2-230 kV PCBs and associated equipment.	
Maco-Mati 138 kV Transmission Line 2	Davao Oriental, Compostela Valley	Dec 2035
	Transmission Components: ▪ Maco–Mati: 1-795 MCM ACSR, 48 km Substation Components: ▪ Maco 138 kV Substation Expansion, 2-138 kV PCBs and associated equipment; ▪ Mati 138 kV Substation Expansion, 2-138 kV PCBs and associated equipment.	

10.4 Proposed Transmission Outlook for 2040

The identified grid expansion projects in Mindanao by 2040 mainly consider the anticipated rapid load growth. The Mindanao Grid 230 kV transmission backbone network will be extended to Zamboanga Sibugay, Compostela Valley, and Southwestern areas to improve power reliability. The 230 kV network expansion consists of Lala – Naga 230 kV Transmission Line, Nabunturan – Bunawan 230 kV Transmission Line, and Matanao – Tacurong 230 kV Transmission Line Projects.

Expected development in new areas in Mindanao is also considered which will require transmission power delivery service. Establishment of Lala – San Miguel 138 kV Transmission Line and Baganga – Mati 138 kV Transmission Line projects will provide more sustainable and reliable power supply delivery to their service areas.

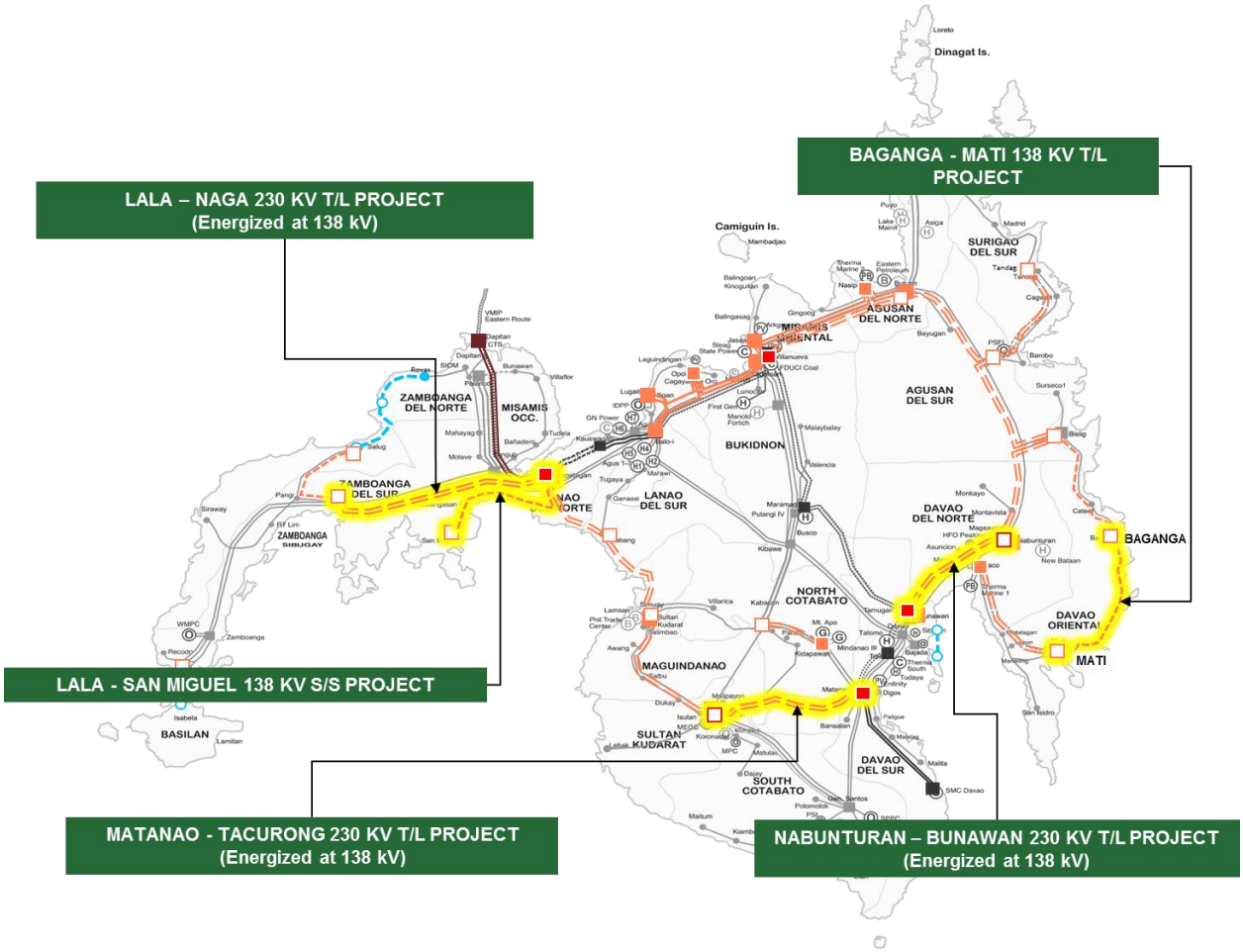


Figure 10.4: Proposed Mindanao Transmission Outlook for 2040

Table 10.4: Proposed Mindanao Transmission Outlook for 2040

Project Name/Driver(s)	Province(s) and Components	ETC
System Reliability		
Lala–Naga 230 kV Transmission Line	Zamboanga del Sur, Lanao del Norte	Dec 2040
	Transmission Components: ▪ Lala–Naga: 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR/AS, 150 km Substation Components: ▪ Lala 230 kV Substation Expansion, 2-230 kV PCBs and associated equipment; ▪ Naga 230 kV Substation (New), 2-230 kV PCBs and associated equipment.	
Baganga–Mati 138 kV Transmission Line	Davao Oriental	Dec 2040
	Transmission Components: ▪ Baganga–Mati: 138 kV Transmission Line, ST-SC, 1-795 MCM ACSR, 105 km Substation Components: ▪ Baganga 138 kV Substation (Expansion), 2-138 kV PCBs and associated equipment; ▪ Mati 138 kV Substation (Expansion), 2-138 kV PCBs and associated equipment.	
Lala–San Miguel 138 kV Transmission Line	Zamboanga del Sur, Lanao del Norte	Dec 2040
	Transmission Components: ▪ Lala–San Miguel: ST-SC, 1-795 MCM ACSR, 87 km Substation Components: ▪ Lala 138 kV Substation Expansion, 2-138 kV PCBs and associated equipment; ▪ San Miguel 138 kV Substation (New), 1-50 MVA 138/69-13.8 kV Power Transformer and accessories, 4-138 kV PCBs, 3-69 kV PCBs and associated equipment.	

Project Name/Driver(s)	Province(s) and Components	ETC
Nabunturan–Bunawan 230 kV Transmission Line	Davao del Norte	Dec 2040
	Transmission Components: ▪ Nabunturan–Bunawan: 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR/AS, 70 km Substation Components: ▪ Nabunturan 230 kV Substation (New), 4-230 kV PCBs and associated equipment; ▪ Bunawan 230 kV Substation Expansion, 4-138 kV PCBs and associated equipment.	
Matanao–Tacurong 230 kV Transmission Line	Davao del Sur & Sultan Kudarat	Dec 2040
	Transmission Components: ▪ Matanao–Tacurong : 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR/AS, 93 km Substation Components: ▪ Matanao 230 kV Substation Expansion, 4-230 kV PCBs and associated equipment; ▪ Tacurong 230 kV Substation (New), 4-230 kV PCBs and associated equipment.	

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 2016, 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. In 2017, additional 230 kV designed submarine cable was installed between Negros and Panay.

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

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.

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 2016-2040

Project Name	Provinces	ETC
Bolo to San Pablo 500 kV Backbone	Ilocos Sur, La Union, Pangasinan	Dec 2024
Nagsaag to Kabugao 500 kV Backbone	Isabela, Pangasinan, and Apayao	Dec 2035
Western Luzon 500 kV Backbone	Pangasinan, Zambales	Jun 2025
Metro Manila 500 kV Backbone Loop	Taguig	Sept 2021
Batangas-Mindoro Interconnection Project	Batangas, Oriental Mindoro amd Occidental Mindoro	Mar 2021
Luzon–Visayas HVDC Bipolar Operation	Camarines Sur and Leyte	Dec 2030
Cebu-Negros-Panay 230 kV Backbone	Cebu, Negros Occidental, Iloilo	Aug 2020
Metro Cebu 230 kV Backbone Loop	Cebu	Dec 2040
Cebu–Bohol–Leyte 230 kV Backbone	Cebu, Bohol, and Leyte	Dec 2035
Mindanao-Visayas Interconnection Project	Cebu, Lanao del Norte, Zamboanga del Norte	Dec 2020
Mindanao 230 kV Backbone	Mindanao Island	Mar 2019
Western Mindanao 230 kV Transmission Backbone	Zamboanga del Sur, Sultan Kudarat, Maguindanao, South Contabato	Dec 2040
Eastern Mindanao 230 kV Transmission Backbone	Agusan Del Norte, Agusan Del Sur, Compostella Valley	Dec 2025

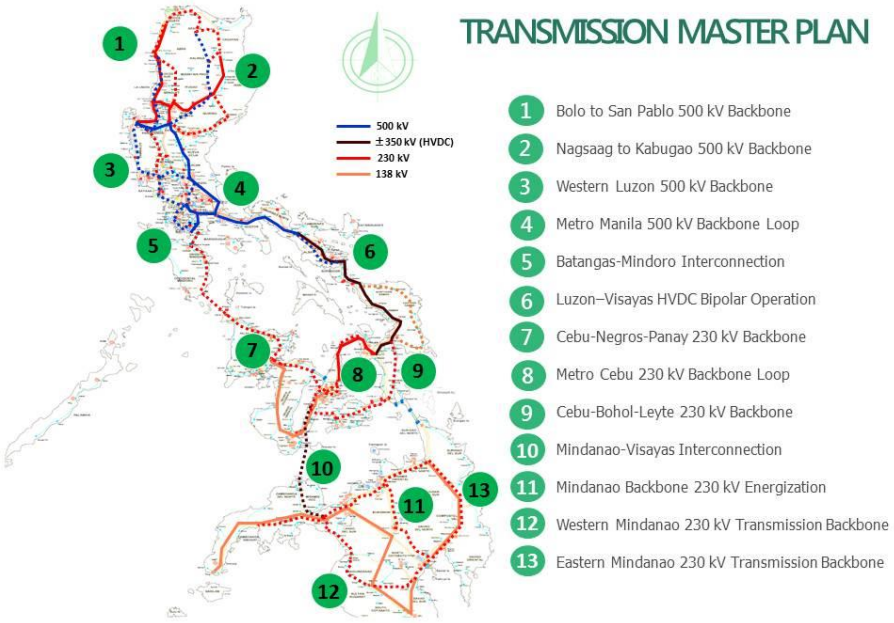


Figure 11.1 - Transmission Backbones and Island Interconnections

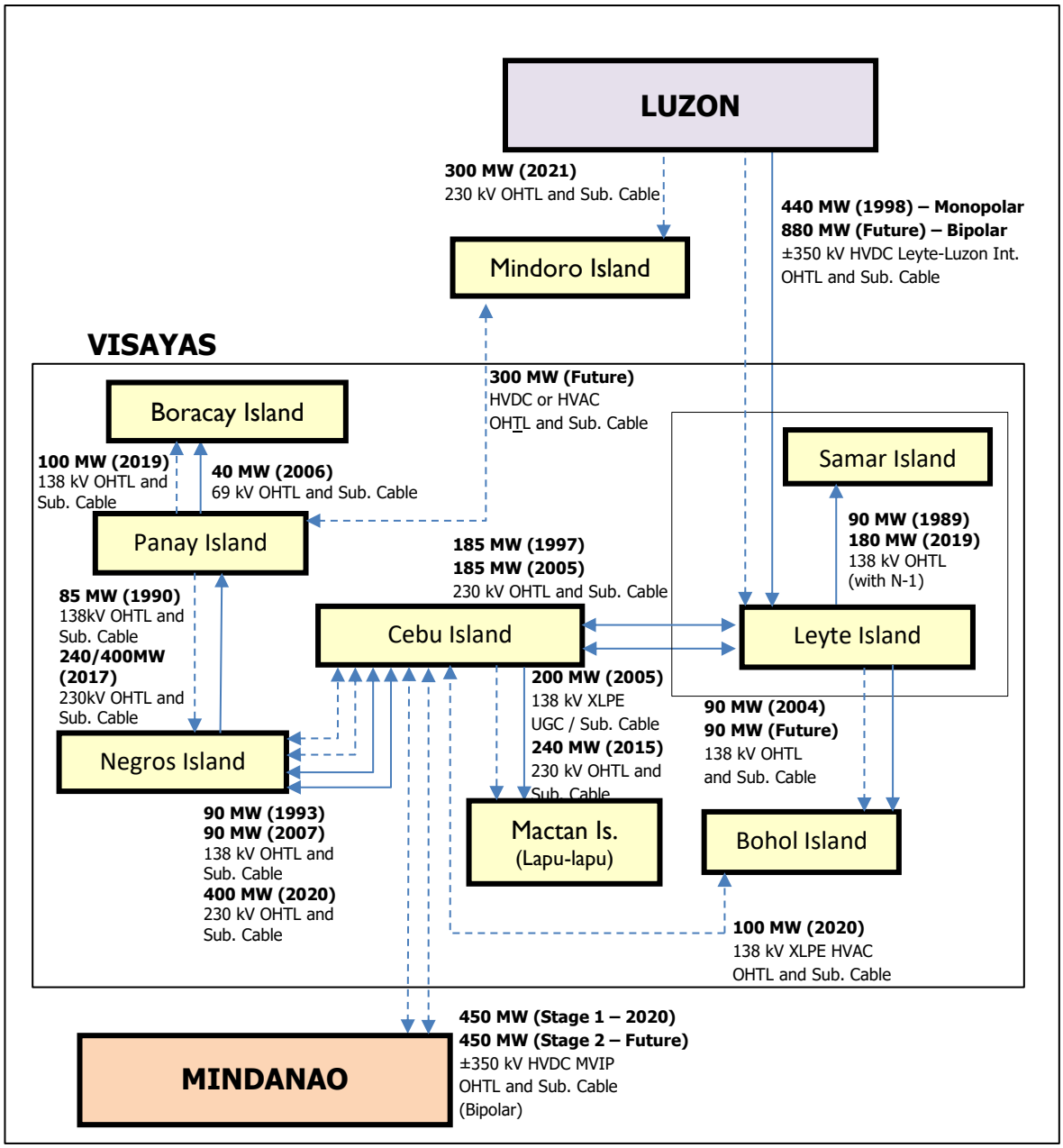


Figure 11.2 - Existing and Future Philippine Network Topology

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

11.2.2 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 2016 was more than 64 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 connection substation in the Luzon Grid for the planned interconnection is the proposed Pinamukan 500 kV Substation. This new 500 kV Substation, located further down south of Batangas City, could serve as the interconnection substation of Mindoro Island aside from the generation connection hub of proposed bulk generations.

