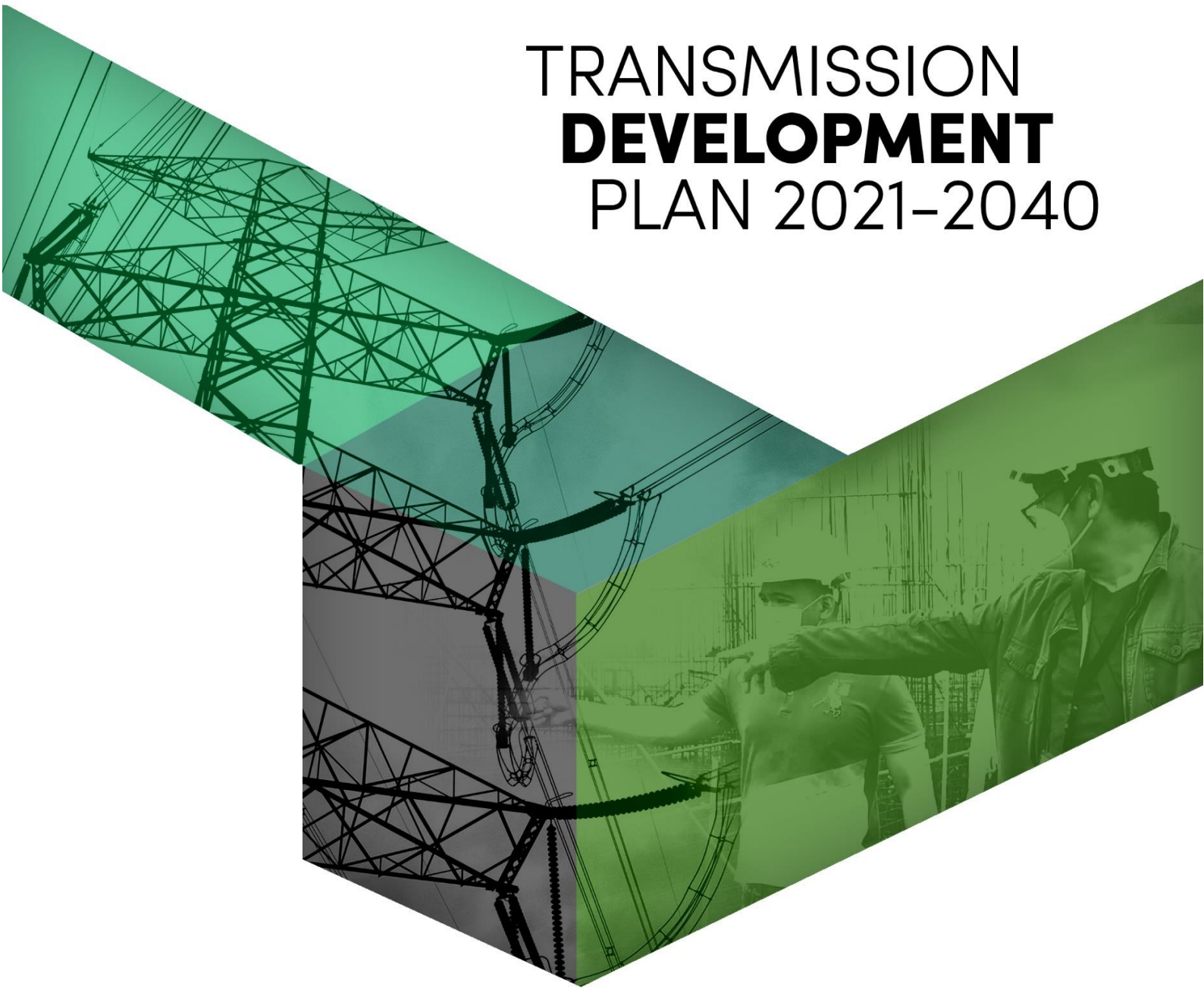
NGCP

TRANSMISSION **DEVELOPMENT** PLAN 2021-2040



CONSULTATION DRAFT

TRANSMISSION DEVELOPMENT PLAN

2021-2040

Consultation Draft

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MESSAGE FROM THE PRESIDENT

On behalf of the NGCP Management, I am pleased to present the Transmission Development Plan 2021-2040, the 20-year roadmap for the expansion of the Philippine power grid, which holds a vital role in the growth of the electric power industry. The conversion from three-volume to one-volume or One TDP is guided by the overall objectives by 2040 set in the Power Sector Roadmap which is highlighted in the 2018-2040 Philippine Energy Plan (PEP) – ensure quality, reliable, affordable, and secure supply; expand access to electricity; ensure a transparent and fair playing field in the power industry; and total electricity access in the country.

In support of the PEP's Roadmap for the Transmission Sector, we formulated the TRANSMISYON 2040. It is composed of NGCP's goal for every five-year Regulatory Period and the steps to be taken to achieve each goal. TRANSMISYON 2040 complements the Power Development Program of the DOE which is aligned with "AmBisyon Natin 2040" platform, the collective and long-term vision to uplift the well-being of Filipinos by securing access to reliable and affordable energy services and technologies. In the next 20 years, the Luzon, Visayas, and Mindanao Grids will continue to evolve as a unified Philippine Grid towards a more robust, flexible, resilient, and smart grid.

The grid development thrust in the TDP 2021-2040 is geared towards the implementation of grid resiliency program, improvement in transmission planning for the Competitive Renewable Energy Zones (CREZ), integration of emerging technologies, re focused development strategy for 69 kV facilities, increased electricity access through island/off-grid interconnections, and continuous development of major transmission backbone. With NGCP as both Transmission Network Provider and System Operator, investment in the transmission network is generally motivated by the need to meet the system requirements and at the same time comply with transmission regulations in line with the energy policies of the government. These policies, which were promulgated through the DOE Department Circulars include Adoption of Energy Resiliency, Establishment of CREZ in the Country, Framework for Energy Storage System, National Smart Grid Policy, and Omnibus Guidelines on Enhancing Off-grid Power Development and Operation.

We included in the TDP 2021-2040 the connection of incoming and future plants in the system including the required transmission reinforcements in support of the generation capacity additions under the PDP 2019-2040 of the DOE. The TDP also includes the reinforcement and extension of existing transmission backbone in major islands, expansion of substations to accommodate higher demand and upgrading of existing links between main islands including 69 kV facilities towards various Distribution Utilities. The project drivers are generally classified as Load Growth, Generation Entry, System Reliability and Security, Power Quality and Technology, Policy Direction and Market Operation Support. This TDP also contains the status of the remaining ERC-approved projects for the 4th Regulatory Period (2016-2020) and projects for implementation in the 5th Regulatory Period (2021-2025). Beyond 2025 are indicative transmission projects for the succeeding five-year intervals until 2040.

In this TDP, we will share our ideas, listen to your inputs and concerns, flesh out the challenges our industry is facing, and work together to continuously improve our development plans. We are confident that with the support and valuable inputs of stakeholders in the development of this document, NGCP is ensured of an optimal and responsive TDP for the benefit of all electricity end-users.

ANTHONY L. ALMEDA
President & CEO

NGCP

Chapter 1 – Preliminaries

1.1 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 characteristics; 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 Network Provider (TNP), 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.

NGCP is persistently committed to the international standards to advance the Visions and Mission of the corporation. In its continuing effort to provide quality and efficient service, NGCP received its recertification of OHSAS 18001:2007 on July 25, 2018. BSI issued NGCP Certificates of Registration with Effective Dates of 2018-07-04 and Expiry Dates of 2021-03-11 to the following standards Quality Management System – ISO 9001:2015, Environmental Management System – ISO 14001:2015 and Occupational Health and Safety Management – BS OHSAS 18001:2007.

1.2 Transmission Grid Performance

The Rules for Setting Transmission Wheeling Rates (RTWR) provide for the establishment of a Performance Incentive Scheme (PIS) with rewards and penalties applied to the extent that the actual level of performance by the Regulated Entity exceeds or falls short of performance measures that have been established and approved, for implementation, by the Regulator within a certain regulatory period.

The Third Regulatory Period (3rd RP) ended in December 2015. In accordance with the regulatory reset process for the Fourth Regulatory Period (4th RP) under Article VII of the RTWR, a new PIS must be developed specifying the service quality measures/indices as well as the target level of performance that must be applied to the transmission grid. However, the 4th RP reset process has been delayed.

Notwithstanding the delay in the reset process, NGCP continuously monitors the performance of the transmission grid using the 3rd RP-ERC approved indices as discussed below:

1. System Interruption Severity Index (SISI) - the ratio of the unserved energy to the system peak load occurring during the rating/reporting period. Unserved energy is the energy not served due to transmission line interruption(s) computed by outage duration multiplied by the load involved before the interruption. System peak load, on the other hand, is the highest demand for a particular rating/reporting period measured in megawatts (MW).

2. Frequency of Tripping (FOT) per 100 ckt-km (FOT/100ckt-km) - measures the number of line outages (transients and permanent or sustained) initiated by tripping of the relay subject to exclusion of identified events.

3. System Availability (SA) - a proportion of total circuit time is the percentage of the system being considered on-line during the rating/reporting period. A circuit is regarded as being unavailable when it is out of service for construction, refurbishment, maintenance, or fault.

4. Frequency Limit Compliance (FLC) - refers to the percentage of time during the rating period that the system frequency is within the allowable frequency range of 60 ± 0.3 Hz.

5. Voltage Limit Compliance (VLC) - refers to the percentage of the number of voltage measurements during the rating period that the voltage variance did not exceed ± 5% of the nominal voltage of all buses identified in the inclusion (Luzon – 230 kV & 500 kV, Visayas – 138 kV & 69 kV, Mindanao – 138 kV) monitored at the high side of the substation.

6. Congestion Availability Indicator (ConA) for Luzon grid only - measures the availability of a subset of lines and transformers in the Luzon and Visayas Grids.

7. Ancillary Services Availability Indicator (ASAI) – measures the availability of ancillary services on each of the three grids in accordance with the requirements of Section 3.3 of the draft Ancillary Services Procurement Plan (ASPP).

The 2020 performance of the transmission grid covering the period 26 August 2019 – 25 August 2020 is shown in Table 1.1.

Table 1.1: 2020 Performance of Transmission Grid

Performance Indicator	Luzon	Visayas	Mindanao
System Interruption Severity Index, system-min.	0.8697	10.0108	9.124
Frequency of Tripping, count per 100ckt-km	0.9322	0.3353	0.504
System Availability, %	99.2081	99.7644	99.7369
Frequency Limit Compliance, %	100	99.988	99.9208
Voltage Limit Compliance, %	99.9985	99.9801	99.9765
Congestion Availability Indicator, %	99.0437	-	-
Ancillary Services Availability Indicator, %	29.0414	23.6024	77.2541

Figures 1.1 to 1.7 show the chart of each of the seven ERC-approved Performance Indices' comparative performances for 2018, 2019 and 2020.

Reliability Indicators

As a regulated entity, NGCP provides Transmission Services to all users of the grid and are bound by the Transmission Reliability Standards under Chapter 3 of the Philippine Grid Code (PGC). Correspondingly, power interruptions caused or initiated by transmission lines and equipment that resulted in the loss of service to grid users were included in the evaluation.

The SISI and FOT/ckm are measures of NGCP's transmission reliability. System Interruption Severity Index (SISI) performance for the three (3) Regions improved this year 2020 compare to the actual result in 2019. Luzon SISI posted 0.8700 s-m compared with the 2019 result of 5.9460 s-m. The Visayas region also improved to 10.0110 s-m as compared with its last year's 25.2220 s-m. Mindanao SISI this period improved at 9.1240 s-m as compared to 28.6170 s-m in 2019.