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:

- Pinamukan–Lobo CTS 230 kV T/L, ST-DC 1-795 MCM ACSR, 37 km;
- Lobo CTS-Mahal na Pangalan CTS 230 kV Submarine Cable, 6-1,600 mm^2 XLPE, 25 km;
- Mahal na Pangalan CTS–Calapan 230 kV T/L, ST-DC 1-795 MCM ACSR, 6 km;

- Pinamukan 230 kV S/S: 4-230 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.

11.2.3 Mindanao-Visayas Interconnection Project (MVIP)

The Mindanao-Visayas Interconnection Project was previously known as Visayas-Mindanao Interconnection Project (VMIP). The change to MVIP aims to indicate the importance and priority given to Mindanao Grid which has long been isolated. Luzon and the Visayas Grids are already interconnected since 1998 and with electricity market in operation since 2006 and 2008, respectively. The name MVIP indicates further support to boost the development of the country's electricity market to include the Mindanao Grid.

The tangible benefits in terms of reduced investments in power generation due to the implementation of MVIP 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 MVIP:

a) The benefit that is difficult to be quantified in monetary terms includes the attractiveness of MVIP to power generation investments due to the bigger market through an interconnected power network;
b) From a technical standpoint, MVIP 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. MVIP 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.

Major Project Components:

I. Land Portion

a) Overhead DC Transmission Lines:
   - Dumanjug CS-Santander CTS (Visayas Side): 73 km, ±350 kV HVDC OHTL, Bipolar, 3-795 MCM ACSR Condor; and
   - Dapitan CTS (Mindanao Side)-Lala CS: 138 km, ±350 kV HVDC OHTL, Bipolar, 3-795 MCM ACSR Condor.

b) Overhead AC Transmission Lines:
   - Dumanjug CS-Magdugo S/S: 52 km, 230 kV, ST-DC, 4-795 MCM ACSR;
   - Cebu GIS S/S-Umapad S/S Line Extension: 0.1 km, 230 kV, ST-DC, 2-410 mm^2 STACIR; and

- Umapad CTS-Umapad S/S Line Extension: 0.1 km, 138 kV SP-SC, 2-410 mm^2 STACIR.

c) Electrode Lines/Stations:
- Lala CS-Kolambugan ES: 20 kV OHTL (2 lines), 20 km, 2-795 MCM ACSR Condor; and
- Dumanjug CS-Alegria ES: 20 kV OHTL (2 lines), 20 km, 2-795 MCM ACSR Condor.

d) Converter Stations (Conventional Bipolar):

Dumanjug 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;
- Power Transformer: 2-150 MVA, 230/138-13.8 kV Power Transformer and accessories, 1-100 MVA, 138/69 kV Power Transformer and accessories;
- Power Circuit Breakers: 14-230 kV PCB and associated equipment, 11-138 kV PCB and associated equipment, 2-69 kV PCB and associated equipment;
- Oil immersed DC Smoothing Reactor: including DC filters and 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.

Lala 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;
- Power Transformer: 2-150 MVA, 230/138-13.8 kV Power Transformer and accessories;
- Power Circuit Breakers: 8-230 kV PCB and associated equipment;
- Oil immersed DC Smoothing Reactor: including DC filters and 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.

e) Substations:
- Umapad S/S (New): 2-150 MVA, 230/138-13.8 kV Power Transformers and accessories, 2-150 MVA, 230/69-13.8 kV Power Transformers and accessories, 13-230 kV PCB and associated equipment, 4-138 kV PCB and associated equipment, 9-69 kV PCB and associated equipment;
- Magdugo S/S (Expansion): 2-230 kV PCB and associated equipment; and
- Other Equipment/Facilities identified based on the result of GIS, e.g., power compensating equipment, etc.

II. Marine Portion

Santander CTS-Dapitan CTS, 90 km, ±350 kV HVDC, Bipolar, 1,500 mm^2 HVDC Mass Impregnated (MI) submarine cable.

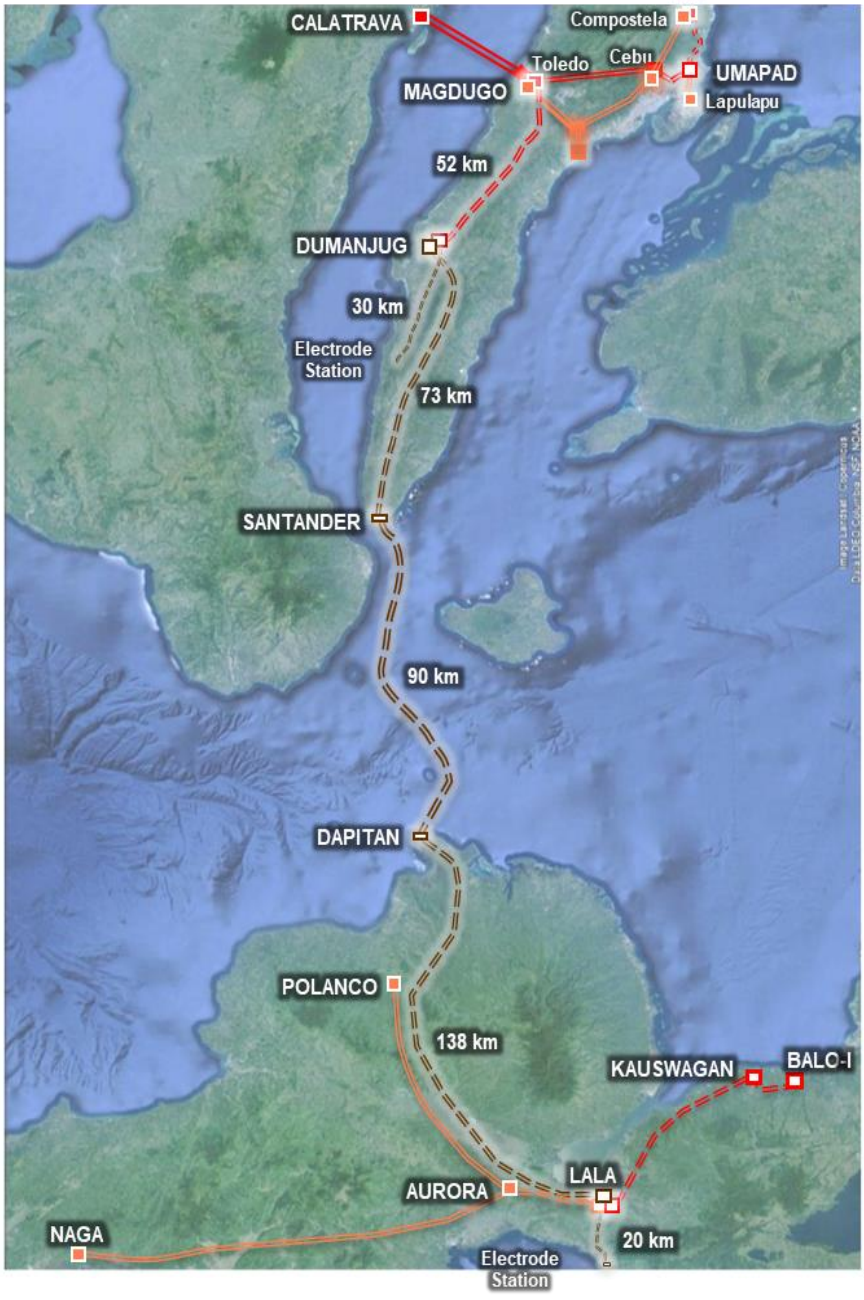


Figure 11.3 – Connection Configuration of MVIP

11.2.4 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	Length (kms)			Population[a]	Land Area[b] (km^2)	2015 Peak Demand (MW)	2040 Peak Demand (MW)
		Submarine	Overhead	Total				
LUZON								
Mindoro	Batangas	25	43	68	1,331,473	10,104	64.48	221.34
Catanduanes	Presentacion	32	8	40	260,964	1,492	10.22	33.74
Marinduque	General Luna	23	11	34	234,521	953	8.74	23.71
Ticao	Abuyog	20	35	55	95,129	385	1.79	2.58
Masbate	San Jacinto	16	16	32	706,897	3,337	16.35	37.04
Tablas	San Jose	61	36	97	164,012	844	6.53	26.96
Lubang	Calaca	54	20	74	28,920	245	0.76	1.54
Palawan	San Jose	252	173	425	886,308	13,980	49.70	261.42
Busuanga	San Jose	84	52	136	22,046	393	4.39	16.96
VISAYAS								
Bantayan	Medellin	21	24	45	144,116	134	5.34	16.88
Siquijor	Bacong	20	24	44	95,984	337	4.65	16.58
Camotes[1]	Isabel	18	8	26	91,688	204	3.02	11.83
Semirara	San Jose	33	0	33	14,892	55		
MINDANAO								
Siargao	Cagdiano	13	7	20	116,587	623	5.13	11.28
Samal[2]	Lasang	9	21	30	95,993	272	5.99	14.81
Basilan	Pitogo	27	12	39	297.306	690	8.67	29.04
Dinagat	Canlanipa	30	15	45	127,152	1,036	3.16	13.22
Camiguin	Esperanza	30	37	67	88,478	238	4.33	8.95
Siasi	Parang	43	32	75	67,705	193	0.7	1.84
Sulu	Taberlongan	100	34	134	607,735	2,055	8.34	20.11
Tawi-Tawi	Pagatpat	84	60	144	207,595	1,636	5.66	31.93

[a] Based on 2015 Census of Population (POPCON 2015)
[b] Based on Philippine Standard Geographic Code (PSGC)
1 Ponson Island excluded
2 Talicud Island excluded, Land area of Talicud Island from choosephilippines.com

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	
NLREC Wind Farm Expansion	69
Balaoi Wind Power Project	159
Burgos Solar Plant	30
Lal-lo Solar PV Power Plants	100
Santa Solar Power Project	20
Pilipinas Einstein Solar PV Power Plant	50
Pilipinas Newton Solar PV Power Plant	50
VISAYAS	
First Toledo Solar Power Project	60
Vista Alegre Solar PV Farm Project	50
Cebu Wind Power Plant	50
SPC Diesel-Fired Power Barge	32

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 A2, 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 Mindanao-Visayas 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.

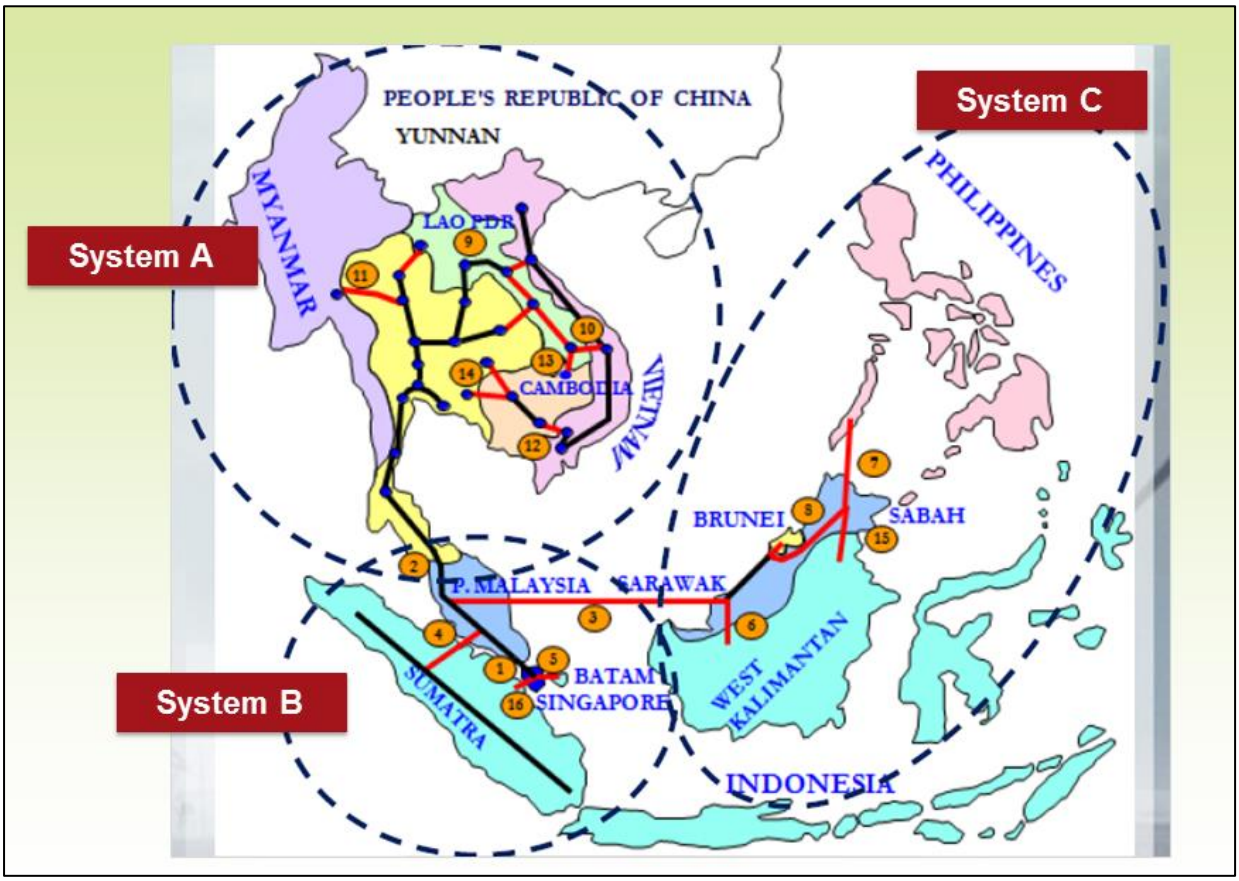


Figure A2 - The ASEAN Power Grid

Appendix 3 – Generation and Load Distribution Per Area

Generation and Load Distribution in the Luzon Grid

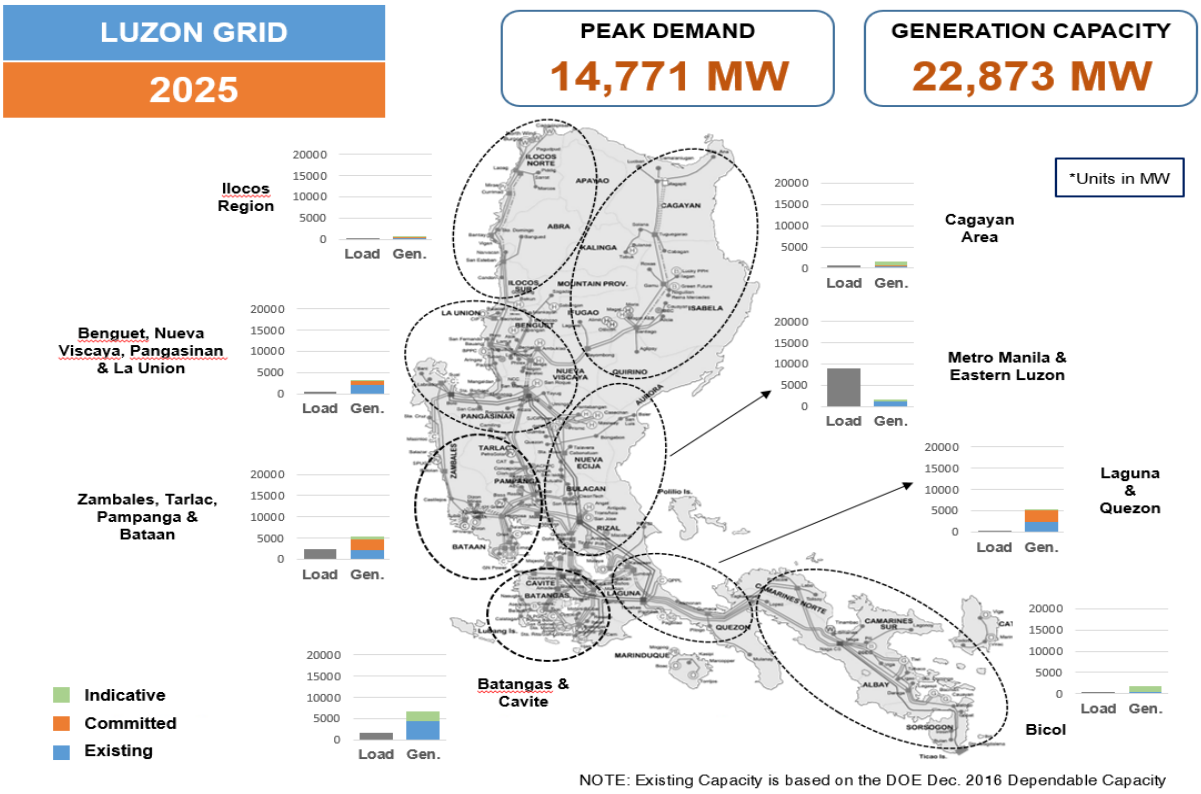


Figure A3.1 – Projected Luzon Grid Generation and Load Distribution in 2025

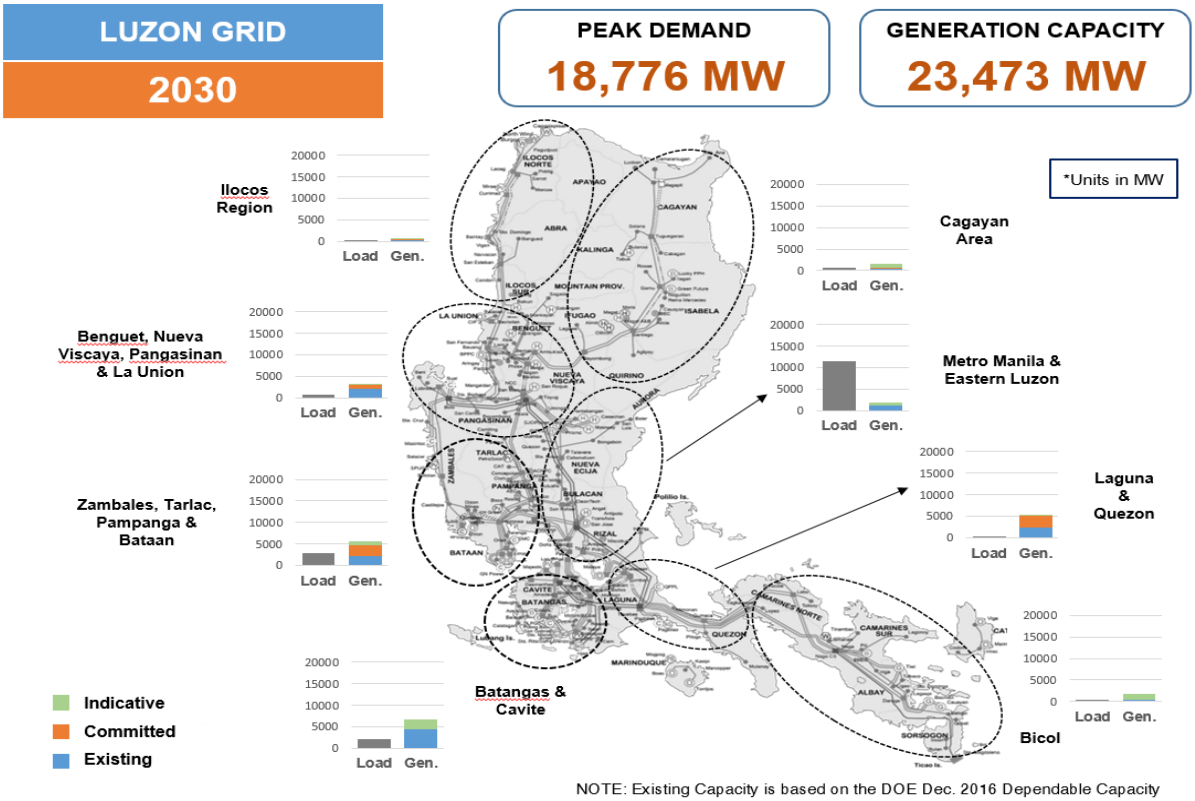
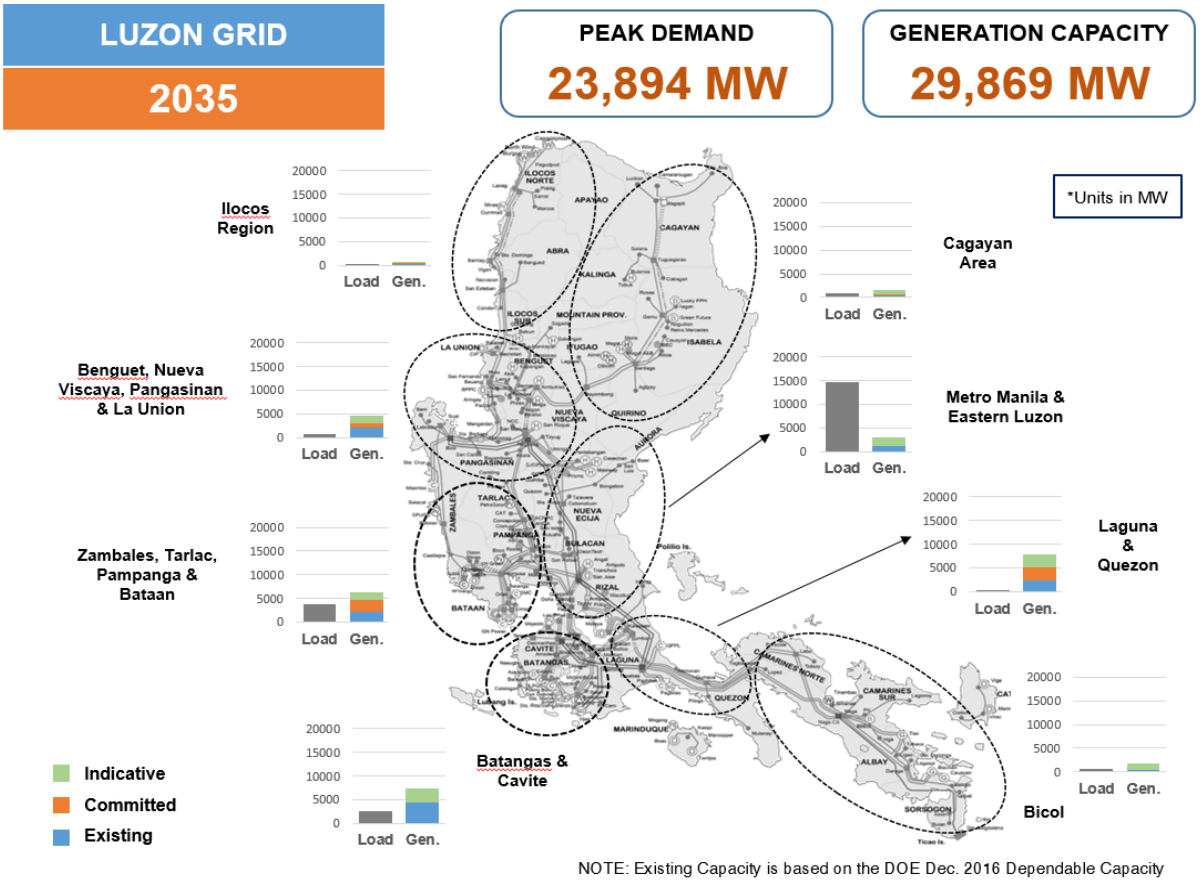
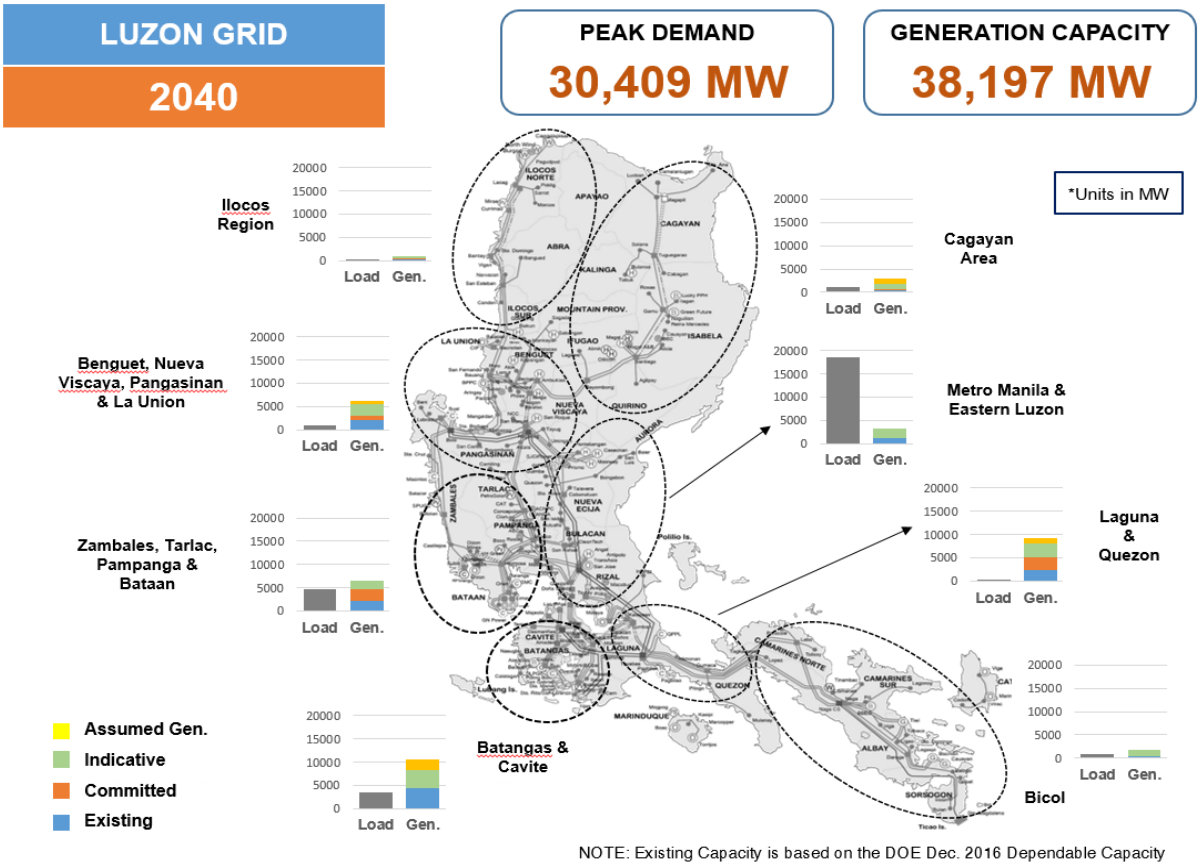