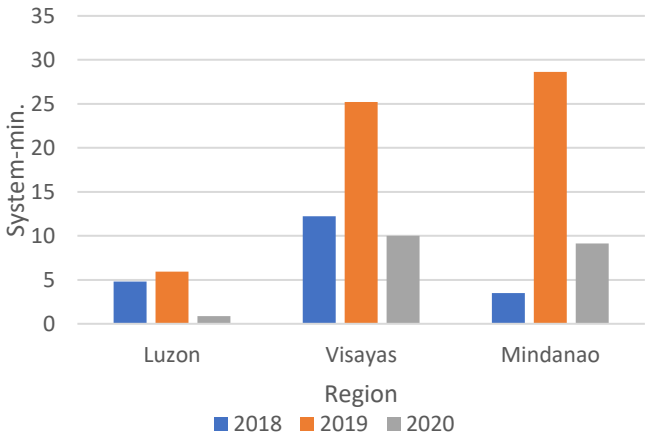


Figure 1.1: System Interruption Severity Index

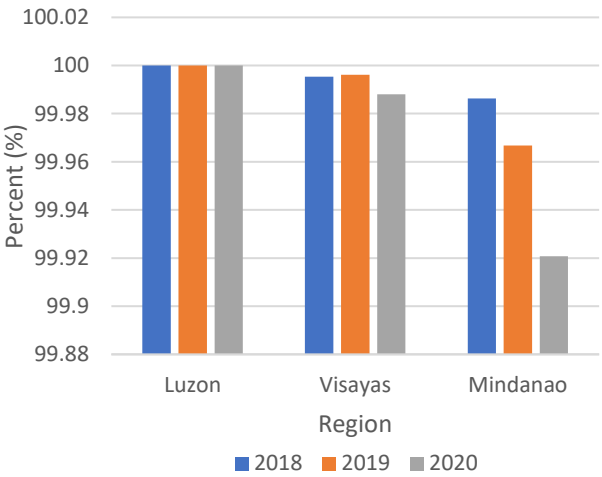


Figure 1.2: Frequency of Tripping Events

The Frequency of Tripping Events per 100 circuit-kilometer (FOT/100 ckm), however, declined in the three (3) Regions during this period as compared to the 2019 actual result. The Luzon FOT declined at 0.9320 as against its 2019 actual of 0.6700. The Visayas FOT also declined at 0.3353 as compared to its 2019 result at 0.1280. Mindanao FOT also declined at 0.5040 as compared to 0.3560 value in 2019.

System Availability (SA) in Luzon and Mindanao declined during the conclusion of the regulatory period of 2020 but improved in the Visayas Region. The decline in SA may be attributed to the number of acts of nature (i.e. earthquakes and passage of several typhoons) experienced during this last quarter of 2019.

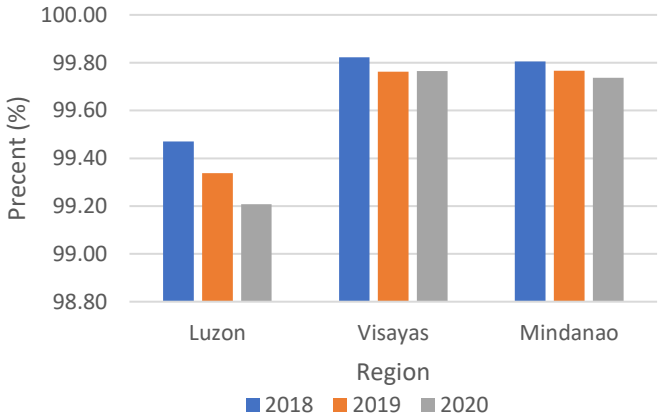


Figure 1.3: System Availability

The Luzon region declined by 99.2081% as compared with 99.3372% in 2019. The Visayas SA improved to 99.7644% compared with 99.7619% in 2019. The Mindanao SA declined to 99.7369% compared to 99.7658% value in 2019.

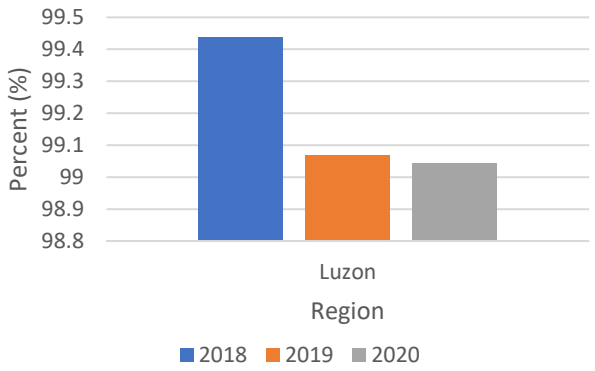


Figure 1.4: Luzon ConA

The Luzon ConA also declined at 99.0437%, from its actual result of 99.0665% during the same period in 2019.

Power Quality

Quality of service is measured with reference to system voltage and frequency. The system is normally managed such that frequency is maintained within the allowable operational limits of 59.7 and 60.3 Hz. On the other hand, system voltages are monitored individually at connection points with the customers to ensure that voltages are within the allowable operational limits of +/- 5% of the nominal value is not exceeded.

Frequency Limit Compliance (FLC) Luzon FLC remained at 100% and consistent with the previous year but saw decline in Visayas and Mindanao. The Visayas region declined at 99.9880% compared with 99.9961% in 2019. Mindanao grid FLC also decline to 99.9208% compared to that of 99.9668% actual in 2019.

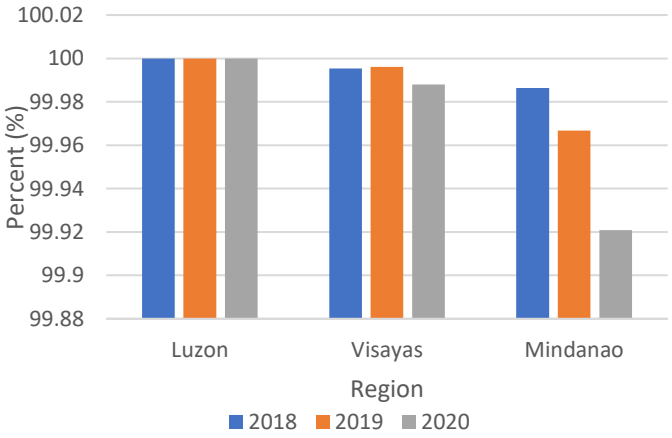


Figure 1.5: Frequency Limit Compliance

Incidents of frequency violations in the Visayas were and during the process of Blocking/Deblocking of the HVDC. In Mindanao, frequency violations were caused by tripping of voltage sensitive loads along Zamboanga Peninsula, overdrawing of customers and unavailability of AS providers to deliver the required services, also, affected by very low system demand aggravated by the over-nomination of some power customers with their BPS generator.

The Voltage Limit Compliance (VLC) meantime also improved in Luzon but were down in Visayas and Mindanao. Luzon grid VLC improved to 99.9985% compared to 99.9412% in 2019. The Visayas and Mindanao grids did not improve and are down 99.9801% and 99.9765%, respectively, compared to their 2019 actuals of 99.9902% and 99.9973%.

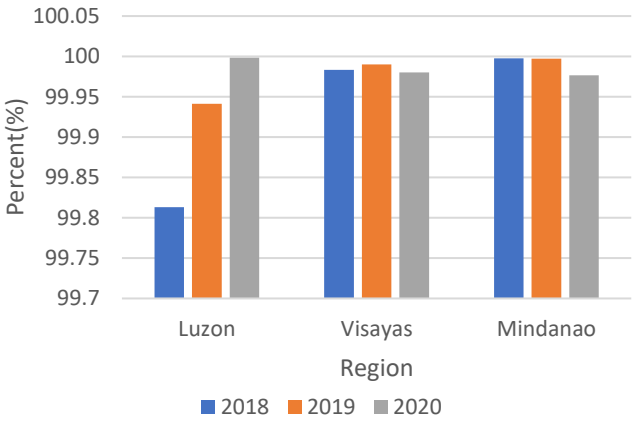


Figure 1.6: Voltage Limit Compliance

In the Visayas, voltage violations were due to demand and generation unbalances in some area with insufficient reactive power support and caused by the sudden decrease/increase of the VRE plants. In Mindanao, voltage violations were affected by the tripping of large power plants that resulted to load dropping, also there were recorded over voltages due to very low system demand in some area on the start of April 2020.

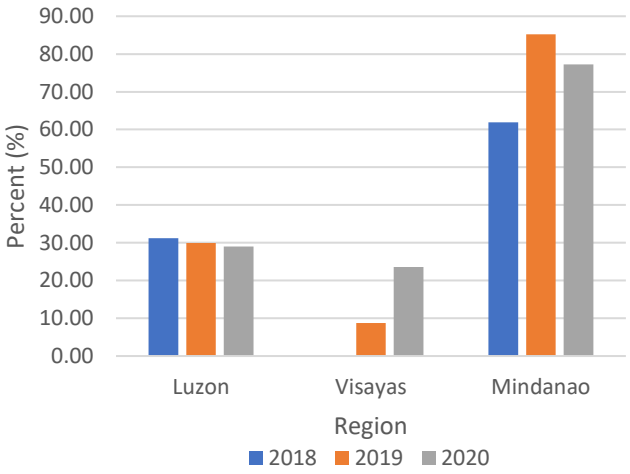


Figure 1.7: Ancillary Services Availability Indicator

ASAI slightly declined in Luzon and Mindanao Grids while the Visayas Grid improved compared to its 2019 actual results. ASAI for Visayas improved at 23.6024% this period as compared with 2019 actual results at 8.7847%. ASAI performance for Luzon and Mindanao declined as compared with its 2019 actual result due to lack of Ancillary Services Providers. Appendix 9 shows NGCP plans for the procurement od Ancillary Services.

1.3 Introduction to NGCP's Transmission System Network

The country's transmission systems are composed of 500 kV, +/- 350 kV HVDC, 230 kV, 138 kV, 115 kV and 69 kV facilities. As the sole Transmission Network Provider, NGCP plays a vital role in a 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: 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 its customers – power generators, private distribution utilities, electric cooperatives, government-owned utilities, economic-zones, and directly-connected customers. It is responsible in dispatching the power plants and transmitting the generated power to 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.

Transmission Development Plan 2021 - 2040 consists of fourteen chapters summarized as follows:

Chapter 1: Preliminaries

provides an overview of NGCP organization and operation as a TNP and a regulated entity;

Chapter 2: Existing Philippine Grid

discusses the profile of each grid and the existing transmission facilities;

Chapter 3: Planning Approach and Drivers for Grid Development

discusses the TDP preparation process including the latest demand projection as input to the simulation studies to identify future transmission needs and transmission expansions in each grid;

Chapter 4: Grid Resiliency

discusses the resiliency plans and programs for the transmission system through climate change adaptation measures, including discussion on asset condition assessment and prioritization;

Chapter 5: Emerging Technologies

presents compliance to DOE policies and NGCP initiatives to adopt the emerging technology for grid development, including discussions on Energy Storage System, SMART Technologies and grid monitoring system;

Chapter 6: Competitive Renewable Energy

discusses the establishment and development of Competitive Renewable Energy Zones (CREZ) in the country pursuant to DOE Department Circular 2018-09-0027[1] leading to the improvement in system planning to identify the needed transmission facility for each CREZ;

Chapters 7: 69 kV Facilities

discusses NGCP's initiatives and way forward to issues and policies related to subtransmission assets;

Chapter 9 - 11: Transmission Outlook

discusses the transmission outlook for 2021-2040 including the details of the proposed transmission projects for Luzon, the Visayas and Mindanao Grids;

Chapter 12: Major Island Interconnection

presents the major island interconnections and backbone transmission projects for the period 2021-2040. Also includes information on small islands for potential interconnections to the main grids in line with DOE Department Circular 2019-01-0001[2];

Chapter 13: Operation and Maintenance

presents the operation and maintenance programs for 2021 – 2040 to improve transmission facilities in the country for the reliable, adequate, secure, and stable service for all users of the nationwide electricity transmission system; and

[1] DOE DC 2018-09-027 "Establishment and Development of CREZ in the Country".
[2] DOE DC 2019-01-0001 "Prescribing the Omnibus Guidelines on Enhancing Off-Grid Power Development and Operation".

presents the developmental programs for 2021 – 2040 planning horizon for the SCADA, telecommunication and protection components of the grid.