Figure A3.2 – Projected Luzon Grid Generation and Load Distribution in 2030



NOTE: Existing Capacity is based on the DOE Dec. 2016 Dependable Capacity

Figure A3.3 – Projected Luzon Grid Generation and Load Distribution in 2035



NOTE: Existing Capacity is based on the DOE Dec. 2016 Dependable Capacity

Figure A3.4 – Projected Luzon Grid Generation and Load Distribution in 2040

Generation and Load Distribution in the Visayas Grid

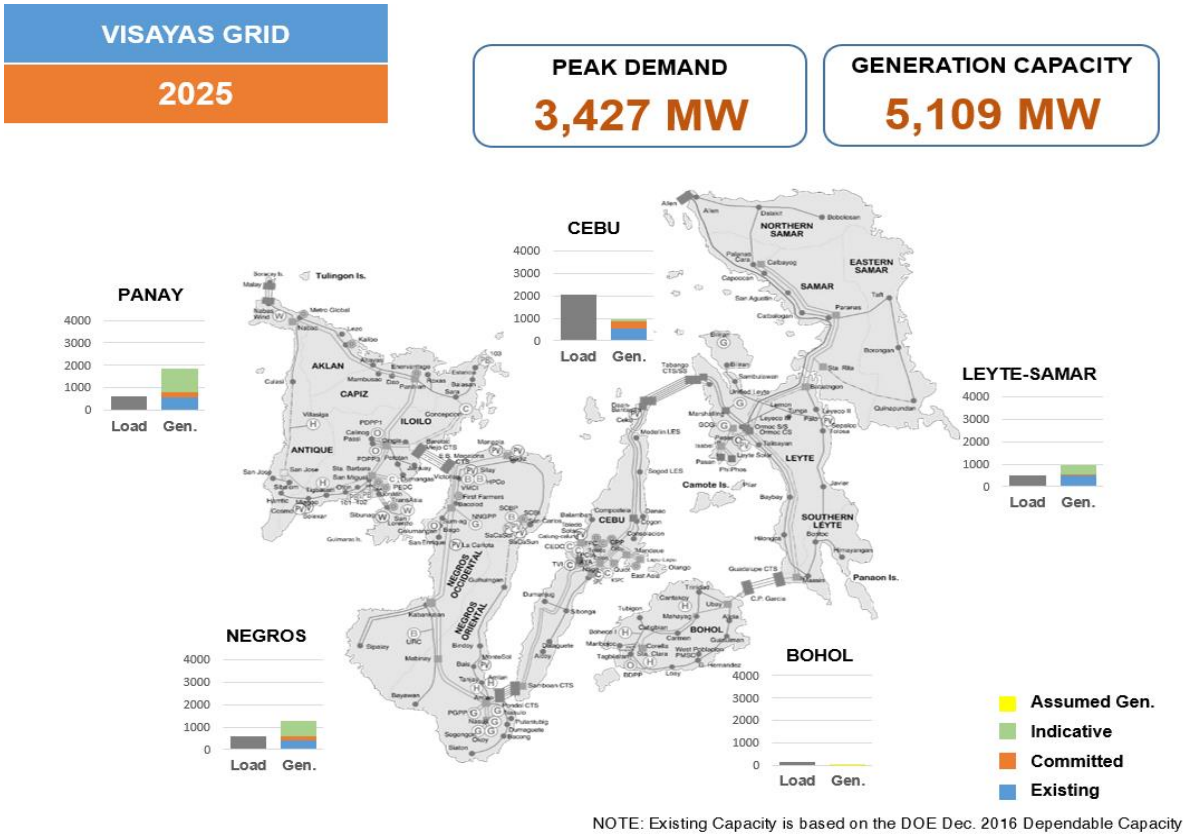


Figure A3.5 – Projected Visayas Grid Generation and Load Distribution in 2025

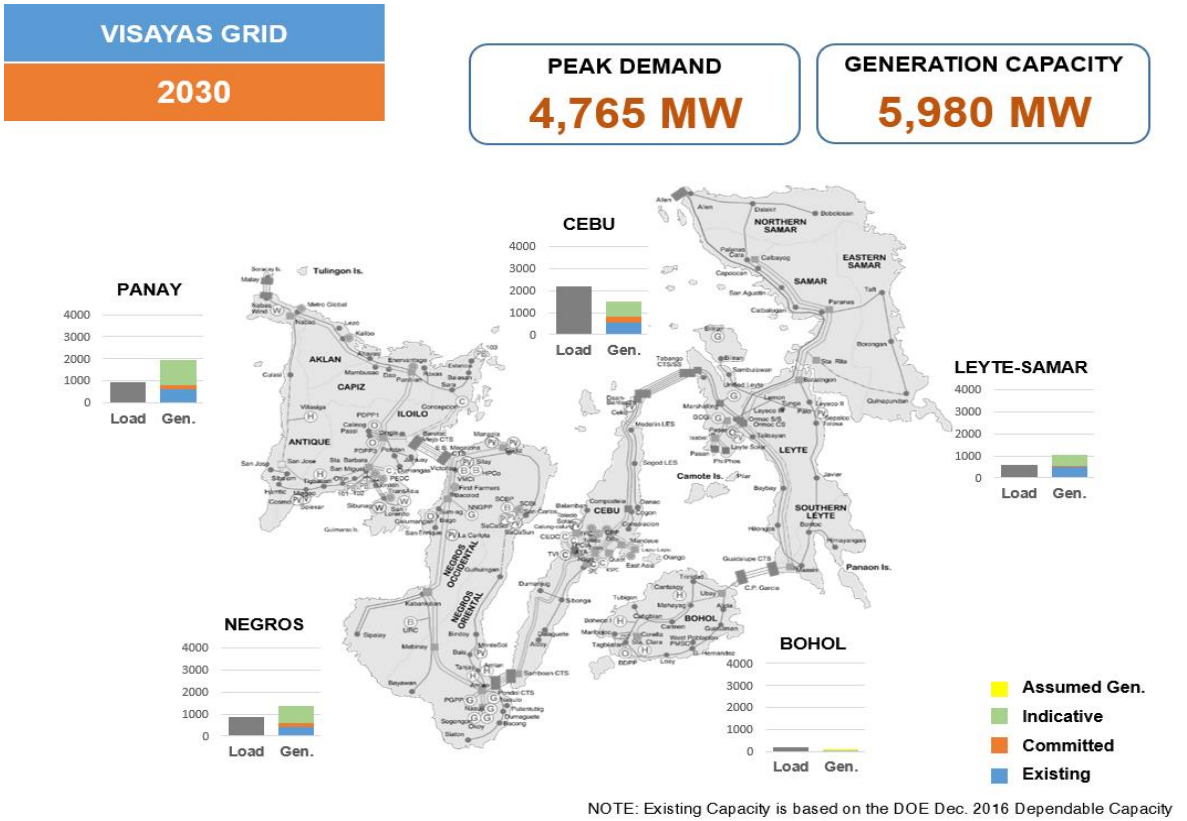


Figure A3.6 – Projected Visayas Grid Generation and Load Distribution in 2030

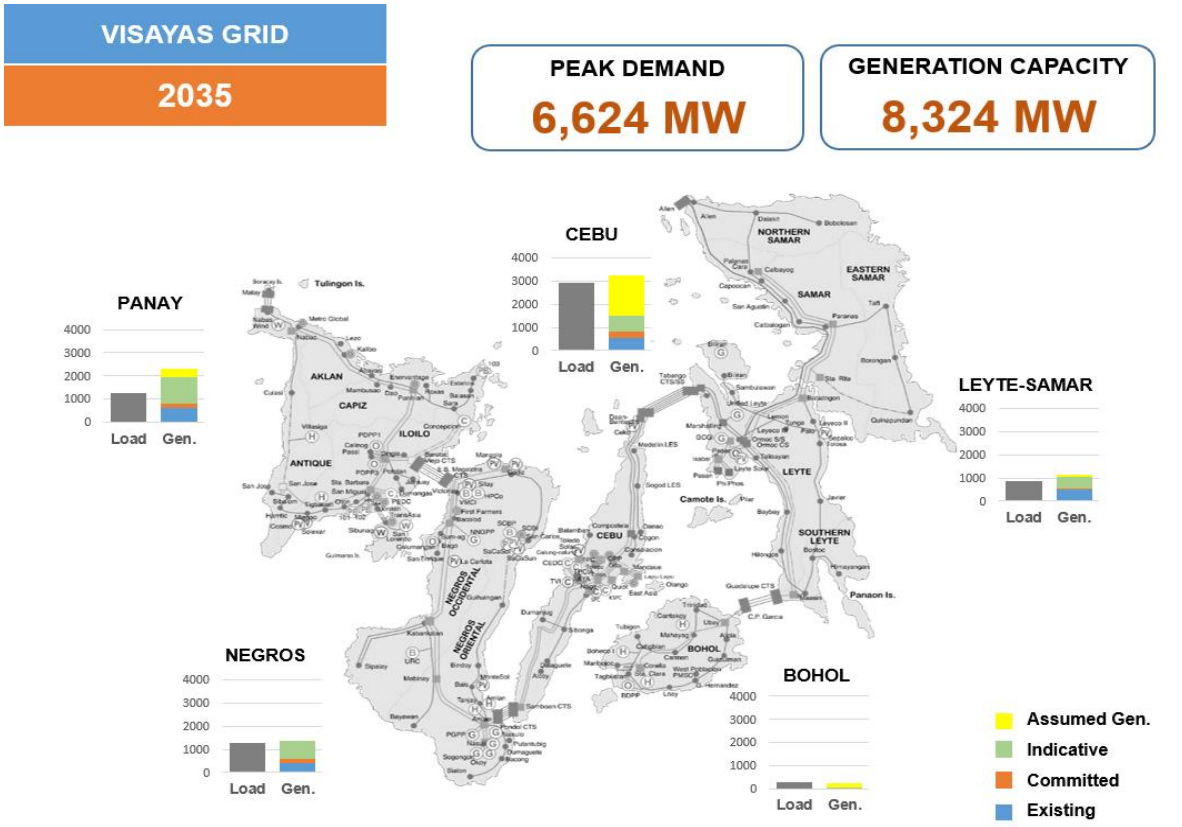


Figure A3.7 – Projected Visayas Grid Generation and Load Distribution in 2035

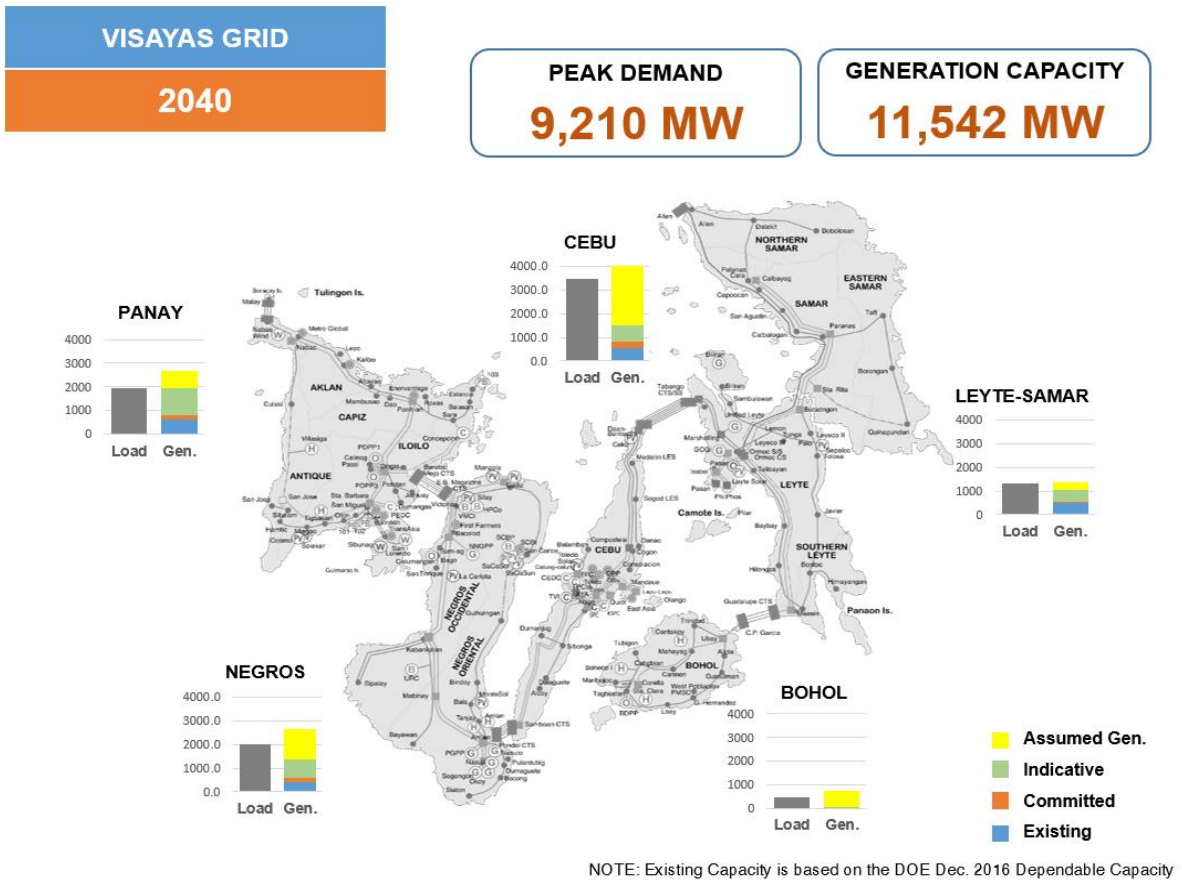
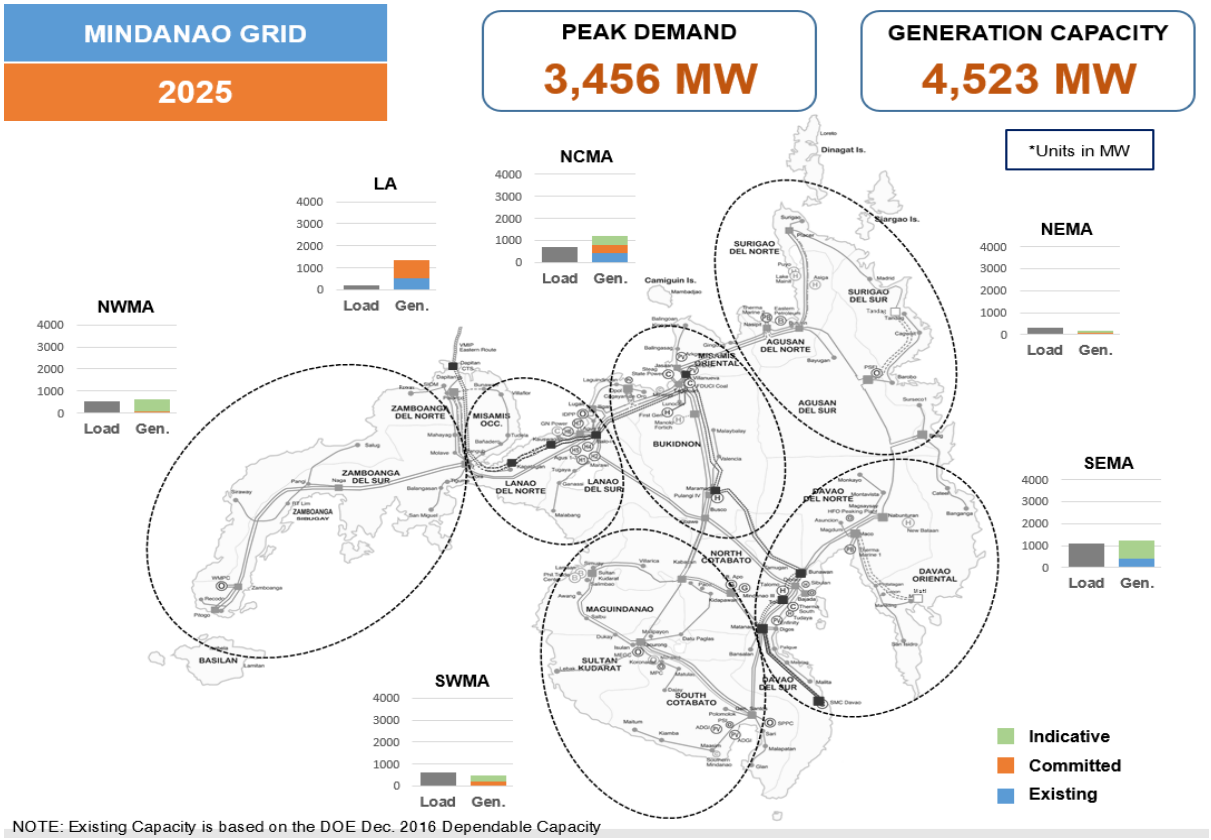


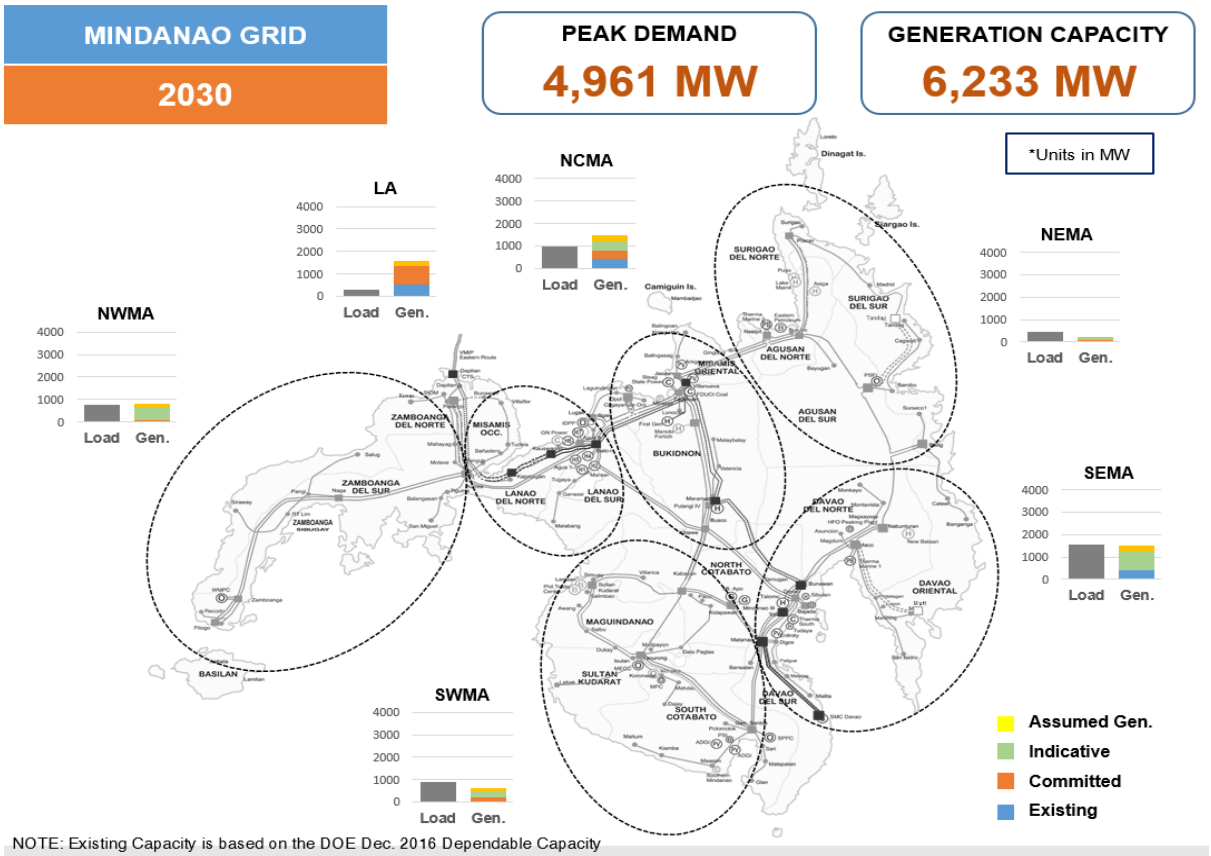
Figure A3.8 – Projected Visayas Grid Generation and Load Distribution in 2040