1.4 TRANSMISYON 2040

NGCP has always been committed to build a strong and reliable power transmission network through various programs and projects that prioritize network development.

Shown in Figure 1.8 is the medium (2019-2022) and long-term (2023-2040) Power Sector Roadmap involving the Transmission Sector based from the Philippine Energy Plan (PEP) 2018-2040 of the DOE issued in 2020.

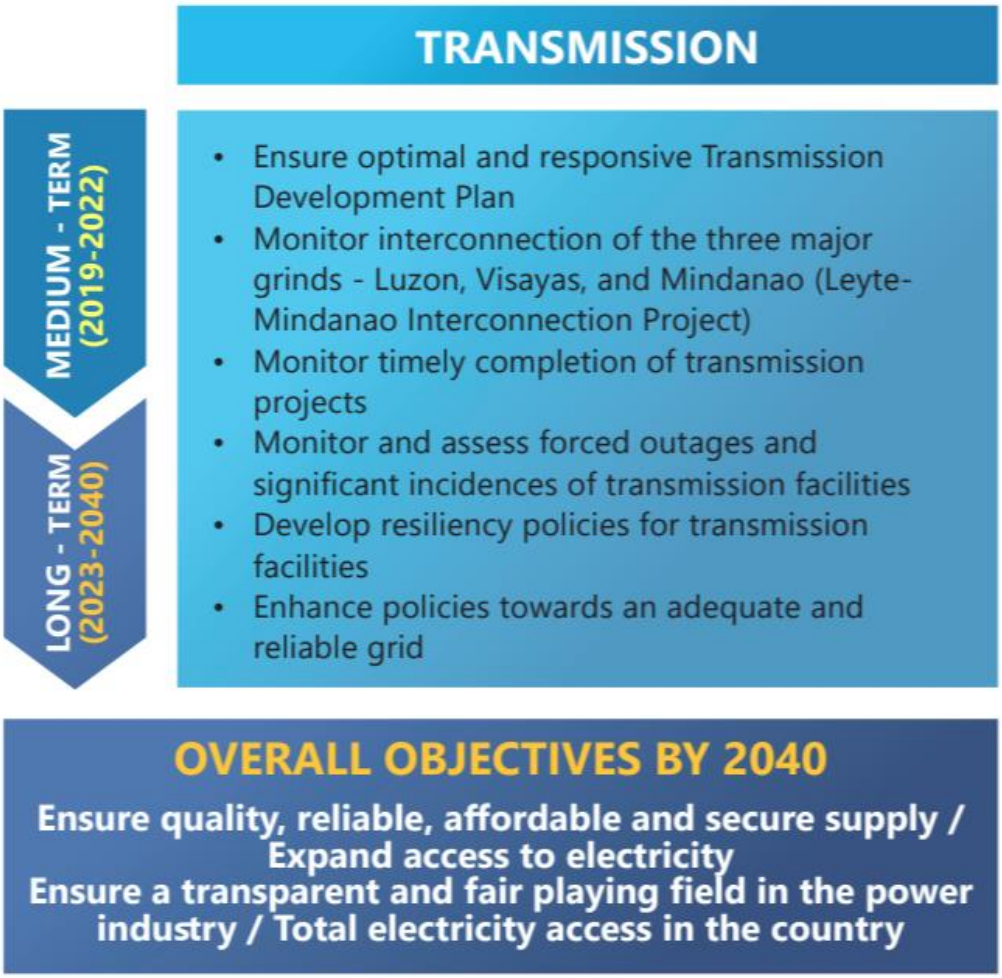


Figure 1.8: Power Sector Roadmap (Transmission)

In support to the PEP's Power Sector Roadmap, NGCP formulated the "TRANSMISYON 2040" as shown in Figure 1.9.

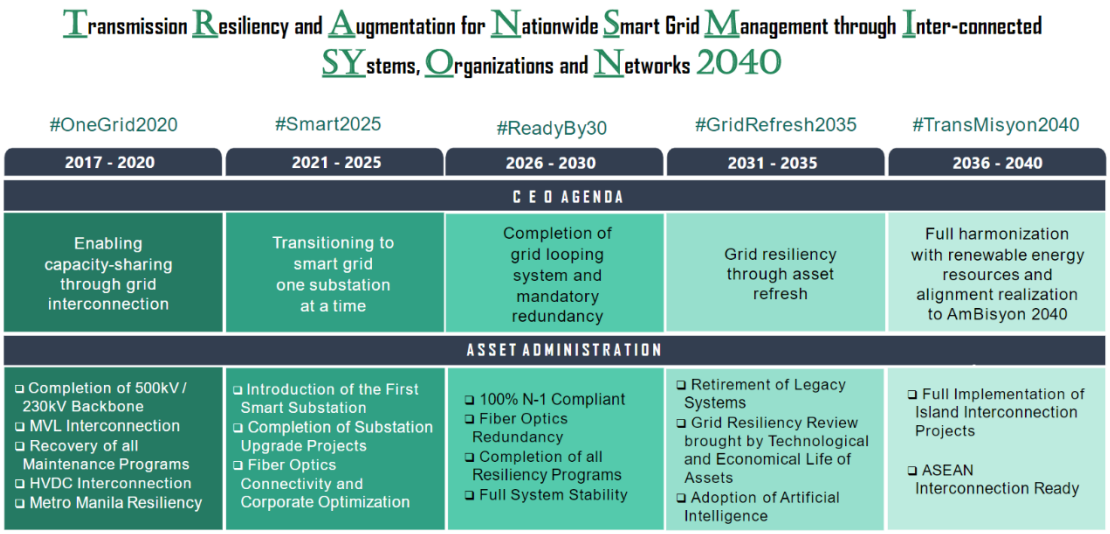


Figure 1.9: TRANSMISYON 2040

The figure above shows NGCP's goal for every regulatory period and the steps that will be taken to achieve each goal. The overall objectives by 2040 is the full implementation of Island Interconnection Projects within the country, which is aligned with the overall objectives of the DOE to ensure quality, reliability, affordability, and security of supply of electricity.

Chapter 2 – Existing Philippine Grid

2.1 Grid Profile

A total of 37,773 MVA substation capacities and 20,519 CKT-KM are accounted for in the transmission assets being managed by NGCP, as shown in Table 2.1. In addition, a total of 4,279.46 MVAR from capacitor banks and shunt reactors have been installed in appropriate locations in different parts of the grid to ensure that voltages across the network are within the levels prescribed in the Philippine Grid Code.

Table 2.1: Summary of Existing Facilities as of August 2020

PARTICULARS	LUZON	VISAYAS	MINDANAO	PHILIPPINES
Substation Capacity (MVA)	27,955	4,487	5,331	37,773
Transmission Line Length (CKT-KM)	9,396	5,299	5,824	20,519
Capacitor Bank (MVAR)	1,962.50	281.95	382.50	2,626.95
Shunt Reactor (MVAR)	965	595	92.51	1,652.51

2.2 Dependable Capacity Mix

The dependable capacity indicated in the following section is based on the DOE's List of Existing Power Plants (Grid-connected) as of June 2020.

The Philippines has a total dependable capacity of 22,398 MW including embedded generation. Coal-fired power plants (CFPP) recorded the largest share with 9,743 MW, while Oil-based and Natural gas accounted for 2,633 MW and 3,286 MW, respectively. On the other hand, RE-based plants recorded 1,792 MW for Geothermal, 3,481 MW for Hydro, 225 MW for Biomass, 811 MW for Solar, and 427 MW for Wind.

Figure 2.1 and Table 2.2 show the distribution of dependable capacity for Luzon, the Visayas, and Mindanao.

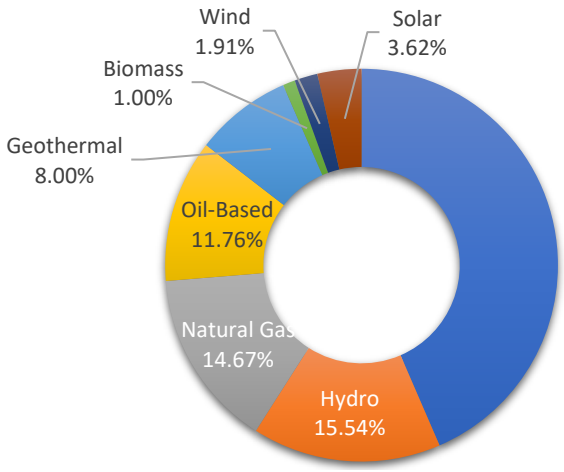


Figure 2.1: Philippine Dependable Capacity Mix (Grid-connected)

Table 2.2: Existing Dependable Capacity

Power Plant Type / Fuel Source / RE Source	LUZON		VISAYAS		MINDANAO	
	MW	%	MW	%	MW	%
Conventional Power Plants	**11,237**	**73.2%**	**1,824**	**55.7%**	**2,601**	**68.7%**
▪ Coal	6,520	42.5%	1,349	41.2%	1,874	49.5%
▪ Oil-based	1,431	9.3%	475	14.5%	727	19.2%
▪ Natural Gas	3,286	21.4%	-	-	-	-
RE-Based Power Plants	**4,099**	**26.7%**	**1,453**	**44.3%**	**1,184**	**31.3%**
▪ Wind	337	2.2%	90	2.7%	-	-
▪ Solar PV	363	2.4%	381	11.6%	67	1.8%
▪ Biomass	105	0.7%	97	3.0%	23	0.6%
▪ Geothermal	824	5.4%	865	26.4%	103	2.7%
▪ Hydro	2,470	16.1%	20	0.6%	991	26.2%
TOTAL	**15,336**		**3,277**		**3,785**	

2.3 Luzon Transmission Network



Figure 2.2: Luzon Transmission Network

The bulk generation sources in the Luzon Grid are in the northern and southern parts of the Luzon Island while the load center is in Metro Manila area. About 50% 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 2,200 MW generation from Masinloc and Sual CFPP to Metro Manila.



Figure 2.3: North Luzon Transmission Corridor

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.

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, Marilao (Duhat), and San Jose 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 southern part of Metro Manila, 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.

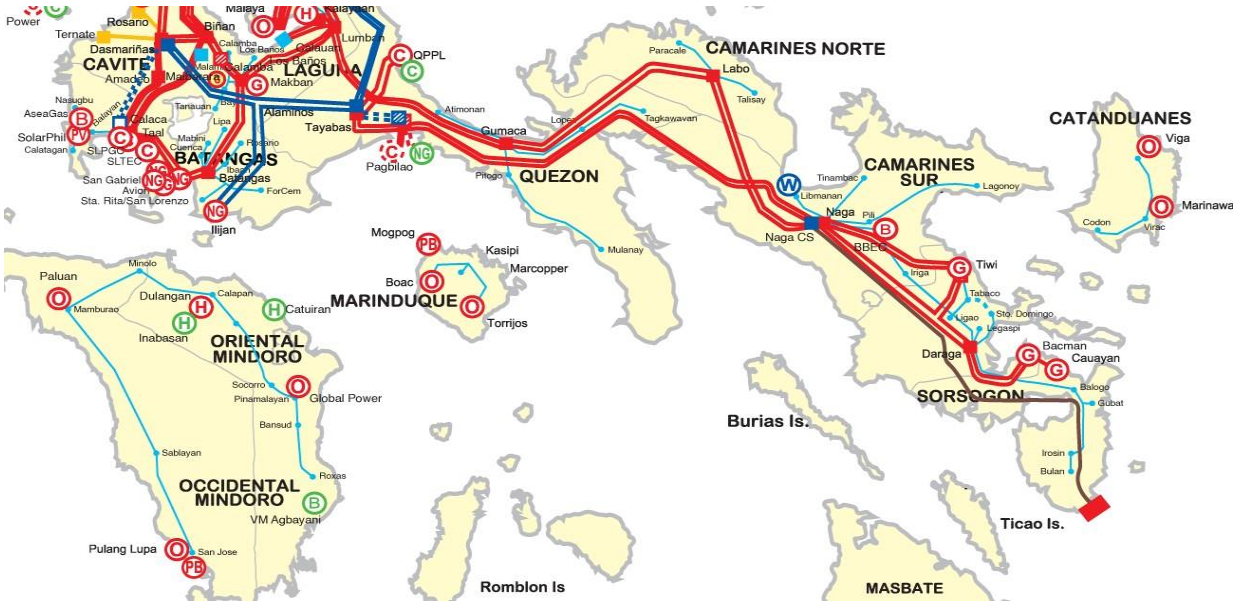


Figure 2.4: South Luzon Transmission Corridor

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 3,300 MW from Ilijan Natural Gas, Pagbilao and QPPL CFPP. The 230 kV transmission system in Batangas and Laguna area caters more than 3,100 MW total generation capacity of Calaca CFPP, new coal-fired power plants and the other Natural Gas Plants (San Lorenzo, Sta. Rita, and Avion).