Generation and Load Distribution in the Mindanao Grid



NOTE: Existing Capacity is based on the DOE Dec. 2016 Dependable Capacity

Figure A3.9 – Projected Mindanao Grid Generation and Load Distribution in 2025



NOTE: Existing Capacity is based on the DOE Dec. 2016 Dependable Capacity

Figure A3.10 – Projected Mindanao Grid Generation and Load Distribution in 2030

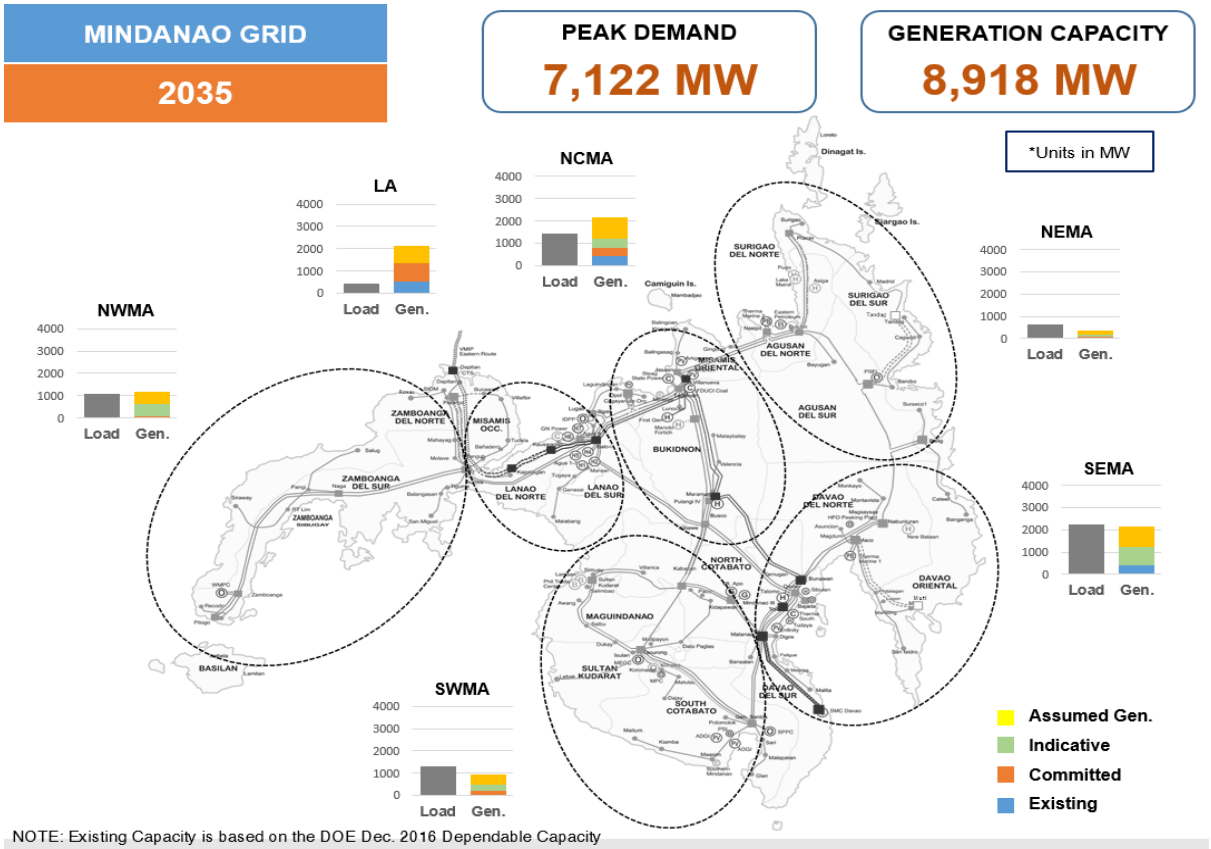


Figure A3.11 – Projected Mindanao Grid Generation and Load Distribution in 2035

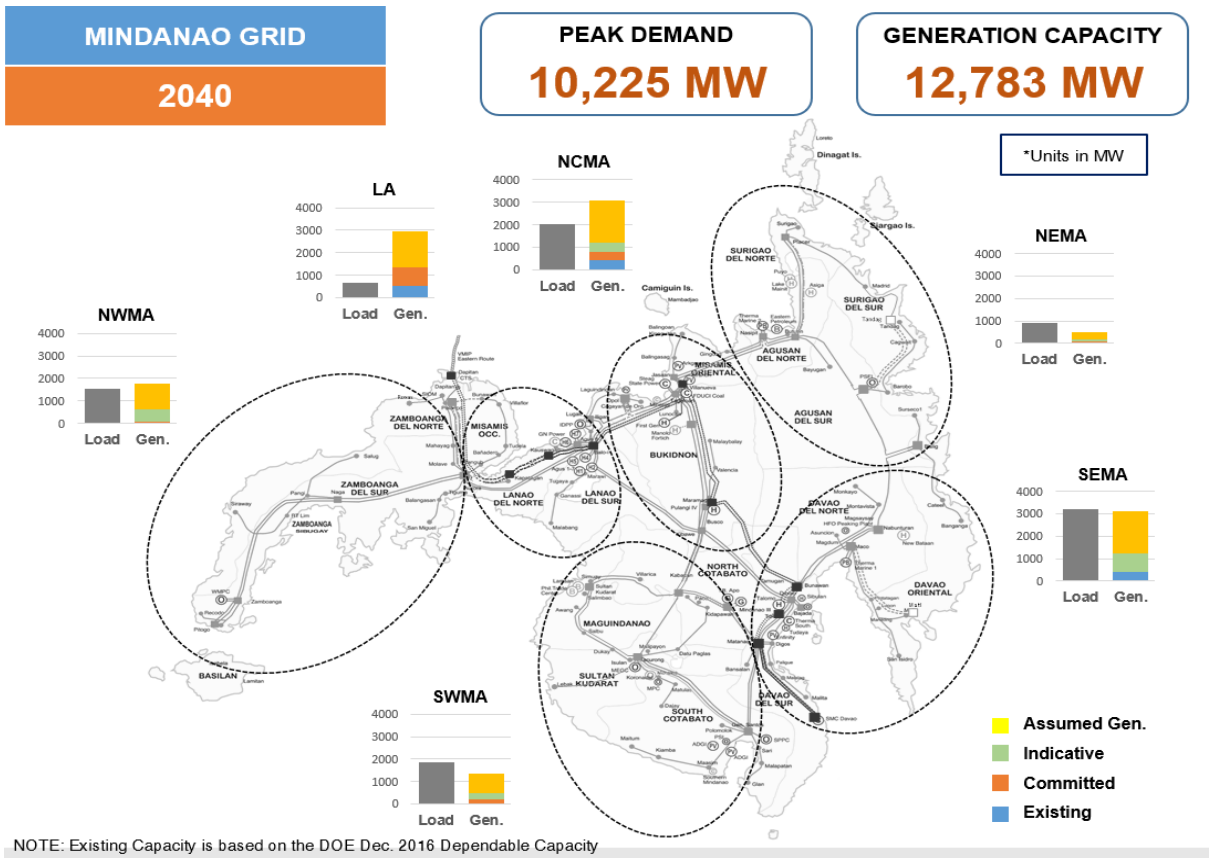


Figure A3.12 – Projected Mindanao Grid Generation and Load Distribution in 2040

Appendix 4 – Other Renewable Energy Potential[8]

USAID Biomass Resource Assessment - Luzon

Table A4.1 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 A4.2 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	

[8] All data presented in Appendix 4 are sourced from DOE.

Table A4.3 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 A4.4 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 A4.5 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
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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 A4.6 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

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
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
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

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
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
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

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
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
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
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

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
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
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

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
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
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

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
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
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

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
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
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

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
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
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

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
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 A4.7 AWARDED BIOMASS PROJECTS

Island/Grid	Region	Province	Municipality	Name of Project	Developer	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

Island/Grid	Region	Province	Municipality	Name of Project	Developer	Potential Capacity (MW)
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
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

Table A4.8 AWARDED OCEAN ENERGY PROJECTS

Island/Grid	Region	Province	Municipality	Name of Project	Developer	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 A4.9 AWARDED GEOTHERMAL PROJECTS

Island/Grid	Region	Province	Name of Project	Developer	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

Island/Grid	Region	Province	Name of Project	Developer	Potential Capacity (MW)
	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
			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

Island/Grid	Region	Province	Name of Project	Developer	Potential Capacity (MW)
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 5 – Changes from TDP 2014 – 2015 to TDP 2016 – 2040

Project Name	2014 – 2015 TDP	TDP 2016 – 2040	Remarks
Luzon Projects			
Bataan-Cavite Transmission Line FS	ETC: Dec 2017	ETC: Jun 2018	Updated ETC based on project timeline
Luzon Substation Reliability I	ETC: May 2016	ETC: Dec 2018	Updated ETC based on project timeline Remaining works for Labo 50 MVA transformer
Luzon PCB Replacement	ETC: Dec 2016	ETC: Dec 2018	Updated ETC based on project timeline
San Jose–Angat 115 kV Line Upgrading	ETC: Jun 2017	ETC: Dec 2018	Updated ETC based on project timeline
San Jose-Quezon 230 kV Line 3	ETC: Dec 2017	ETC: Mar 2019	Updated ETC based on project timeline
Hermosa-Floridablanca 69 kV T/L	ETC: Mar 2018 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	ETC: Jun 2019 Hermosa–Floridablanca 69 kV Transmission Line 1-795 MCM ACSR/AS, SP/ST-SC, 17.7 km Hermosa Substation 3-69 kV PCBs	Updated ETC based on project timeline Decrease in line length based on field survey. Project component transferred from North Luzon Substation Upgrading
Relocation of Steel Poles along Hermosa–Duhat 230 kV Transmission Line	ETC: Dec 2018 Hermosa – Duhat 230 kV T/L 18 steel poles	ETC: Jun 2019 Hermosa–Duhat 230 kV Transmission Line 230 kV, SP-SC, 2-795 MCM, 20 steel poles	Updated ETC based on project timeline Updated steel pole component based on actual survey
Bataan 230 kV Grid Reinforcement	ETC: Dec 2018	ETC: Aug 2019	Updated ETC based on project timeline
Mariveles–Hermosa 500 kV Transmission Line	ETC: Nov 2019 New Mariveles 500 kV S/S 9-500 kV PCBs	ETC: Sep 2019 New Mariveles 500 kV Substation	Updated ETC based on project timeline

	Mariveles-Hermosa 500 kV T/L ST-DC, 4-410 mm^2 TACSR/AS, 40 km	14-500 kV PCBs Mariveles–Hermosa 500 kV Transmission Line ST-DC, 4-410 mm^2 TACSR/AS, 49.2 km Mariveles–Mariveles (GN Power): Power Supply 13.8 kV Transmission Line SP-DC, 2/0 MCM ACSR, 3.28 km	Additional PCBs for the power plant connection Update project components based on route survey
North Luzon Substation Upgrading Project	ETC: Dec 2018 / Jun 2022	ETC: Oct 2019 / Jun 2022	Updated ETC based on project timeline
	Stage 1 Bauang 230 kV S/S (Replacement) 7-230 kV PCBs	Stage 1: Bauang 230 kV Substation (Replacement) 6-230 kV PCBs	
	Hermosa 69 kV S/S 12-69 kV PCBs	Hermosa 69 kV Substation 10-69 kV PCBs	Two P CBs were transferred under Hermosa–Floridablanca 69 kV Transmission Line Project
		Quezon 230 kV Substation (Expansion) 3-230 kV PCBs	Due to reconfiguration of termination brought by the additional transformer of Meralco
		Concepcion 69 kV Substation 22-69 kV PCBs	Reconfiguration of 69 kV feeder to allow the termination of additional loads and solar power plant
	Stage 2: Bacnotan 230 kV S/S (Expansion) 1-50 MVA 230/69-13.8 kV Power Transformer	Stage 2: Bacnotan 230 kV S/S (Expansion) 1x100 MVA 230/69-13.8 kV Power Transformer	Increase in transformer capacity due to the incoming 60 MW Hydro Electric Power Plant of Cordillera Hydro Electric Corporation that will connect at the Bacnotan 69 kV Substation.
	Labrador 230 kV S/S (Replacement) 1-100 MVA 230/69-13.8 kV Power Transformer	Labrador 230 kV S/S (Replacement) 1x300 MVA 230/69-13.8 kV Power Transformer	Increase in transformer capacity due to aggressive load growth in Labrador.
		San Rafael 230 kV Substation (Expansion) 2-69 kV PCBs	Termination for the proposed power plant connection

		Subic 230 kV Substation (Expansion) 4-230 kV PCBs	Termination for the Jovin SQM power plant connection
Pagbilao 500 kV Substation	ETC: Aug 2018	ETC: Nov 2019	Updated ETC based on project timeline
Eastern Albay 69 kV Transmission Line Stage 2	ETC: Jun 2019	ETC: Nov 2019 Sto. Domingo Substation 1-69V PCBs Subic 230 kV Substation 3-230 kV PCBs	Updated ETC based on project timeline Inclusion of 1-69 kV PCB for operational flexibility Termination of Jobin SQM
Tuguegarao-Lal-lo (Magapit) 230 kV T/L	ETC: Oct 2018	ETC: Dec 2019	Updated ETC based on project timeline
Hermosa–San Jose 500 kV Transmission Line	ETC: May 2018	ETC: Dec 2019	Updated ETC based on project timeline
Tuy 500 kV Substation (Stage 1)			New project under TDP 2016-2040
Luzon Voltage Improvement Project – 3	ETC: Jan 2018 / Jun 2022 Stage 1: Paniqui Load-end 69 kV S/S, 3-5 MVAR 69 kV Capacitor Banks Stage 2: Bayambang Load-end 69 kV Substation, 3-5 MVAR 69 kV Capacitor Banks	ETC: Jan 2020 / Jun 2022 Stage 1: Camiling Load-end 69 kV Substation, 3x5 MVAR 69 kV Capacitor Banks, 4-69 kV PCBs Stage 2: Bautista Load-end 69 kV Substation, 3x5 MVAR 69 kV Capacitor Banks, 4-69 kV PCBs	Updated ETC based on project timeline Relocation of the proposed capacitor installation in Paniqui to Camiling was brought about the future relocation of Tarelco I Paniqui LE. The relocation of capacitor location from Bayambang to Bautista LE was due to the shifting of Cenpelco's Bayambang LE from San Manuel to Balingueo
Clark–Mabiga 69 kV Transmission Line	ETC: Jun 2018	ETC: Feb 2020	Updated ETC based on project timeline
Tiwi Substation Upgrading	ETC: Jul 2019 Tiwi C 230 kV S/S, 15-230 kV PCBs	ETC: Mar 2020 Tiwi C 230 kV Substation 12-230 kV PCBs	Updated ETC based on project timeline Reduction due to redeployment of PCBs from other substation Updated transmission line component

		Daraga/Naga–Tiwi C Line Extension 230 kV Transmission Line ST-DC, 1-795 MCM ACSR/AS, 0.7 km Tiwi A–Tiwi C Line Extension 230 kV Transmission Line ST-DC, 1-795 MCM ACSR/AS, 0.3 km Malinao/Ligao–Tiwi C Line Extension 69 kV SP-SC, 1-336.4 MCM ACSR/AS, 1.5 km	based on actual survey.
Antipolo 230 kV Substation	ETC: Dec 2019 Bus-in point along San Jose-Taytay 230 kV T/L ST-DC 4-795 MCM ACSR, 2 km	ETC: Mar 2020 Bus-in point along San Jose–Taytay 230 kV Transmission Line ST-DC, 4-795 MCM ACSR, 2-0.75 km	Updated ETC based on project timeline
Western 500 kV Backbone (Stage 1)	ETC: Dec 2018	ETC: Jun 2020	Updated ETC based on project timeline
Mexico–San Simon 69 kV Transmission Line	ETC: Jun 2020		Harmonized with the new project scheme of San Simon 230 kV Substation Project
Luzon Voltage Improvement Project – 4	ETC: Dec 2019 / Jun 2022	ETC: Jul 2020 / Jun 2022 Stage 1: Bulan Load-End 69 kV Substation 3x2.5 MVAR, 69 kV Capacitor Banks, 4-69 kV PCBs Malvar Load-End 69 kV Substation 2x5 MVAR, 69 kV Capacitor Banks, 3-69 kV PCBs	Updated ETC based on project timeline Augmentation for the capacitor banks at Balogo Switching Station
Manila (Navotas) 230 kV Substation	ETC: May 2020	ETC: Aug 2020	Updated ETC based on project timeline
Ambuklao–Binga 230 kV Transmission Line Upgrading	ETC: Dec 2019	ETC: Dec 2021	Updated ETC based on project timeline
Binga–San Manuel 230 kV Transmission Line Stage 1 & 2	ETC: Dec 2019	ETC: Dec 2021	Updated ETC based on project timeline
South Luzon Substation Upgrading Project	STAGE 1 Naga 230 kV S/S (Replacement) 1-230 kV PCB	Stage 1: Lumban 230 kV Substation (Expansion) 2-69 kV PCBs	PCB component update based on substation design layout

	STAGE 2 Daraga 230 kV S/S (Replacement) Gumaca 230 kV S/S (Replacement) 3-69 kV PCBs	Stage 2: Daraga 230 kV Substation (Replacement) 4-230 kV and 2-69 kV PCBs Gumaca 230 kV Substation (Replacement) 2-69 kV PCBs	
Northern Luzon 230 kV Loop	Bangui – Pamplona – Lal-lo (Magapit) 230 kV, ST-DC, 1-795 MCM, ACSR, 130 km Pamplona 230 kV S/S (New) 2-300 MVA, 230/115-13.8 kV Power Transformers, 10-230 kV and 6-115 kV PCBs	Sanchez Mira 230 kV Substation (New) 2x300 MVA, 230/115-13.8 kV Power Transformers, 10-230 kV and 6-115 kV PCBs Pudtol 230 kV Substation (New) 10-230 kV PCBs Bangui–Sanchez Mira 230 kV Transmission Line ST-DC, 2-795 MCM, ACSR, 70 km Sanchez Mira–Pudtol, 230 kV Transmission Line ST-DC, 2-795 MCM, ACSR, 57 km Pudtol–Lal-lo (Magapit), 230 kV Transmission Line ST-DC, 2-795 MCM, ACSR, 38 km	Update on the location of collector station in Cagayan Valley Area Inclusion of Pudtol 230 kV Substation to cater Hydro generation in the Province of Apayao
Pinamukan 500/230 kV Substation			New project under TDP 2016-2040
Sta. Maria / Ibaan 500 kV Substation			The project was harmonized with the development of the proposed Pinamukan 500/230 kV Substation to cater the bulk generation development in Batangas City.

Bolo–San Pablo 500 kV Transmission Line			New project under TDP 2016-2040
Pagbilao–Tayabas 500 kV Transmission Line	Pagbilao-Tayabas 500 kV T/L ST-DC, 4-795 MCM ACSR/AS, 17 km	Pagbilao-Tayabas 500 kV T/L ST-DC, 4-795 MCM ACSR/AS, 21 km Naga Line Extension 230 kV Transmission Line ST-DC, 4-795 MCM ACSR/AS, 1.5 km	Updated transmission line component based on actual survey.
Bolo 5th Bank	ETC: Jun 2019	ETC: Dec 2025	Updated ETC based on project timeline
Calamba 230 kV Substation	ETC: Mar 2019	ETC: Jul 2019	Updated ETC based on project timeline
Tanauan 230 kV Substation	Tanauan 230 kV S/S 1-100 MVA, 230/69 kV Power Transformer, 7-230 kV and 3-69 PCBs	Tanauan 230 kV Substation 2x100 MVA, 230/69 kV Power Transformer, 8-230 kV and 5-69 PCBs Calamba 230 kV Substation 2-230 kV PCBs	Updates on the component based on the feeders that will terminate at connect Tanauan Substation
Pasay 230 kV Substation	ETC: Jul 2020	ETC: Aug 2020	Updated ETC based on project timeline
Concepcion–Sta. Ignacia 69 kV Transmission Line			New project under TDP 2016-2040
Nagsaag–Tumana 69 kV Transmission Line			New project under TDP 2016-2040
Taguig 500 kV Substation	ETC: Nov 2020	ETC: Feb 2021	Updated ETC based on project timeline
Plaridel 230 kV Substation			New project under TDP 2016-2040
San Simon 230 kV Substation	ETC: Feb 2024 San Simon 230 kV S/S 1-300 MVA 230/69 kV transformer, 5-230 kV and 9-69 kV PCBs	ETC: May 2021 San Simon 230 kV Substation 2x300 MVA 230/69 kV transformer, 2-100 MVAR 230 kV capacitor, 8-230 kV and 4-69 kV PCBs Mexico 230 kV Substation 6-69 kV PCBs	Updated ETC based on project timeline Updates on the project component based on the new and expansion of existing steel plants in the area

	230 kV T/L Extension 2-795 MCM ACSR, ST-DC, 4-km. from the bus-in point along Hermosa-Duhat Line	230 kV Transmission Line Extension 2-795 MCM ACSR, SP-DC, 1.5 km. from the cut-in point along Hermosa–Duhat Line Mexico–STR 120D (Calumpit Line Segment) 69 kV Line SP-SC, 1-410 mm^2 TACSR, 12.3 km STR 120D–PELCO 3 (Apalit Tap) 69 kV Line SP-SC, 1-410 mm^2 TACSR, 2.52 km San Simon–Real Steel 69 kV Line SP-SC, 1-410 mm^2 TACSR, 3.27 km San Simon–Melters 69 kV Line SP-SC, 1-410 mm^2 TACSR, 6.10 km	
Pinili 230 kV Substation	ETC: Dec 2019 Pinili 115 kV S/S (New) 1-100 MVA 115/69-13.8 kV Power Transformer, 6-115 kV and 5-69 kV PCBs	ETC: Jun 2021 Pinili 230 kV Substation (New) 1x100 MVA 230/69 kV Power Transformer, 10-230 kV and 5-69 kV PCBs **Pinili 'bus-in' to San** Esteban–Laoag 230 kV Transmission Line ST-DC, 1-795 MCM ACSR/AS, 2 km Pinili–Currimao 69 kV Transmission Line ST-DC, 1-795 MCM ACSR/AS, 7 km	Updated ETC based on project timeline Change to 230 kV Substation based on the long term development in the area. This includes the anticipated renewable energy connection in Ilocos Region
Marilao 500 kV Substation	Marilao 500 kV S/S 14-500 kV and 14-230 kV PCBs Marilao-Manila 230 kV T/L SP-DC, 4-795 MCM ACSR, 3.6 km	Marilao 500 kV Substation 16-500 kV and 12-230 kV PCBs, 2x90 MVAR Line Reactor, 2x100 MVAR Shunt Capacitor Navotas Line Extension to Marilao 230 kV Transmission Line SP-DC, 4-795 MCM ACSR/AS, 3.6 km	Inclusion of 2x100 MVAR Capacitor and its associated PCBs Referring to the same transmission line extension

Abuyog 230 kV Substation	Abuyog (Sorsogon) 230 kV S/S 6-230 kV PCBs	Abuyog (Sorsogon) 230 kV Substation 2-25 MVAR Capacitor, 2-25 MVAR Shunt Reactor, 10-230 kV PCBs	Inclusion of 2x25 MVAR Capacitor and 2x25 MVAR Shunt Reactor along with its associated PCBs
Liberty 230 kV Substation			New project under TDP 2016-2040
Porac 230 kV Substation	Porac 230 kV S/S 1-300 MVA 230/69 kV transformer, 5-230 kV and 9-69 kV PCBs Hermosa-Porac-Clark 4-795 MCM ACSR, ST-DC, 54 km	Porac 230 kV Substation 2x300 MVA 230/69 kV transformer, 8-230 kV and 4-69 kV PCBs Capas 230 kV Substation (Expansion) 4-230 kV PCBs Hermosa–Porac–Capas ST-DC, 4-795 MCM ACSR, 64 km Clark 230 kV Transmission Line Extension ST-DC, 4-795 MCM ACSR, 5 km	Increase in transformer capacity due to aggressive load growth in the area and maintaining the n-1 provision of the PGC. Update on the configuration
Capas 230 kV Substation			New project under TDP 2016-2040
Silang 500 kV Substation			New project under TDP 2016-2040
Tower Structure Upgrading of Bicol Transmission Facilities			New project under TDP 2016-2040
La Trinidad–Calot 69 kV Transmission Line	ETC: Jun 2019 La Trinidad 69 kV S/S Expansion 1-69 kV PCB	ETC: Dec 2021 La Trinidad 69 kV S/Y Expansion 1-69 kV PCB	Updated ETC based on project timeline
Nasugbu 69 kV Switching Station			New project under TDP 2016-2040
San Manuel–Nagsaag 230 kV Transmission Line	Binga Line Extension 230 kV, SP-DC, 2-795 MCM ACSR, 0.6 km	Binga Line Extension 230 kV, SP-DC, 2-795 MCM ACSR/AS, 0.8 km	Updated transmission line component based on actual survey.
Taguig–Taytay 230 kV Transmission Line	ETC: Oct 2020 Taytay 230 kV S/S 4-230 kV PCBs	ETC: Sep 2022 Taytay 230 kV Substation Expansion 6-230 kV PCBs	Updated ETC based on project timeline Additional PCBs due to the reconfiguration of the substation

Minuyan 115 kV Switching Station	Minuyan Switching Station 8-115 kV PCBs	Minuyan Switching Station 11-115 kV PCBs	Update on number of PCBs based on the reconfiguration
Balayan 69 kV Switching Station	ETC: Jun 2021	ETC: Jun 2024	Updated ETC based on project timeline
Western 500 kV Backbone – Stage 2	ETC: Jun 2024 Castillejos 500 kV S/S 6-230 kV PCBs	ETC: Jun 2025 Castillejos 230 kV Substation 2x300 MVA, 230/69 kV Power Transformer, 12-230 kV Bolo 500 kV Substation 4-500 kV PCBs Hermosa 500 kV Substation 4-500 kV PCBs	Updated ETC based on project timeline
Navotas–Dona Imelda 230 kV Transmission Line	Manila/Navotas-Dona Imelda 230 kV T/L 2-410 mm^2 TACSR, SP-DC, 10 km	Manila/Navotas–Dona Imelda 230 kV Transmission Line SP-DC, 2-610 mm^2 TACSR, 4.6 km and 230 kV XLPE cable, 4.7 km Navotas 230 kV Substation Expansion 2-230 kV PCBs	Updates on project scheme
Navotas–Pasay 230 kV Transmission Line	ETC: Jul 2020 Navotas-Pasay 230 kV T/L 4-795 MCM ACSR, SP-DC, 13 km	ETC: Dec 2025 Navotas–Pasay (Submarine Cable Portion) 230 kV Transmission Line SC-DC, 2-200 mm^2XLPE, 14 km Navotas–Pasay (Overhead Line Portion) 230 kV Transmission Line SP-DC, 2-410 mm^2 TACSR/AS, 1.3 km	Updated ETC based on project timeline Consider submarine cable option
Daraga–Ligao 69 kV Transmission Line Upgrading	ETC: Dec 2022	ETC: Dec 2025	Updated ETC based on project timeline
Naga–Pili 69 kV Transmission Line Upgrading	ETC: Dec 2022	ETC: Dec 2025	Updated ETC based on project timeline
La Trinidad–Sagada 230 kV Transmission Line	ETC: Dec 2024	ETC: Dec 2027	Updated ETC based on project timeline
Tuy 500/230 kV Substation (Stage 2)			New project under TDP 2016-2040
Bolo–San Pablo 500 kV Transmission Line			New project under TDP 2016-2040