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.

2.4 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 have existing AC interconnections with effective transfer capacity as of December 2019 as follows: Leyte-Cebu (2x200 MW), Cebu-Negros (2x90 MW), Negros-Panay (1x180 MW) and Leyte-Bohol (1x90 MW). These submarine cables provide the capability of sharing excess generation between islands to accommodate the Visayas' growing demand.

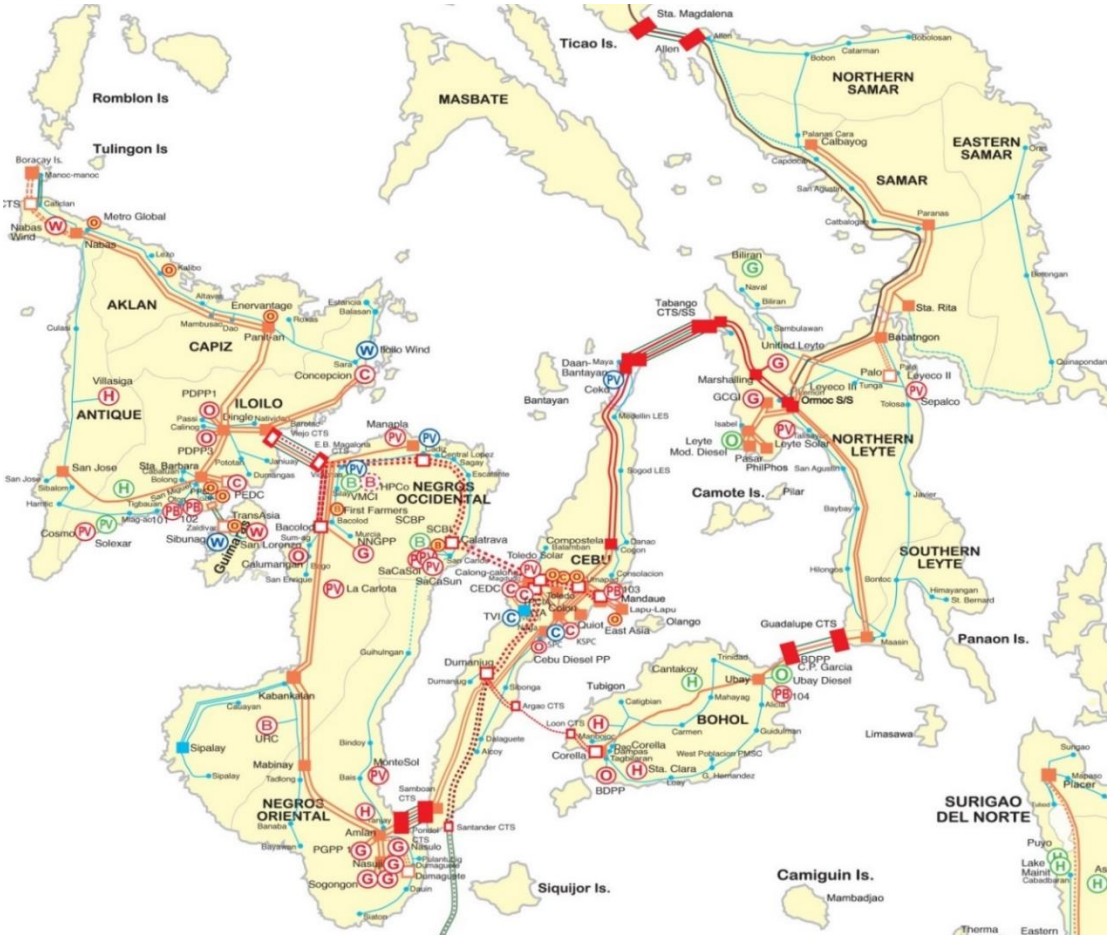


Figure 2.5: Visayas Transmission Network

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 5,299 circuit-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 Transmission 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 645 MW geothermal resources that comprise about 20% of the total dependable capacity in the Visayas.



Figure 2.6: Eastern Visayas Transmission Network

Central Visayas (District 2) is composed of Cebu and Bohol Islands. Cebu can be well considered as the major load center of the Visayas Grid. In 2020, it has a peak load of 1,058 MW which accounted for 48.1% of the grid's total demand. Bohol has the lowest peak load among sub-grids at 94 MW in 2020.

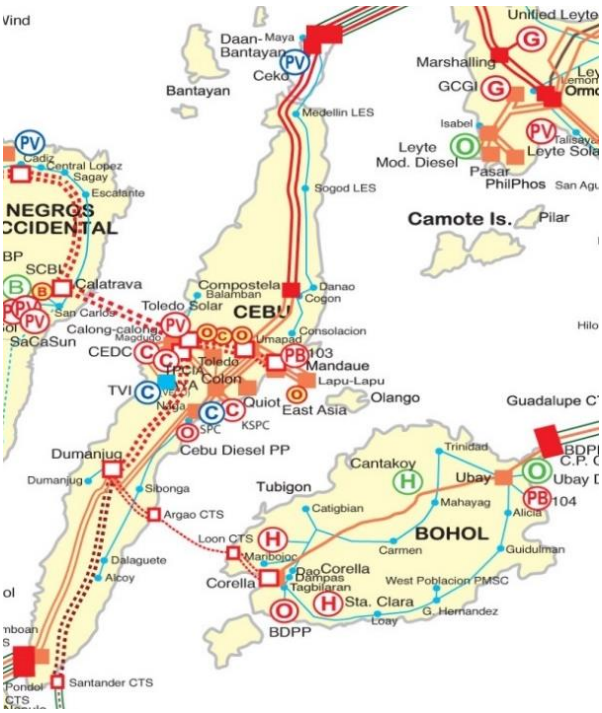


Figure 2.7: Central Visayas Transmission Network

In the Island of Negros (District 3), the load center is in Bacolod City in the northern part, while the bulk of generation, composed mostly of geothermal power plants, is in the southern part. There are also many generation power plants in Northern Negros which is composed mostly of solar and biomass power plants. There is a total of 264 MW solar generation capacity in Negros Island which accounted for 69.36% of the grid's total solar generation capacity.



Figure 2.8: Negros Island Transmission Network

Panay Island (District 4) has many large coal power plants; PEDC (317.4 MW) in the southern part while PCPC (135 MW) in the southeastern part. Panay has become less reliant on power import from other islands via the 230 kV Negros–Panay Interconnection (initially energized at 138 kV) and, most of the time, exports power to Negros.



Figure 2.9: Panay Island Transmission Network

2.5 Mindanao Transmission Network

The Mindanao transmission system is composed of six districts. District 1 - North Western Mindanao Area (NWMA) covers the provinces of Zamboanga del Norte, Zamboanga del Sur, Zamboanga Sibugay, and Misamis Occidental; District 2 - Lanao Area (LA) consists of the provinces of Lanao del Norte and Lanao del Sur; District 3 - North Central Mindanao Area (NCMA), which coverage includes the provinces of Bukidnon and Misamis Oriental; District 4 - North Eastern Mindanao Area (NEMA) comprises of the Agusan del Norte, Agusan del Sur, Surigao del Norte, and Surigao del Sur provinces; District 5 - South Eastern Mindanao Area (SEMA) covers the Davao Region, which is composed of the following provinces: Davao del Sur, Davao del Norte, Davao Oriental, Davao Occidental, and Davao de Oro; and lastly, District 6 - South Western Mindanao Area (SWMA), which covers the provinces of South Cotabato, Cotabato, North Cotabato, Sultan Kudarat, and Maguindanao.

While the bulk of power generation is situated in the northern part of the island, the areas that consume the bigger power allotment are Davao Region and SOCCSKSARGEN located in southern Mindanao. Their total load demand accounts to almost half of the total load demand in the island.

The bulk of energy sources is a combination of renewable and conventional power plants which are generated in Lanao Area and Misamis Oriental for northern Mindanao and in Davao Area in southern Mindanao. Geographical locations of the said power plants are shown in Figure 2.10.



Figure 2.10: Mindanao Transmission Network

The power supply for Cagayan de Oro City, Davao City, and General Santos City are transmitted through a looped transmission line via the Balo-i-Tagoloan-Maramag-Kibawe-Davao 138 kV corridor and the Balo-i-Villanueva-Maramag-Bunawan 230 kV backbone. The Mindanao Grid comprises mostly of 138 kV transmission corridors and 69 kV radial lines. Each line is designed to provide reliable and quality power supply to the customer.

There are three high voltage transmission corridors emanate from Lanao area. These allow the bigger portion of generated power supply in the area, which is produced by the hydroelectric and the coal-fired power plants, to be transmitted all over Mindanao.

Chapter 3 - Planning Approach and Drivers for Grid Development

3.1 TDP Process Flow



Figure 3.1: TDP Process Flow

3.1.1 DOE Inputs

DOE's annual System Peak Demand Forecast and Generation Capacity Addition Line-up are the two major inputs in the TDP. In relation to the transmission network analysis, the system peak demand forecast shall be broken down and forecasted into individual transformer loads. On the other hand, NGCP's own non-coincident substation peak loading forecasts are used in determining load-end substation expansion requirements.

3.1.2 Stakeholders Engagement

One of the requirements of EPIRA in the preparation of the TDP is to conduct consultations 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.

3.1.3 TDP Update

The inputs from the DOE and the electric power industry participants are used to determine the system requirements of the grid for the next 20 years. This involves the conduct of load flow, short-circuit, and transient stability studies using special software in power system simulation. The assessments are made with reference to the planning criteria and limits prescribed in the PGC.

3.1.4 Consultation with Stakeholders

This step is 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 contained in the TDP.

3.1.5 Submission to DOE

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

3.2 Planning Criteria

The system assessment takes off from the model of the existing transmission network. By referring to the recent list of generation capacity additions and using the updated system peak load forecast, which is disaggregated into per substation transformer level, the network model for the planning horizon as covered by the TDP will be developed.

In conducting the simulation studies, different generation dispatch scenarios are considered. For Luzon Grid, the bulk generations are in the northern and southern part of the island. Thus, the Maximum North, Maximum South, Typical Generation and Other Generation scenarios are considered. On the other hand, Maximum Leyte and Maximum Panay scenarios are considered for the Visayas Grid, while Maximum North and Dry Season scenarios are considered 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 program which is part of the enhancements in 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 3.1: Generation 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	Specific 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 is 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 consider 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.

The TDP 2021-2040 will be used as reference in the next regulatory reset application and in subsequent applications of NGCP. While the TDP already provides a long list of projects needed by the network, project prioritization and project ranking will 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 2021-2040, with components shown in Chapters 9, 10, and 11, 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.

Like 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 2021-2040. However, a more detailed ten-year CAPEX Program[3] will be included in the next regulatory reset application together with other relevant information necessary for a more extensive review and evaluation by the ERC following the transparency provision for a prudent CAPEX in the RTWR.