Pinamukan–Tuy 500 kV Line			New project under TDP 2016-2040
Liberty–Nagsaag 230 kV Transmission Line	ETC: Dec 2024 Liberty 230 kV S/S 1-100 MVA 230/69 kV Power Transformer, Control Room Liberty 230 kV S/S 11-230 kV PCBs	ETC: Dec 2029 Liberty 230 kV Substation 6-230 kV PCBs	Updated ETC based on project timeline Liberty 230 kV Substation already a separate project. Five PCBs already part of the Liberty 230 kV Substation Project
Luzon–Visayas HVDC Bipolar Operation			New project under TDP 2016-2040
San Esteban–Laoag 115 kV Transmission Line Upgrading			New project under TDP 2016-2040
Saog 230 kV Substation			New project under TDP 2016-2040
Malvar 230 kV Substation	ETC: Dec 2024	ETC: Dec 2028	Updated ETC based on project timeline
Iriga 230 kV Substation			New project under TDP 2016-2040
San Agustin 230 kV Substation			New project under TDP 2016-2040
Liberty–Baler 230 kV Transmission Line	ETC: Apr 2025 Liberty 69 kV S/S 4-69 kV PCBs Baler 69 kV S/S Control Room, 4-69 kV PCBs	ETC: Apr 2035 Baler 230 kV Substation 1–50 MVA, 230/69-13.8 kV Power Transformer, 5-230 kV and 3-69 kV PCBs	Updated ETC based on project timeline Change in component due to staging of implementation
Mamplasan 230 kV Substation			New project under TDP 2016-2040
Silang–Las Piñas 230 kV Transmission Line			New project under TDP 2016-2040

Dasmariñas-Las Piñas 230 kV Transmission Line 3 & 4			Harmonized with the project scheme of Silang–Las Piñas 230 kV Transmission Line
Pasay–Taguig 230 kV Transmission Line			New project under TDP 2016-2040
Silang–Taguig 500 kV Transmission Line	ETC: Dec 2024 Silang 500 kV S/S 11-500 kV PCBs	ETC: Dec 2027 Silang 500 kV Substation 4-500 kV PCBs	Updated ETC based on project timeline Silang 500 kV Substation already a separate project
Mexico–Clark 69 kV Transmission Line Upgrading	ETC: Apr 2024	ETC: Apr 2028	Updated ETC based on project timeline
Liberty–Cabanatuan–San Rafael–Mexico 230 kV Transmission Line Upgrading	ETC: Jun 2025	ETC: Apr 2030	Updated ETC based on project timeline
Naga – Presentacion 230 kV Transmission Line			New project under TDP 2016-2040
Limay–Pasay 230 kV Transmission Line			New project under TDP 2016-2040
Santiago–Kabugao 500 kV Transmission Line			New project under TDP 2016-2040
Magalang 230 kV Substation	ETC: Jun 2025	ETC: Jun 2032	Updated ETC based on project timeline
FBGC 230 kV Substation			New project under TDP 2016-2040
San Mateo 230 kV Substation			New project under TDP 2016-2040
Presentacion 230 kV Substation			New project under TDP 2016-2040
Taguig–FBGC 230 kV Transmission Line			New project under TDP 2016-2040
Taguig–Muntinlupa 230 kV Transmission Line			New project under TDP 2016-2040
Alaminos 500 kV Switching Station	ETC: Dec 2024	ETC: Dec 2035	Updated ETC based on project timeline

Matnog 230 kV Substation			New project under TDP 2016-2040
Kalinga 500 kV Substation			New project under TDP 2016-2040
Baras 500 kV Switching Station	ETC: Dec 2024	ETC: Dec 2038	Updated ETC based on project timeline
Sagada–San Esteban 230 kV Transmission Line			New project under TDP 2016-2040
Santiago–Dinadiawan 230 kV Transmission Line	ETC: Nov 2025 Dinadiawan-Baler 230 kV T/L ST-DC, 1-795 MCM ACSR/AS, 52.6 km Dinadiawan 230 kV S/S 1-50 MVA 230/69-13.8 kV Power Transformer, 8-230 kV PCBs Baler 230 kV S/S 6-230 kV PCBs	ETC: Dec 2040 Dinadiawan 230 kV Substation 1x50 MVA 230/69-13.8 kV Power Transformer, 5-230 kV and 3-69 kV PCBs	Updated ETC based on project timeline Change in component due to staging of implementation. Formerly Santiago–Dinadiawan–Baler 230 kV Transmission Line Project
Dinadiawan–Baler 230 kV Transmission Line			Formerly part of the Santiago–Dinadiawan–Baler 230 kV Transmission Line Project
Capas–Kadampat 230 kV Transmission Line			New project under TDP 2016-2040
Bataan–Cavite 230 kV Transmission Line			New project under TDP 2016-2040
Upgrading of Bicol Transmission Facilities			New project under TDP 2016-2040
Batangas-Mindoro Interconnection Project (BMIP)	Batangas–Lobo CTS 230 kV T/L 1-795 MCM ACSR, ST-DC, 45 km Batangas S/S Expansion 1-230 kV PCB	Pinamukan–Lobo CTS 230 kV T/L 1-795 MCM ACSR/AS, ST-DC, 37 km Pinamukan 230 kV Substation 4-230 kV PCBs	Updated transmission line connection

Visayas Projects			
Eastern Panay Transmission Project	ETC: Jun 2016	ETC: Feb 2018	Updated ETC based on project timeline
Visayas Substation Reliability I	ETC: Dec 2016	ETC: Mar 2018	Updated ETC based on project timeline
Sta. Rita–Quinapondan 69 kV Transmission Line	ETC: Jun 2016	ETC: Jun 2018	Updated ETC based on project timeline
Cebu-Negros-Panay 230 kV Backbone Stage 1	ETC: Dec 2017	ETC: Feb 2018	Updated ETC based on project timeline
San Carlos – Guihulngan 69 kV Transmission Line	ETC: Dec 2016	ETC: Jun 2018	Updated ETC based on project timeline
Ormoc–Babatngon 138 kV Transmission Line	ETC: Oct 2016	ETC: Dec 2018	Updated ETC based on project timeline
Visayas Substation Reliability II	ETC: Sep 2017	ETC: Dec 2018	Updated ETC based on project timeline
New Naga (Colon) Substation Project (Remaining Works)	ETC: Mar 2019	ETC: Sep 2019	Updated ETC based on project timeline
Naga (Visayas) Substation Upgrading Project	ETC: Mar 2019	ETC: Sep 2019	Updated ETC based on project timeline
Tagbilaran 69 kV Substation Project	ETC : Dec 2017	ETC : Nov 2019	Updated ETC based on project timeline
Cebu-Lapu-lapu 230 kV T/L	Mandaue-Lapulapu Submarine Cable, SC, 2-3C 500mm^2 XLPE Submarine cables, 0.5 km	Cebu-Lapulapu Submarine Cable SC, 2-3C 500mm^2 XLPE Submarine cables, 1.1 km Cebu-Umapad CTS (initially energized at 138kV) ST/SP-DC, 2-795 MCM ACSR, 9 km	Changes are due to space limitations in Mandaue S/S and change in transmission route due to ROW issues.
Panitan-Nabas 138 kV Transmission Line 2 Project	ETC: Mar 2018	ETC: Dec 2019	Updated ETC based on project timeline
CNP 230 kV Backbone Project - Stage 3 (Negros-Cebu Interconnection)	ETC : Aug 2020 San Carlos 230 kV S/S Magdugo 230 kV S/S 2x300 MVA and 1-150 MVA 230/138 kV Power Transformers San Carlos-Toledo CTS 230 kV Submarine Cable	ETC : Dec 2020 Calatrava 230 kV S/S Magdugo 230 kV S/S 3x300 MVA 230/138 kV Power Transformers Calatrava-Toledo CTS 230 kV Submarine Cable	Updated ETC based on project timeline Specific cable size meeting the 400 MW capacity was only known during the TDP 2016-2040 preparation.

	Double Circuit, 400 MW-capacity XLPE subcable, 29 km	Double Circuit, 6-1,600 mm^2 XLPE subcable, 29 km	
Visayas Voltage Improvement Project	ETC : Dec 2018	ETC : Dec 2021	Updated ETC based on project timeline
CNP 230 kV Backbone Project - Stage 2 (Cebu Substation 230 kV Upgrading)	ETC : Dec 2019 Cebu 230 kV S/S 3-138 kV PCBs	ETC : Jul 2019 Cebu 230 kV S/S 2-138 kV PCBs Extension of Bato-Cebu 230 kV Lines ST-DC, 2-610 mm^2 TACSR OHTL, 0.75 km Extension of Cebu-Lapulapu 230 kV Lines, SP-DC, 4-795 MCM ACSR, 0.425 km Extension of Colon/Quiot-Cebu 138 kV Lines 138 kV Underground Cables, Double Circuit of 180 MW capacity, 0,250 km	Updated ETC based on project timeline Based on updated lay-out/configuration New components under CNP 230 kV Backbone Project - Stage 2 (Cebu Substation 230 kV Upgrading)
Panay–Guimaras 138 kV Interconnection Project	ETC : Dec 2019 Zaldivar 138 kV S/S 5-138 kV and 4-69 kV PCBs Guimaras-Panay 138 kV Submarine Cable XLPE, 100 MW, 3km Zaldivar CTS Cable Sealing End Equipment Panay CTS – PEDC Switching Station ST-DC, 1-795 MCM ACSR, 2km PEDC Switching Station 4-138 kV PCBs Panay CTS Cable Sealing End Equipment	ETC : Jan 2021 Zaldivar 138 kV S/S 6-138 kV and 1-69 kV PCBs Ingore–PEDC 138 kV T/L ST-DC, 1-795 MCM ACSR, 2 km PEDC 138 kV S/S 1x100 MVA, 138/69-13.8 kV Power Transformer , 2-138 kV PCBs and 8-69 kV PCBs ; Zaldivar 69 kV bypass line ST-SC, 1-336.4 MCM ACSR, 0.7 km;	Updated ETC based on project timeline Based on updated lay-out/configuration Reclassified component from Connection Asset to Transmission Asset Reclassified component from Connection Asset to Transmission Asset Specified Ingore as the specific site in Panay Additional 100 MVA for N-1 Based on updated configuration

		PECO Baldoza 69 kV line transfer SP-SC, 1-336.4 MCM ACSR, 0.07 km; PPC & PECO 69 kV line transfer SP-SC, 1-336.4 MCM ACSR, 0.09 km; Banuyao 69 kV line transfer SP-SC, 1-336.4 MCM ACSR, 0.8 km. Zaldivar CTS – Zaldivar SS 138 kV T/L ST-DC, 2-795 MCM ACSR, 1km Zaldivar 69 kV bypass line ST-SC, 1-336.4 MCM ACSR, 0.7 km	
Negros–Panay 230 kV Interconnection Project Line 2		ETC : Dec 2025	New project under TDP 2016 – 2040
Nabas-Caticlan-Boracay 138kV Transmission Line Project	ETC : Mar 2021	ETC : Feb 2021	Updated ETC based on project timeline To comply with N-1 requirement
Amlan–Dumaguete 138 kV Transmission Line Project	ETC : Jun 2023 Amlan 138 kV S/S 4-138 kV PCBs Dumaguete 138 kV S/S (New) 4-69 kV PCBs Amlan–Dumaguete 138 kV T/L ST-DC, 1-795 MCM ACSR, 22 km	ETC : Dec 2021 Amlan 138 kV S/S 3-138 kV PCBs Dumaguete 138 kV S/S (New) 6-69 kV PCBs Amlan–Dumaguete 138 kV T/L ST-DC, 1-795 MCM ACSR, 25 km	Updated ETC based on project timeline Updated configuration based on latest info Updated configuration based on latest info Updated length based on latest info
Laray 230 kV Substation Project	ETC : Dec 2020 Laray 230 kV S/S (New) 2x150 MVA 230/69-13.8 kV Power Transformer , 6-230 kV PCB (GIS), 5-69 kV PCB (GIS) Naga-Laray 230 kV T/L ST/SP-DC, 2-610 mm^2 TACSR, 4-795 MCM ACSR, 22 km	ETC : May 2022 Laray 230 kV S/S (New) 3x100 MVA 138/69-13.8 kV Power Transformer , 11-230 kV PCB (GIS) (initially energized at 138 kV), 7-69 kV PCB (GIS) OHTL from Laray to Tapping Point along Magdugo-Colon 138 kV Lines (initially energized at 138 kV)	Updated ETC based on project timeline Updated based on latest configuration (138 kV initially energized) Specified the connection scheme which is tap, not direct connection

		ST/SP-DC, 2-610 mm^2 TACSR, 4-795 MCM ACSR, 23 km	
Babatngon–Palo 138 kV Transmission Line Project	Babatngon–Palo 138 kV T/L ST-DC, 1-795 MCM ACSR, 20 km.	Babatngon–Palo 230 kV T/L (138 kV energized) ST-DC, 4-795 MCM ACSR, 20 km.	Changes to accommodate future load growth in Leyte and considers long term development of 230 kV Backbone loop among Cebu, Bohol and Leyte Islands.
Silay 230 kV Substation Project		ETC : Sep 2024	New project under TDP 2016 – 2040
Unidos 138 kV Substation Project		ETC : Sep 2025	New project under TDP 2016 – 2040
Sogod 230 kV Substation Project		ETC : Sep 2025	New project under TDP 2016 – 2040
Iloilo 230 kV Substation Project		ETC : Dec 2025	New project under TDP 2016 – 2040
Cebu–Bohol 230 kV Interconnection Project	ETC : Dec 2020 Sibonga 138 kV S/S (New) 1x50MVA, 138/69 kV Transformer, 13-138 kV and 3-69 kV PCBs , 3-40 MVAR Reactor Corella 138 kV S/S 3-138 kV PCB 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	ETC : Dec 2021 Dumanjug 230 kV S/S 6-230 kV PCBs , 2x40 MVAR Reactor Corella 230 kV S/S 2x300 MVA, 230/138kV Power Transformer , 8-230 kV and 2-138 kV PCBs , 2x40 MVAR Reactor Dumanjug S/S–Sibonga CTS ST-DC, 4-795 MCM, 20 km; Sibonga CTS–Corella CTS Single circuit submarine cable system of 400 MW capacity at 230 kV, 30km Loon CTS-Corella S/S ST-DC, 4-795 MCM, 17 km	Updated ETC based on project timeline Changed S/S site based on latest survey results Transformer under MVIP Updated based on latest configuration Adapted outright 230 kV scheme Additional OHTL due to change in site Changed to higher capacity and voltage as it will be part of the backbone