[3] Composed of two 5-year regulatory periods, i.e., 2016-2020 and 2021-2025

3.3 Project Drivers

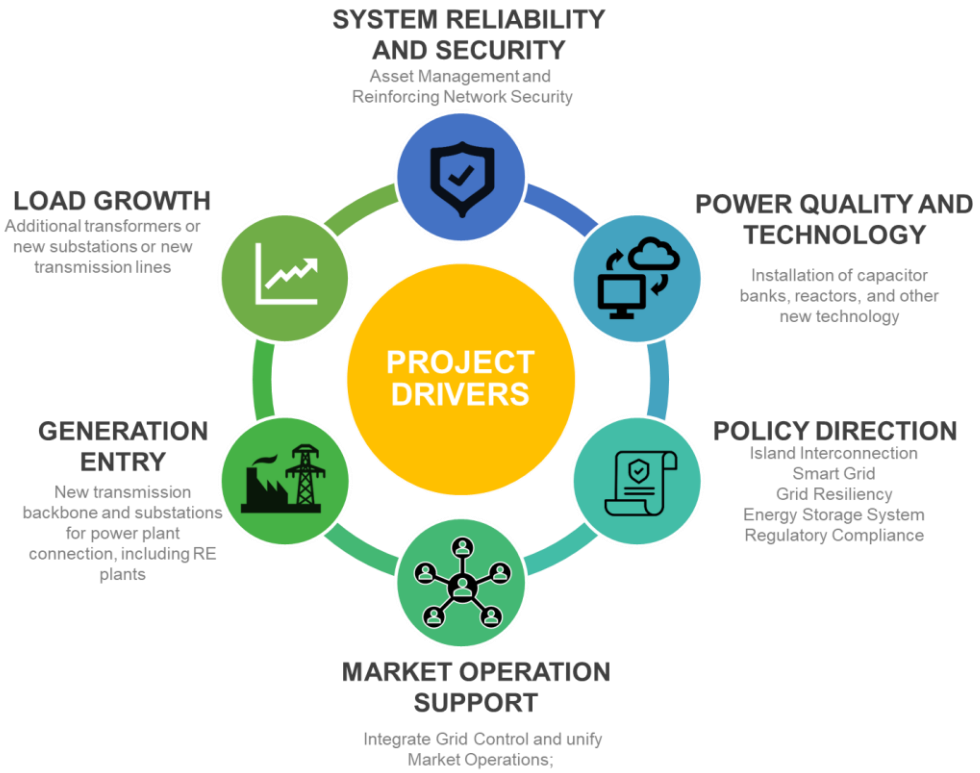


Figure 3.2: Project Drivers

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

a. Generation Entry – this pertains to accommodation of new power plant connections to the grid and bulk generation capacity additions that include conventional and renewable energy power plants, which usually drive new transmission backbone development.

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

c. System Reliability and Security – this pertains to projects that will ensure the reliability and security of the Grid as prescribed in the PGC. This includes projects that provide N-1 contingency, network security, and replacements for defective and ageing assets. The assets' conditions are evaluated to come up with an effective planning for the replacement program to ensure that unwarranted asset failures will be prevented or mitigated. Procurement of spares for the high voltage equipment, secondary devices, and transmission line equipment is regularly planned to ensure a stable system availability.

d. Power Quality and Technology – this involves the installation of equipment that will aid in operating the grid within the PGC-prescribed limits. This also involves projects related to new and developing technologies that have substantial application to the operation and maintenance of the transmission system, which includes, online monitoring of HVEs, centralized operation of substations, and the use of robots among others.

e. Policy Direction – this pertains to DOE-issued policies to ensure the reliability, quality, and security of supply of electric power and other government or regulatory compliances related to safety, environmental, and technical standards. To date, these include projects involving island/off-grid interconnection, Smart Grid, Grid Resiliency, Energy Storage System, Competitive Renewable Energy Zones (CREZ), among others.

f. Market Operation Support – This pertains to projects related to the integration of grid control and the unification of market operation.

3.4 System Peak Demand

The annual peak demand forecast is one of the important input parameters in the preparation of the TDP.

3.4.1 Power Demand Trend

3.4.1.1 Basis of the Transmission-level Forecast

The demand forecast for the TDP 2021-2040 adopted the peak demand projections of the DOE based on GDP-to-elasticity approach.

3.4.1.2 Historical Demand for Electricity

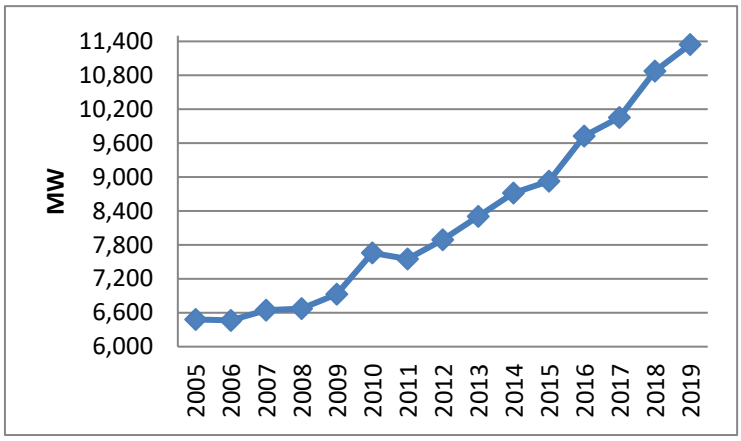
Total peak demand (in MW, non-coincident sum) of the Philippines shows consistent upward trend from 2005 to 2019 with an Average Annual Compounded Growth Rate (AACGR) of 4.34%. Total demand growth was at its highest in 2010 (at 9.53%) while it was at its most sluggish in 2011 (at 0.04%).

Table 3.2: Summary of Historical Demand per Grid (2005-2019), 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
2017	10,054	1,975	1,760	13,789
2018	10,876	2.053	1,853	14,782
2019	11,344	2.224	2,013	15,581
%AACGR (2006-2019)	**4.08%**	**6.13%**	**4.09%**	**4.34%**

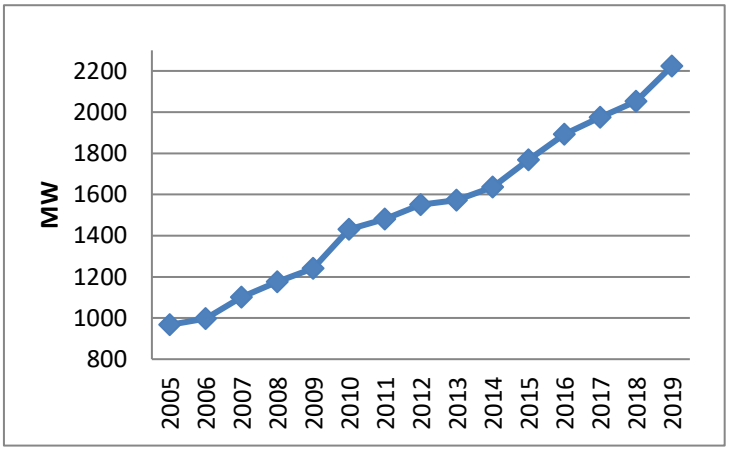
*Includes embedded generation monitored by NGCP

3.4.1.3 Luzon



The Luzon Grid has posted an AACGR of 4.08% for the period 2006-2019. 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 due to increased utilization of air-conditioning units. 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 2019, Luzon posted an average annual growth of 5.36% or 507 MW.

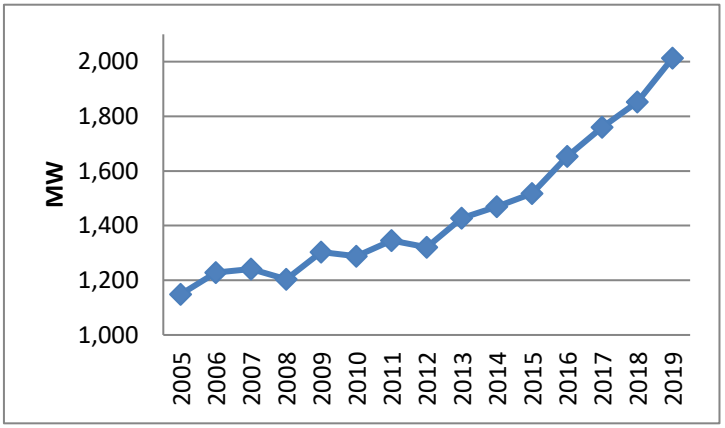
3.4.1.4 Visayas



The aggregate demand in Visayas Grid has posted an AACGR of 6.13% for the period 2006-2019. 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 1.35%. 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 4.07% year after the Typhoon Yolanda and the demand continued to rise from 2014

to 2019. During this period, an average annual growth of 6.35% or 118 MW was recorded in the Visayas Grid.

3.4.1.5 Mindanao



Mindanao Grid has posted an AACGR of 4.09% for the period 2006-2019. 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 3.10% growth rate in the next two years. In 2016, a record high 8.98% demand growth was registered in Mindanao Grid. This year, more than 800 MW additional generation capacity was added to Mindanao. In 2017 and 2018 the demand of Mindanao further improved and posted an increase of 6.46% and 5.28% respectively. In 2019, a 160 MW demand increase was recorded in the Mindanao Grid; the highest in terms of absolute increase in the past 14 years.

3.4.2 Forecast for TDP 2021-2040

Power demand for the country is expected to grow at an AACGR of 6.23% for the period 2021-2025, 6.73% for 2026-2030 and 6.49% 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 7.72% for 2021-2040 while the Luzon and Visayas Grids at 6.07% and 7.19%, respectively. Table 4.2 shows the projected demand disaggregated per O&M District based on the transformer peak demand coincident with the System Peak. It was derived from the DOE Forecast as of 24 August 2020 based on gross generation level.

The implementation of community quarantine, starting March 2020, throughout the country due to CoViD-19 pandemic has greatly affected the country's social and economic activities. High power demand expected to occur in the summer months of 2020 was not realized. With the current situation, the DOE adopted NEDA low Gross Domestic Product (GDP) economic growth assumption in its preparation of the system peak demand forecast. DOE also considered the year-to-date peak demand as the peak demand for 2020 -11,103 MW in Luzon, 2,201 MW in Visayas and 1,978 MW in Mindanao.

A comparison of the projected load and generation capacity per area per grid is also available (see Appendix 1).

Table 3.3: Summary of Projected Demand per District (MW)

Area		2020	2021	2022	2023	2024	2025	2030	2035	2040
Luzon		**11,103**	**11,841**	**12,387**	**13,125**	**13,917**	**14,769**	**20,070**	**27,138**	**36,101**
MERALCO		**8,348**	**8,381**	**8,714**	**9,032**	**9,371**	**9,718**	**11,670**	**14,021**	**16,852**
1	NCR	5,638	5,659	5,885	6,099	6,328	6,563	7,880	9,468	11,379
2	North	365	367	381	395	410	425	511	614	738
3	South	2,345	2,355	2,448	2,538	2,633	2,730	3,279	3,939	4,735
North Luzon		**2,060**	**2,607**	**2,767**	**3,089**	**3,445**	**3,841**	**6,586**	**10,623**	**16,101**
1	Ilocos	179	214	223	241	263	290	466	680	878
2	Mt. Province	109	126	132	144	158	173	266	378	458
3	North Central	220	278	284	329	369	419	691	1004	1243
4	Cagayan Valley	252	284	292	321	353	390	670	1036	1358
5	West Central	388	478	505	554	615	690	1244	2107	3245
6	South Central	855	1168	1271	1438	1620	1810	3154	5295	8779
7	North Tagalog	57	59	60	63	66	69	94	122	140
South Luzon		**696**	**853**	**906**	**1,004**	**1,101**	**1,210**	**1,814**	**2,494**	**3,148**
1	Batangas/Cavite	327	432	456	504	550	605	918	1294	1698
2	Laguna/ Quezon	99	112	118	128	135	144	177	197	202
3	Bicol	270	310	332	372	416	461	719	1003	1249
Visayas		**2,201**	**2,394**	**2,528**	**2,691**	**2,891**	**3,111**	**4,423**	**6,280**	**8,827**
1	Panay	411	447	472	502	539	580	825	1172	1647
2a	Cebu	1058	1151	1215	1294	1390	1496	2126	3019	4244
2b	Bohol	94	102	108	115	123	133	188	268	376
3	Leyte-Samar	271	295	311	331	356	383	544	773	1086
4	Negros	368	400	422	449	483	520	739	1049	1474
Mindanao		**1,978**	**2,098**	**2,223**	**2,395**	**2,584**	**2,789**	**4,138**	**6,088**	**8,751**
1	North Western	238	248	258	278	304	332	531	822	1215
2	Lanao Area	126	126	128	133	142	152	223	321	444
3	North Central	403	453	461	516	572	623	863	1212	1694
4	North Eastern	164	170	174	185	202	219	350	543	805
5	South Eastern	612	619	662	720	768	829	1279	1932	2855
6	South Western	435	482	540	563	596	634	892	1257	1738
Philippines		**15,282**	**16,333**	**17,138**	**18,211**	**19,392**	**20,669**	**28,631**	**39,506**	**53,679**

3.4.3 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 operation 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.

3.4.4 Demand Projections for Transmission Expansions

The SPD projection for each Grid is used in determining the necessary transmission expansion projects. However, for the figure 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. Applicable plant station use and system loss were applied to the generation level to disaggregate the forecast down to the NGCP transformers. 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.

3.5 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 have clearance to undertake System Impact Study (SIS) but are not yet included in the DOE's list of Private Sector Initiated Power Projects (PSIPP) 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 (See Appendix 2). These projects are not included in the official list of DOE's PSIPP.

It is worth noting that the proponents should regularly provide the DOE 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).

New generating power plants are linked to the grid every year to increase and to maintain the demand-supply balance in the system. Table 3.4 shows the list of grid-connected additional capacities as of October 2020.

Table 3.4: List of Grid-Connected Additional Capacities as of October 2020

Power Plant	Location	Installed Capacity (MW)	Dependable Capacity (MW)	Connection Point
Luzon				
Concepcion 2 Solar	Concepcion, Tarlac	70.9	56.7	Concepcion 230 kV Substation
Bataan 2020	25 MW Bataan 2020's Phase 2 Coal Cogen	25	25	Calaguiman 69 kV
	Sub-total (Luzon)	**95.9**	**81.7**	
VISAYAS				
SMCGCP Philippines Energy Storage Co. Ltd. (SPESCL)	Kabankalan City. Negros Occidental	20	20	Kabankalan 138 kV Substation
Isabel Ancillary Service Co. (IASCO)	Brgy. Libertad, Isabel, Leyte	70	70	Interim: Cut-in along Isabel-Pasar 138 kV TL Permanent: Direct to Isabel Substation
	Sub-total (Visayas)	**90**	**90**	
	TOTAL	**185.9**	**171.7**	

In addition to the existing capacity, Table 3.5 shows the capacity summary of DOE's List of PSIPP as of 31 August 2020 for Luzon, the Visayas, and Mindanao. A detailed list of PSIPP is shown in Appendix 3.

Table 3.5: Capacity Summary of DOE's List of PSIPP as of August 2020

	Total Committed Capacity (MW)	Total Indicative Capacity (MW)
Luzon	5,901	38,076.5
Visayas	403.16	4,547.6
Mindanao	429	2,745.5
PHILIPPINES	**6,733.16**	**45,369.6**

Note: BESS not included

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.

Table 3.6 and Figure 3.3 show the list of major committed plants in the Luzon Grid with associated transmission projects that will accommodate their entry and their respective location, respectively.

Table 3.6: Luzon Committed Power Plants and Associated Transmission Projects

Based on DOE List of Private Sector Initiated Power Projects as of Aug 2020			Based on Transmission Development Plan 2021-2040		
Proposed Major Power Plants	Capacity (MW)	Comm. Year	Connection Point	Associated Transmission Project	ETC
COAL					
Masinloc Expansion Project*	300	Unit 3 Sep 2019	Masinloc 230 kV Switchyard	San Manuel–Nagsaag 230 kV Transmission Line	Completed
GNPower Dinginin Supercritical Coal-Fired Power Plant*	1,336	Unit I Oct 2020 Unit 2	GN Mariveles 230 kV Substation (Interim Connection)	Mariveles–Hermosa 500 kV Transmission Line Project Hermosa–San Jose 500 kV Transmission Line Project	Oct 2021 Dec 2021

		Feb 2021	Mariveles (Alas-asin) 500 kV Substation		
AOE Coal-Fired Power Plant*	1,200	Unit 1 Q4 2023 Unit 2 TBD	Pagbilao 500 kV Substation	Pagbilao 500 kV Substation Project Pagbilao – Tayabas 500 kV Transmission Line Subject	Mar 2022 Mar 2025
RPEI Coal-Fired Power Plant*	600	TBD	Castillejos 230 kV Substation	Western Luzon 500 kV Backbone (Stage 1) Castillejos 230 kV Substation Project	Jun 2021 Feb 2024
OIL-BASED					
Ingrid Pililla Diesel Power Plant*	300	Dec 2019	Malaya 230 kV Substation	None	N/A
SPC – Tarlac Bunker Fired Power Plant	11.04	Dec 2019	Capas 230 kV Substation	None	N/A
NATURAL GAS					
EWC CCGT Power Plant *	650	Dec 2022	Pagbilao 230 kV Substation	Pagbilao 500 kV Substation	Mar 2022
BCEI Natural Gas-Fired Power Plant	1,100	Q1 2025	Pinamucan 500 kV Substation	Pinamucan 500 kV Substation	Jun 2024
SOLAR					
ELPI Pasuquin Solar Power Plant Project*	100	Jun 2020	Laoag 115 kV Substation	None	N/A
Alaminos Solar Power Plant	120	Dec 2020	Bay/Makban 230 kV Substation	None	N/A
Tarlac Solar Power Project Phase 2	20	Apr 2019	Concepcion 230 kV Substation	None	N/A
Concepcion 1 Solar Power Project*	15	Dec 2020	Concepcion 69 kV Substation	None	N/A
BIOMASS					
HEC Rice Husk-Fired Biomass Power Plant Project	12	May 2020	San Rafael 69 kV SS	None	N/A
Isabela La Suerte Rice Husk-Fired	5	Nov 2019	ISELCO II San Manuel 13.2 kV feeder	None	N/A
WIND					
Pasuquin Wind Power Project	132	Jun 2020	Laoag 115 kV Substation	None	N/A

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

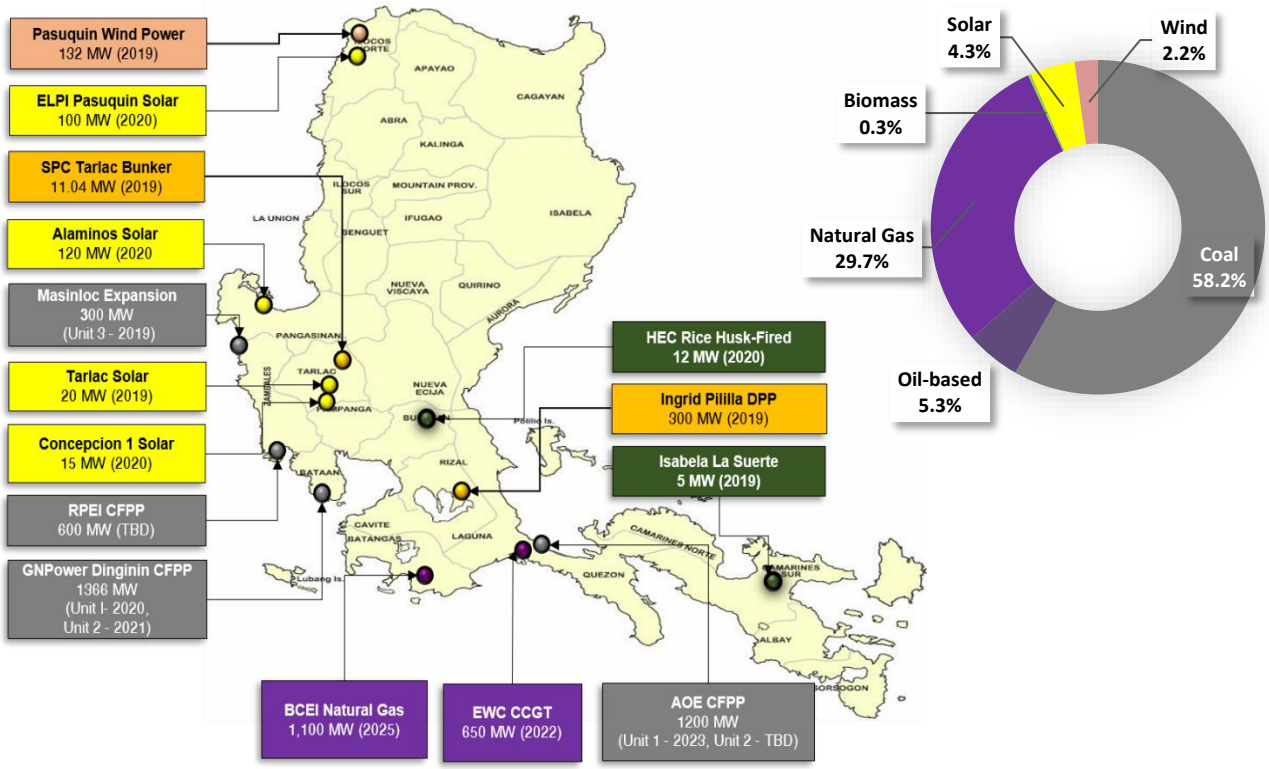


Figure 3.3: Luzon Committed Power Plants[4]

Table 3.7 and Figure 3.4 show the list of major committed plants in the Visayas Grid with associated transmission projects that will accommodate their entry and their respective location, respectively.

Table 3.7: Visayas Committed Power Plants and Associated Transmission Projects

Based on DOE List of Private Sector Initiated Power Projects as of Aug 2020			Based on Transmission Development Plan 2021-2040		
Proposed Major Power Plants	Capacity (MW)	Comm. Year	Connection Point	Associated Transmission Project	ETC
COAL					
Palm Concepcion Coal-Fired Power Project*	135	Dec 2021	Direct connection to Concepcion Substation	Eastern Panay Transmission Line Project	Completed
OIL-BASED					
TPVI Diesel-Fired Power Plant*	44.58	Nov 2020	Existing connection at NGCP's Naga 138 kV Substation	No grid reinforcement required	N/A
BIOMASS					
HDJ Biomass Power Plant Project*	3	Sep 2019	Tap connection along Kabankalan–La Castellana 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2022
SNBI Cane Trash-Fired Biomass Power Project *	25	Oct 2019	Tap connection along Bacolod–San Enrique 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2022
NNBI Biomass Power Plant Project*	25	Nov 2019	Direct connection to NGCP's 69 kV Cadiz Substation or tap connection along	CNP 230 kV Backbone Stage 3	Dec 2022

[4] BESS Power plant not indicated; Source: https://www.doe.gov.ph

Based on DOE List of Private Sector Initiated Power Projects as of Aug 2020			Based on Transmission Development Plan 2021-2040		
Proposed Major Power Plants	Capacity (MW)	Comm. Year	Connection Point	Associated Transmission Project	ETC
			Cadiz-Victorias 69 kV line		
SCBI Multi-Feedstock Biomass Power Project *	20	Nov 2019	Tap connection along Cadiz–San Carlos 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2022
HPC Cogeneration Power Plant Project*	20.58	2020	Tap connection along Cadiz–Silay 69 kV line	CNP 230 kV Backbone Stage 3	Dec 2022
VMC Biomass Expansion Project *	60	Jan 2021	Tap connection along Cadiz-Victorias 69kV line	CNP 230 kV Backbone Stage 3	Dec 2022