Calbayog–Allen 69 kV Transmission Line Project	Calbayog-Allen 69kV T/L SP-SC 1-336.4 MCM ACSR, 78 km.	Calbayog-Allen 138 kV T/L (69 kV energized) ST/SP-DC1 1-795 MCM ACSR, 78 km	Changed to higher capacity of transmission line to support future development in Northern Samar
Visayas Substation Upgrading Project - 1	Leyte: Tabango 230 kV S/S 2-230 kV PCBs and 1-69 kV PCB Maasin 138 kV S/S 2-230 kV PCBs and 1-69 kV PCB Cebu: Daanbantayan 230 kV S/S 1-230 kV PCB	Leyte: Tabango 230 kV S/S Maasin 138 kV S/S Cebu: Daanbantayan 230 kV S/S	Updated based on latest configuration Updated based on latest configuration Updated based on latest configuration
Barotac Viejo–Natividad 69 kV Transmission Line	ETC : Dec 2023 Barotac Viejo–Natividad 69 kV T/L SP-SC, 1-336.4 MCM ACSR, 7km	ETC : Dec 2022 Barotac Viejo–Natividad 69 kV T/L ST-SC, 1-336.4 MCM ACSR, 7km	Updated ETC based on project timeline
Babatngon–Sta. Rita 138 kV Transmission Line Upgrading	ETC : Dec 2024	ETC : Dec 2023	Updated ETC based on project timeline
Visayas Substation Upgrading Project - 2	ETC : Dec 2025	ETC : Dec 2024	Updated ETC based on project timeline
Tabango–Biliran 69 kV Transmission Line Project			New project under TDP 2016 – 2040
Laray–Naalad 230 kV Energization Project			New project under TDP 2016 – 2040
Cordova–Laray 230 kV Transmission Line Project			New project under TDP 2016 – 2040
Taft–Bobolosan 69 kV Transmission Line Project			New project under TDP 2016 – 2040
Bayawan–Sipalay 69 kV Transmission Line			New project under TDP 2016 – 2040
Siaton–Bayawan 69 kV Transmission Line			New project under TDP 2016 – 2040
Iloilo–Nabas 230 kV T/L			New project under TDP 2016 – 2040

Tigbauan 138 kV S/S			New project under TDP 2016 – 2040
Sipalay 138 kV S/S			New project under TDP 2016 – 2040
Marshalling-Babatngon 230kV T/L			New project under TDP 2016 – 2040
Allen-Catarman 138kV T/L			New project under TDP 2016 – 2040
Calbayog–Catarman 138 kV T/L			New project under TDP 2016 – 2040
Visayas Voltage Improvement 2			New project under TDP 2016 – 2040
Umapad-Compostela 230 kV T/L			New project under TDP 2016 – 2040
Cebu-Leyte 230kV Interconnection Line 3			New project under TDP 2016 – 2040
Caticlan-Boracay Interconnection Line 2			New project under TDP 2016 – 2040
Bacolod-Kabankalan 138 kV T/L			New project under TDP 2016 – 2040
San Jose-Nabas 138 kV T/L			New project under TDP 2016 – 2040
Palo-Javier 230 kV T/L	ETC: Jun 2025	ETC: Sep 2034	Updated ETC based on project timeline
Cebu-Bohol 230 kV Line 2			New project under TDP 2016 – 2040
Bohol-Leyte 230 kV Interconnection			New project under TDP 2016 – 2040
Visayas Voltage Improvement 3			New project under TDP 2016 – 2040
Babatngon – Borongan 138 kV T/L			New project under TDP 2016 – 2040
Catarman – Borongan 138 kV T/L			New project under TDP 2016 – 2040

Umapad – Cordova 230 kV T/L			New project under TDP 2016 – 2040
Mindanao Projects			
Manolo Fortich (Lingion) 138 kV Switching Station			New substation under TDP 2016 – 2040 which is being constructed as Contribution in Aid of Construction (CIAC) by Hedcor Bukidnon, Inc.
Balo-i-Kauswagan 230 kV T/L (Formerly Balo-i-Kauswagan-Aurora 230 kV T/L (Phase 1))	ETC: Aug 2017 Kauswagan 230 kV S/S 10-230 kV PCBs Balo-I S/S Expansion 4-230 kV PCBs Balo-I – Kauswagan 230 kV T/L ST-DC, 2-410mm^2 TACSR, 11 km	ETC: Apr 2018 Kauswagan 230 kV S/S 12-230 kV PCBs Balo-I S/S Expansion 2x300 MVA 230/138 kV Transformers, 8-230 kV and 4-138 kV PCBs Balo-I – Kauswagan 230 kV T/L ST-DC, 2-410mm^2 TACSR, 11.1 km	Updated ETC based on project timeline Change on quantity of components were based on updated configuration
Aurora-Polanco 138 kV T/L	ETC: Aug 2017 Polanco 138 kV S/S (new) 5-138 kV PCBs Aurora 138 kV S/S (Expansion) 3-138 kV PCBs Cut-in 69 kV T/L SC-SP/CP 1-336.4 MCM, 4 km Polanco-Polanco (LES) 69 kV T/L SP/CP-DC, 1-336.4 MCM ACSR, 11 km Polanco LES 3-69 kV Air Break Switch	ETC: Jun 2018 Polanco 138 kV S/S (new) 3-138 kV PCBs Aurora 138 kV S/S (Expansion) 4-138 kV PCBs Cut-in 69 kV T/L SP-DC, 1-336.4 MCM ACSR, 4 km	Updated ETC based on project timeline Change on quantity of PCBs and length of transmission line were based on updated configuration
Sultan Kudarat (Nuling) Capacitor Project	ETC: Dec 2016	ETC: Jun 2018	Updated ETC based on project timeline
Agus 6 Switchyard Upgrading / Rehabilitation Project	ETC: Dec 2016	ETC: Jun 2018	Updated ETC based on project timeline
Butuan-Placer 138 kV T/L	ETC: Dec 2017	ETC: Oct 2018	Updated ETC based on project timeline

Toril 138 kV S/S Phase 2	ETC: Dec 2017	ETC: Dec 2018 Toril 138 kV S/S 2-138 kV PCBs	Updated ETC based on project timeline Project is part of Toril SS Project. It was deferred to give way for the advance implementation of Toril Substation Phase 1 (TSI power plant's connection facility)
Mindanao 230 kV Transmission Backbone	ETC: Dec 2018 Balo-i 230 kV S/S: 10-230 kV PCBs Villanueva 230 kV S/S: 1-69 kV PCB	ETC: Mar 2019 Balo-i 230 kV S/S: 2-230 kV PCBs	Updated ETC based on project timeline The original 8-230 kV PCBs for Balo-i Substation were repackaged for Baloi-i-Kauswagan 230 kV T/L Project
Agus 2 Switchyard Upgrading Project	ETC: Feb 2018	ETC: May 2019	Updated ETC based on project timeline
Kauswagan-Lala 230 kV T/L (Formerly Balo-i-Kauswagan-Aurora 230 kV Transmission Line (Phase 2))	ETC: Dec 2022 Aurora 230 kV S/S Expansion 2-300 MVA 230/69-13.8 kV Power Transformers, 6-230 kV and 4-138 kV PCBs Kauswagan 230 kV S/S Expansion 2-230 kV PCBs	ETC: Dec 2020 Lala 230 kV S/S (New) 2x300 MVA 230/138-13.8 kV Power Transformers, 6-230 kV and 6-138 kV PCBs Aurora 138 kV S/S Expansion 3-138 kV PCBs Kauswagan-Lala 230 kV T/L ST-DC, 2-410 mm^2, 86 km Lala 230 kV S/S – Aurora 138 kV S/S Tie Line ST-DC, 2-410 mm^2, 12 km	Updated ETC based on project timeline Changed components on the project due to change in new location of Converter Station from New Aurora SS to Lala substation Transferred 2-230 kV PCBs under Kauswagan 230 kV S/S to Baloi-i-Kauswagan 230 kV T/L Project
Tacurong-Kalamansig 69 kV Transmission Line	ETC: Nov 2019 Tacurong-Kalamansig 69kV T/L ST-SC, 1-336.4MCM ACSR, 80 km transmission line including Communication System	ETC: Sep 2021 Kalamansig 69kV Switching Station 3-69kV PCBs Tacurong-Kalamansig 69kV T/L ST-SC, 1-336.4MCM ACSR, 120 km	Updated ETC based on project timeline Components were updated based on the latest conceptual design
Mindanao Substation Upgrading	Tagoloan 138 kV S/S 1-100 MVA 138/69 kV Power Transformer, 3-138 kV and 2-69 kV PCBs Placer 138 kV S/S 6-69 kV PCBs	Placer 138 kV S/S 5-69 kV PCBs	Components were updated based on the latest demand forecast as well as on the latest conceptual design

	Kidapawan 138 kV S/S 1x50 MVA 138/69 kV Power Transformer	Kidapawan 138 kV S/S 1x50 MVA 138/69 kV Power Transformer (from Culaman S/S)	
Mindanao Substation Rehabilitation		Bunawan 138 kV S/S 6-138 kV PCBs Tagoloan 138 kV S/S 4-138 kV and 1-69 kV PCBs	Components were updated due to the connection of DLPC and the updated list from O&M.
Villanueva–Butuan 230 kV Transmission Line			New Project under TDP 2016-2040
Mindanao Substation Expansion 3 Project			New Project under TDP 2016-2040
Kabacan 138 kV Substation	Kabacan 138 kV S/S 8-138 kV PCBs Kabacan-Manauban 69 kV T/L SC-SP/CP, 1-336.4 MCM, 10 km. Kabacan-Villarica 69 kV T/L SC-SP/CP, 1-336.4 MCM, 2 km	Kabacan 138 kV Substation (New) 11-138 kV PCBs Kidapawan 138 kV Substation 2-138 kV PCBs Gen. Santos 138 kV Substation 4-138 kV PCBs Kabacan–Kidapawan 138 kV Transmission Line ST-DC, 1-795 MCM ACSR/AS, 53 km Kabacan–Villarica 69 kV Transmission Line SP-SC, 1-336.4 MCM ACSR/AS, 40 km	In lieu of the Kabacan-Manauban 69 kV T/L, Kabacan-Kidapawan 138 kV T/L was proposed.
Nasipit Substation Bus-In (formerly Villanueva-Jasaan-Butuan 138 kV T/L)	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 9-138 kV PCBs Jasan 138 kV S/S Expansion 2-138 kV PCBs Villanueva 138 kV S/S Expansion 2-138 kV PCBs	Nasipit 138 kV Substation 8-138 kV and 2-69 kV PCBs Bus-In to Nasipit 138 kV Transmission Line ST-DC, 1-795 MCM ACSR/AS, 4 km Swinging of TM 2 138 kV Transmission Line 1-795 MCM ACSR/AS, 0.5 km	Villanueva-Jasaan 138 kV TL was discarded due to change on generation assumptions in eastern Mindanao

San Francisco–Tandag 138 kV Transmission Line			New Project under TDP 2016-2040
Maco–Mati 138 kV Transmission Line			New Project under TDP 2016-2040
Opol Substation Bus-in Project (formerly Balo-i-Tagoloan-Opol 138 kV Transmission Line)	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	Opol Substation Bus-in to Balo-i-Tagoloan 138 kV Transmission Line ST-DC, 1-795 MCM ACSR/AS, 7 km	Project component list was simplified
Sultan Kudarat–Tacurong 230 kV Transmission Line	Tacurong-Sultan Kudarat 138 kV T/L ST-SC, 1-795 MCM ACSR, 101 km; **Tacurong 138 kV S/S** 2-138 kV PCBs **Sultan Kudarat 138 kV S/S Expansion** 2-138 kV PCBs	Sultan Kudarat–Tacurong 230 kV Transmission Line ST-DC1, 2-795 MCM ACSR/AS, 101 km Tacurong 230 kV S/S (New) 2-230 kV PCBs Sultan Kudarat 230 kV S/S (New) 2-230 kV PCBs	Project was updated based on the long term development plan in the area
Eastern Mindanao 138 kV Transmission Line Reinforcement Project			New Project under TDP 2016-2040
Matanao 230/138 kV Transformer			New Project under TDP 2016-2040
Lala–Malabang–Sultan Kudarat 230 kV Transmission Line			New Project under TDP 2016-2040
Siom–Sindangan–Salug 69 kV Transmission Line			New Project under TDP 2016-2040
Davao–Samal 69 kV Interconnection			New Project under TDP 2016-2040
Zamboanga–Basilan 69 kV Interconnection			New Project under TDP 2016-2040
Bislig–Baganga 138 kV Transmission Line			New Project under TDP 2016-2040
San Francisco–Tandag 138 kV Transmission Line 2			New Project under TDP 2016-2040
Naga–Salug 138 kV Transmission Line			New Project under TDP 2016-2040

Sultan Kudarat–Tacurong 138 kV Transmission Line 2			New Project under TDP 2016-2040
Maco–Mati 138 kV Transmission Line 2			New Project under TDP 2016-2040
Lala–Naga 230 kV Transmission Line			New Project under TDP 2016-2040
Baganga–Mati 138 kV Transmission Line			New Project under TDP 2016-2040
Lala–San Miguel 138 kV Transmission Line			New Project under TDP 2016-2040
Nabunturan–Bunawan 230 kV Transmission Line			New Project under TDP 2016-2040
Matanao–Tacurong 230 kV Transmission Line			New Project under TDP 2016-2040

Appendix 6 – Summary of Asset Lives

Table A6.1 Summary of Asset Lives

Category	Description	Life (Years)	Notes
Transmission Lines	Lattice steel tower line	50	
	Wood pole line	25	
	Concrete pole line	50	
	Steel pole line	50	
Power Cables	Submarine HVDC	50	
	Submarine HVAC	50	
	Underground HVAC	50	
Outdoor Substations – MEAs	Transformers 500 kV	45	N-1 Security
	Transformers 230 kV	35	Without N-1 Security
		45	With N-1 Security
	Transformers 115 kV	35	Without N-1 Security
		45	With N-1 Security
	Reactors	35	
	Capacitor Banks	40	
	Outdoor switch bays	40	500 kV, 230 kV, 138/115 kV, 69 kV outdoor assemblies (see Note 1)
Outdoor Substations – Individual euipment	Circuit breakers	40	500 kV, 230 kV, 138/115 kV, 69 kV
Indoor GIS Substations	500 kV GIS switch bay	45	
	230 kV GIS switch bay	45	
	115 kV GIS switch bay	45	
Substations Secondary	Protective relays and controls	15	
	Metering equipment	30	
	RTUs, SCADA systems	15	
Communications	OPGW links	50	
	PLC links	35	
	Radio links		
System Control		15	

Notes:

1. A switchgear bay includes the primary equipment, busworks, foundations, equipment supports and other structures, protective and control equipment and cabling directly associated with the bay.

Appendix 7 – 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
FICELCO	First Catanduanes 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 Electric Power Research Institute
SGCC	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:

BEI	Bohol Electric Inc.
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 Tower 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 8 – Contact Details

For all inquiries regarding the TDP, you may contact any of the following:

Redi Allan B. Remoroza
Head – Transmission Planning Department
Tel: 63 2 8637636
E-mail: rbremoroza@ngcp.ph

Eufemio C. Buluran, Jr.
OIC–Regional Transmission Planning Manager
Luzon System Planning Division
Tel: 63 2 8637655
E-mail: ecbuluran@ngcp.ph

Christian B. Ereño
Regional Transmission Planning Manager
Visayas System Planning Division
Tel: 63 2 9812535
E-mail: cbereno@ngcp.ph

Fernando S. Javier
Regional Transmission Planning Manager
Mindanao System Planning Division
Tel: 63 2 8637666
E-mail: fsjavier@ngcp.ph

Vicente N. Loria
Transmission Planning Manager
Grid Asset & Project Planning Special Studies Division
Tel: 63 2 8637637
E-mail: vnloria@ngcp.ph

For inquiries relating to load forecast information, you may contact:

Armando A. Pagayon
CRCP Manager
Corporate Regulatory Compliance and Planning Division
Tel: 63 2 8637209
E-mail: aapagayon@ngcp.ph