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

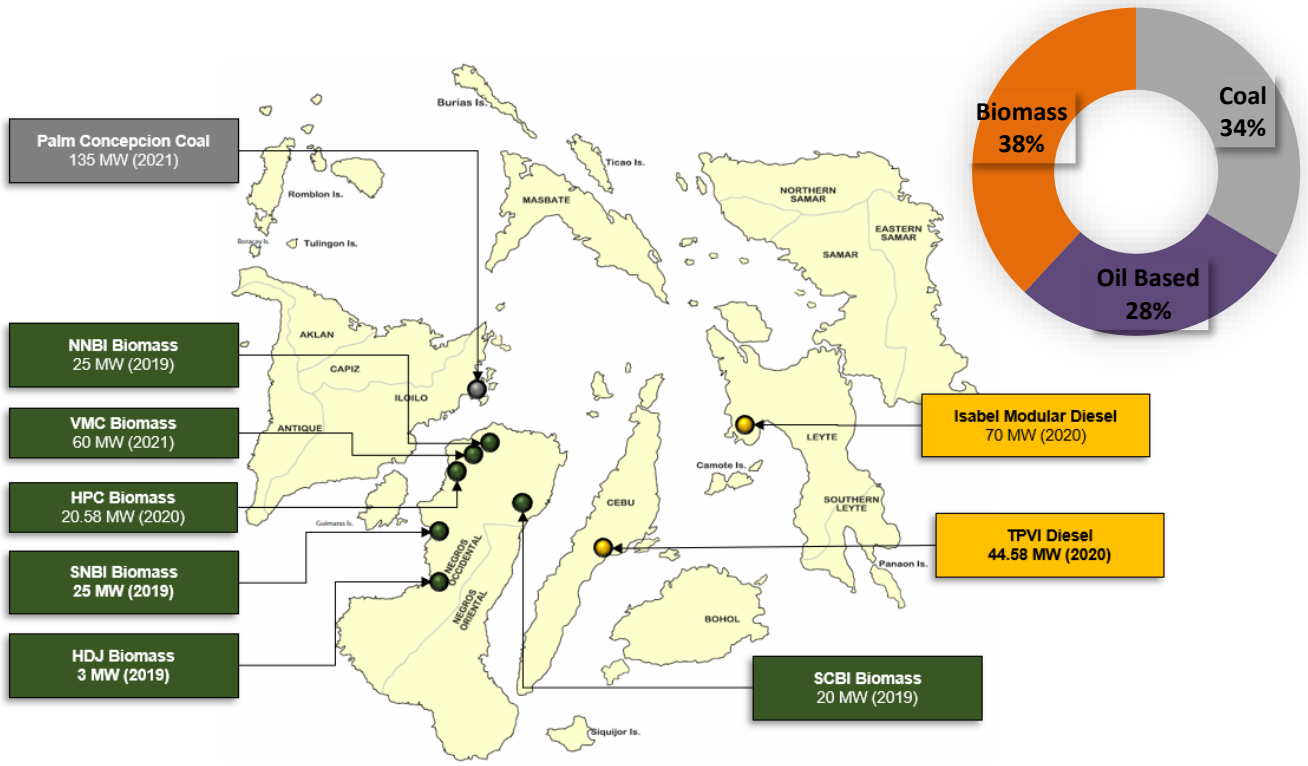


Figure 3.4: Visayas Committed Power Plants

Table 3.8 and Figure 3.5 show the list of major committed plants in the Mindanao Grid with associated transmission projects that will accommodate their entry and their respective location, respectively.

Table 3.8: List of Mindanao Committed Plants and Associated Transmission Projects

Based on DOE List of Private Sector Initiated Power Projects as of Aug 2020			Based on Transmission Development Plan 2021-2040		
Proposed Major Power Plants	Capacity (MW)	Comm. Year	Connection Point	Associated Transmission Project	ETC
COAL					
GNPower Kauswagan Clean Coal-Fired Power Plant*	150	2020	Kauswagan Substation	Balo-i–Kauswagan 230 kV Transmission Line project	Completed
FDC-MPC CFB Coal-Fired Power Plant*	270	2024	Villanueva Substation	Villanueva–Kinamlutan 230 kV T/L	Jan 2027
BIOMASS					
PTCI Rice Husk-Fired Biomass Cogeneration Facility	3	Jun 2019	Sultan Kudarat Substation	Embedded Generation -No Transmission Reinforcement Required	N/A
SPGI Biomass Power Plant Project	6	Nov 2019	Tacurong Substation	Embedded Generation -No Transmission Reinforcement Required	N/A

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

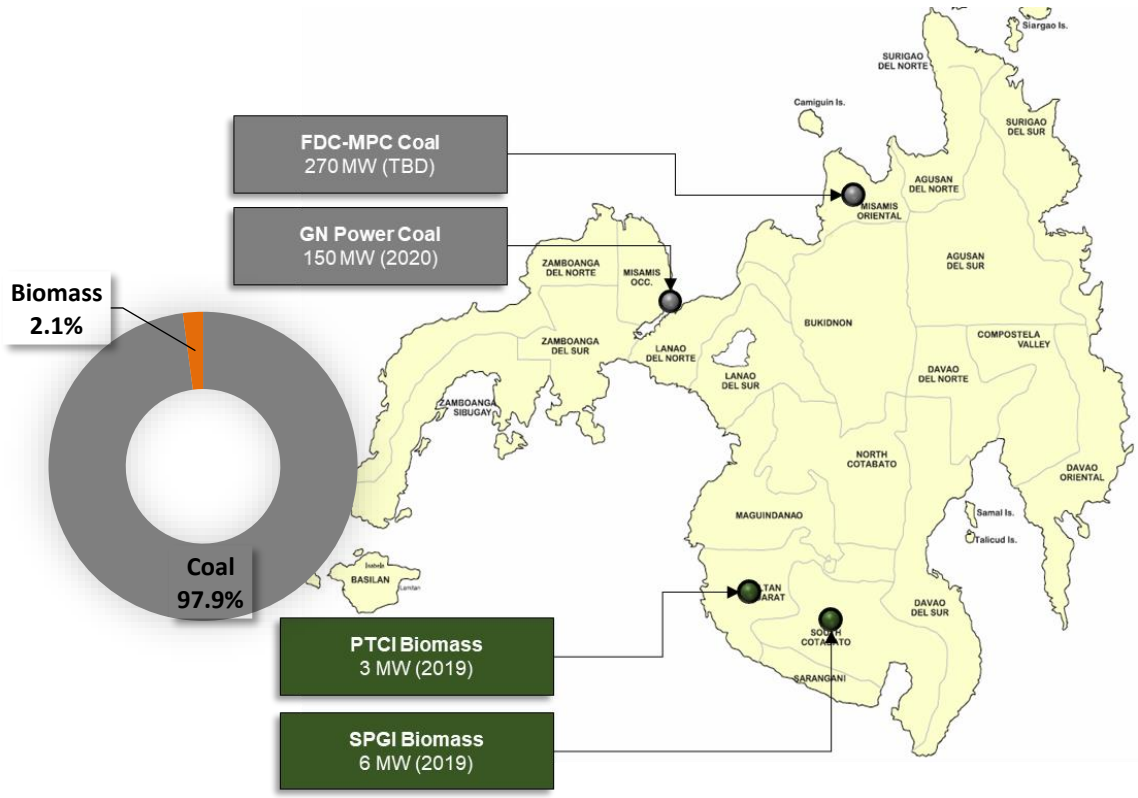


Figure 3.5: Mindanao Major Committed Power Plants[5]

[5] Indicated power plants are those with 5 MW and above in capacity based on DOE's List of Private Sector Initiated Power Projects as of December 31, 2019

3.5.1 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 barely have excess capacity to cater bulk generation addition. Thus, new transmission backbone developments are usually required first for the entry of new large capacity plants.

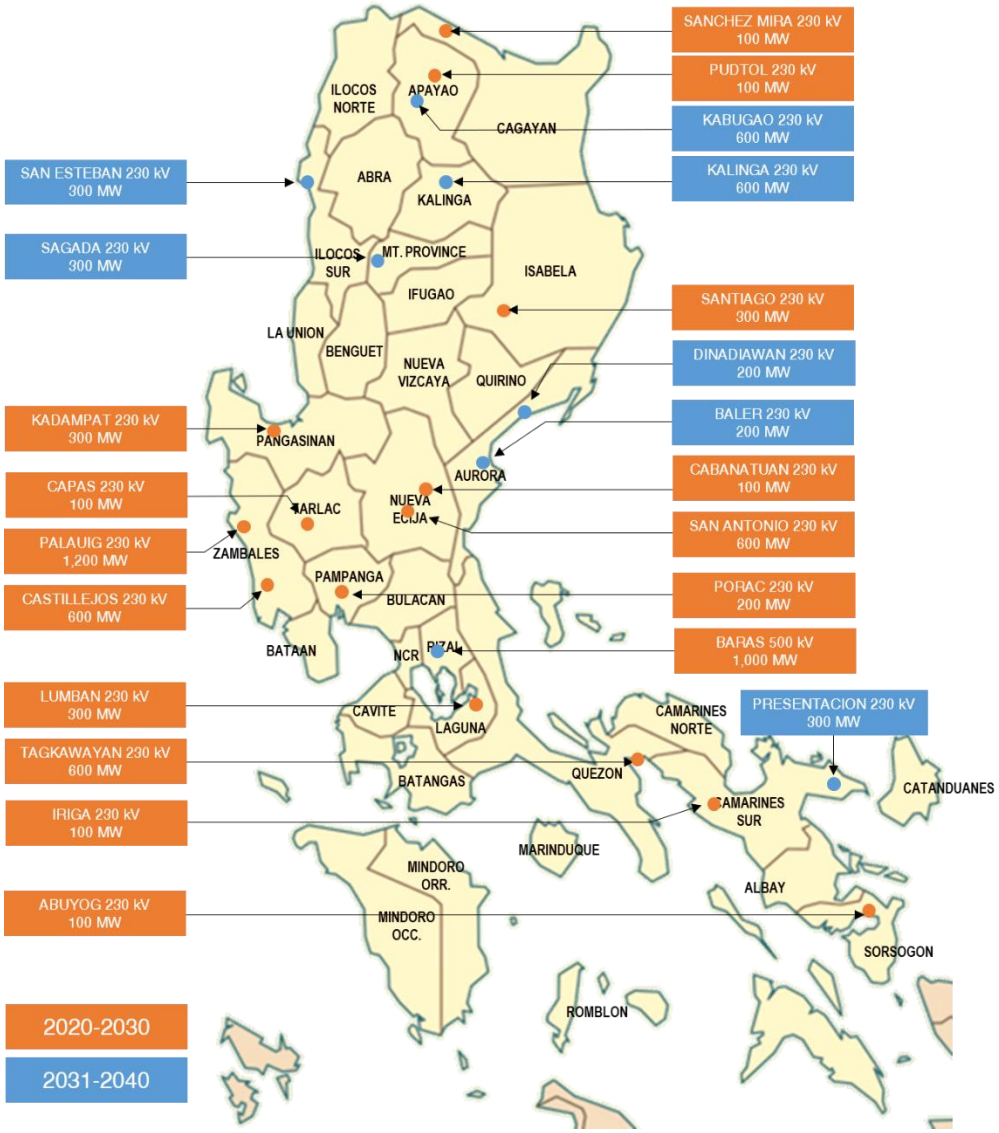


Figure 3.6: Recommended Power Plant Connection Points (Luzon)

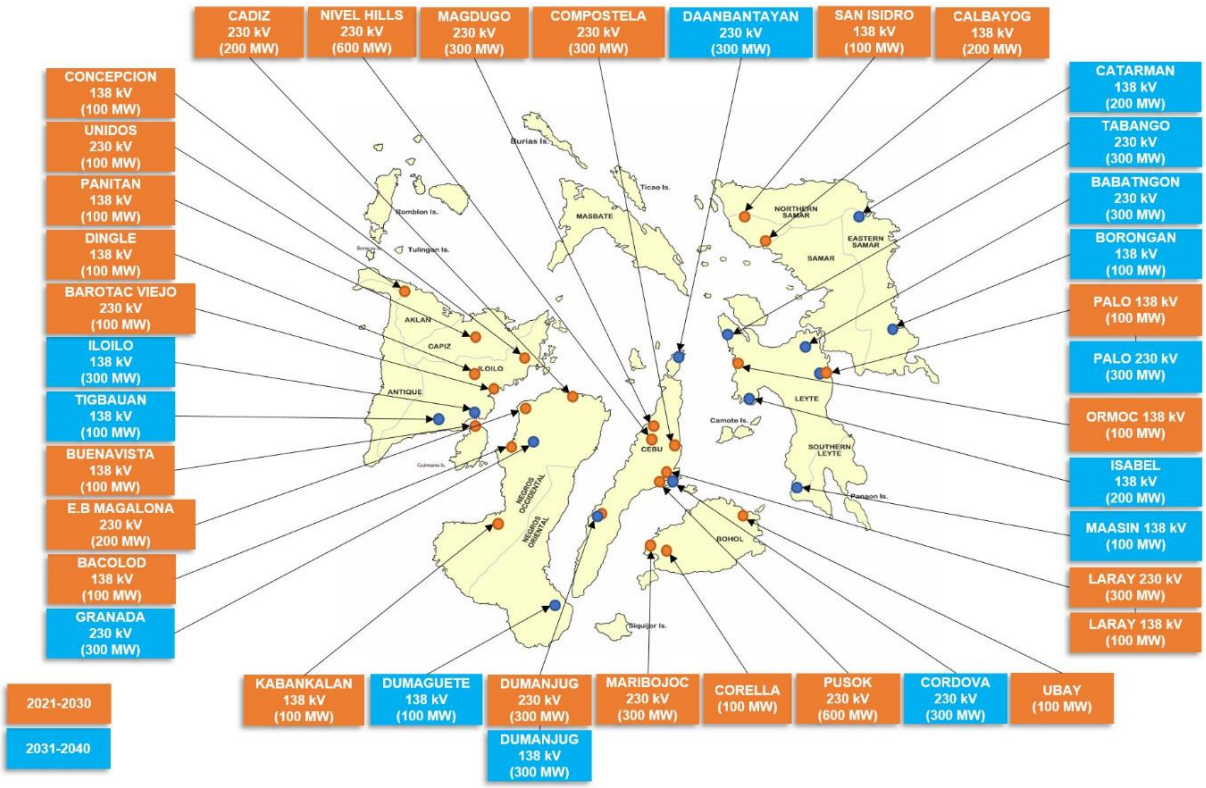


Figure 3.7: Recommended Power Plant Connection Points (Visayas)

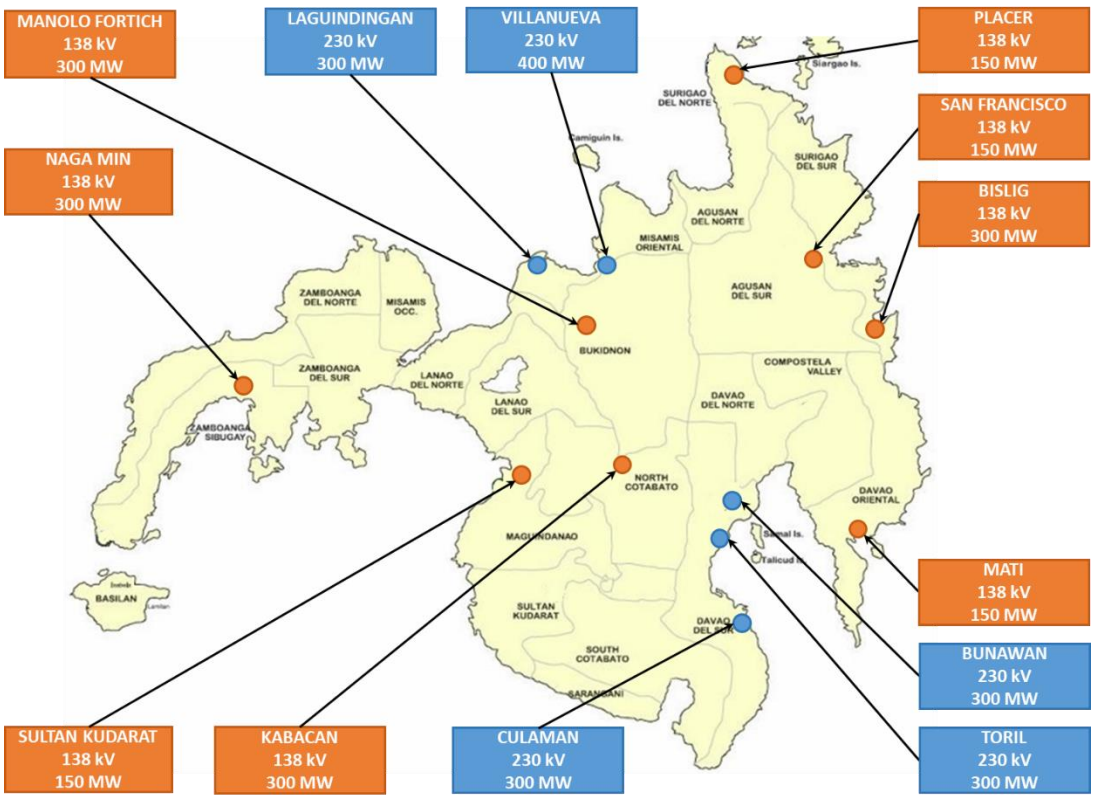


Figure 3.8: Recommended Power Plant Connection Points (Mindanao)

Chapter 4 - Grid Resiliency

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 an excellent system security gives robustness to the power system to withstand unexpected events that have severe consequences[6].

4.1 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.

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 promulgated DOE DC 2018-01-001 "Adoption of Energy Resiliency in the Planning and Programming of the Energy Sector to Mitigate the Potential Impacts of Disasters". The DOE resiliency plans and programs is summarized as follows:

a. Strengthen existing infrastructure facilities;

b. Incorporate mitigation improvements – "Build Back Better" principle;

c. Improve operational and maintenance standards and practices; and

d. Develop resiliency standards

4.2 Climate Change Adaptation Measures

According to DOST-PAGASA, the following impact of Climate Change in the Philippines could be seen through the following:

1. Temperature – Philippine temperature is warming at an average of 0.1 degree Celsius/decade;

2. Rainfall – Increasing trends associated with extreme rainfall in annual and seasonal rainfall;

3. Tropical Cyclone – Decreasing number of tropical cyclone (TCs) and increasing frequency of very strong TCs in the country; and

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

4. Sea Level Rise – Increasing sea level by approximately 20 cm by the end of 21st century.

4.2.1 Resiliency Planning for Transmission System

In anticipation for increasing frequency of super typhoons, earthquakes, volcanic eruptions, and other natural or 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[7]. As the NGCP recognizes its critical role in the country's power industry, specifically in ensuring the uninterrupted transmission and availability of electrical power energy to end user, hence its Plans and Program on Resiliency is summarized as follows:

a. New transmission structures to be built using upgraded wind speed design;

b. Upgrade of old transmission lines – stage by stage;

c. Establishment of transmission backbone loop configuration including the telecommunication network;

d. Enhanced substation site and transmission line route selection criteria using hazard maps issued by government agencies;

e. Establishment of spares for Emergency Restoration System (ERS), steel poles and high voltage equipment including mobile transformers; and

f. Flood control at existing substations, slope protection/concrete bored-pile foundation for existing overhead transmission line structures

4.2.2 Enhancement of Transmission Line and Substation Site Selection

a. In the transmission line route selection process, careful evaluation is 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;

b. For substation sites, the risk of flood or flash flood is 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 that exhibit 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.

[7] Global Platform for Disaster Risk Reduction.

4.2.3 Increase of Transmission Towers Strength and Capacity

The maximum Wind Speed Design (WSD) 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), as shown in Figure 4.1. 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.

a) OHTLs to be erected in Luzon are recommended to be upgraded to withstand wind speed of 300 kph to be able to meet the effects of super typhoon occurring due to climate change; and

b) Existing transmission towers which are designed at 3-second gust wind speed 270 kph should be upgraded or retrofitted to carry higher wind speeds; and

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 lines of at least 230 kV to prevent the pilferage of tower parts which can cause the toppling of steel towers/poles.

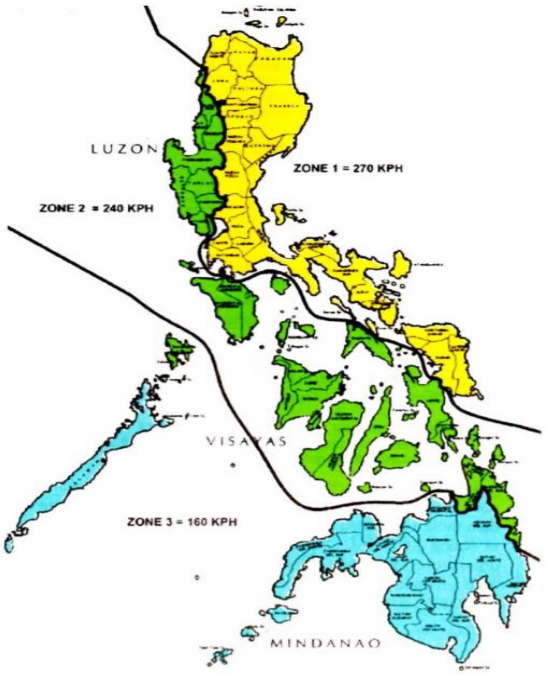


Figure 4.1: Basic Wind Speed of Various Wind Zones, PEC Part 2

4.2.4 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.

4.2.5 Transmission Line Looping Configuration

To further improve the system reliability, enhance the operational flexibility during events of natural calamities, and to support 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.

4.2.6 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. However, because of the excessive cost of underground cable installation, initial applications are 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.

4.3 Asset Replacement

NGCP replacement program adopts a globally accepted practice in the assessment of assets. The methodology being used is believed to provide the most informed decision pertaining to the management of the transmission assets. This will be applied to all NGCP's operational assets which will be discussed in following sub-sections.

4.3.1 Asset Condition Assessment

Condition parameters for each asset type were developed based on the asset's operational and maintenance data, defects, and age. These condition parameters are determined to be the best factors that can accurately represent the overall condition of an asset. The parameters are ranked and evaluated, through the assignment of corresponding weights based on their contribution to asset degradation.

Condition and sub-condition parameters were developed for power transformers, power circuit breakers, current and potential transformers, and surge arresters. The condition parameters shall be used to calculate the health index of an asset. Asset health index refers to the quantitative measure of the relative condition of an asset. The health index can be interpreted as an approximate representation of the estimate life of an asset.

Based from the health index of an asset, its corresponding probability of failure can be derived by using a probability distribution function. The probability of failure of an asset can give a relative possibility of an equipment failure. The effect of such failure should be taken into consideration as part of the evaluation of the asset. To be able to quantify the relative consequence of failure or the criticality of an asset, the social, financial and economic impact of an asset failure must first be identified.

4.3.2 Asset Prioritization

Prioritization of specific assets shall be based on the calculated risks which is derived from the probability of failure and the criticality (consequence of failure). By defining the risk, both the asset condition and its impact in the event of a failure are taken into consideration in the evaluation process.

The assets that fall below the minimum threshold set shall be further evaluated to determine whether to replace or maintain the said asset. Only replacement programs are to be considered since this approach evaluates the condition of existing assets.

The figure below summarizes the overall planning process.

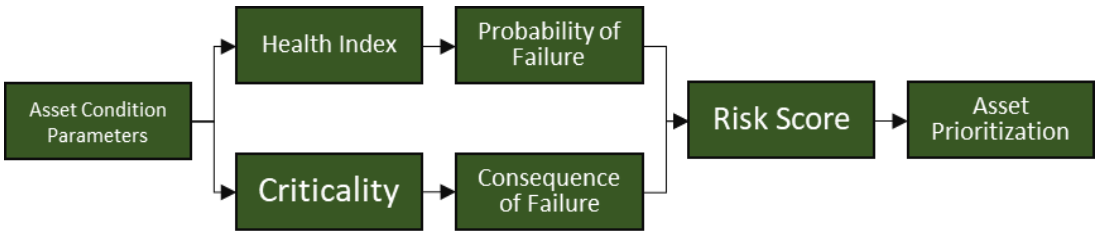


Figure 4.2: Overall Planning Process

4.3.3 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). Appendix 4 shows the summary of Asset Lives. Figure 4.3 shows the 115 kV to 500 kV OHTL age profile.

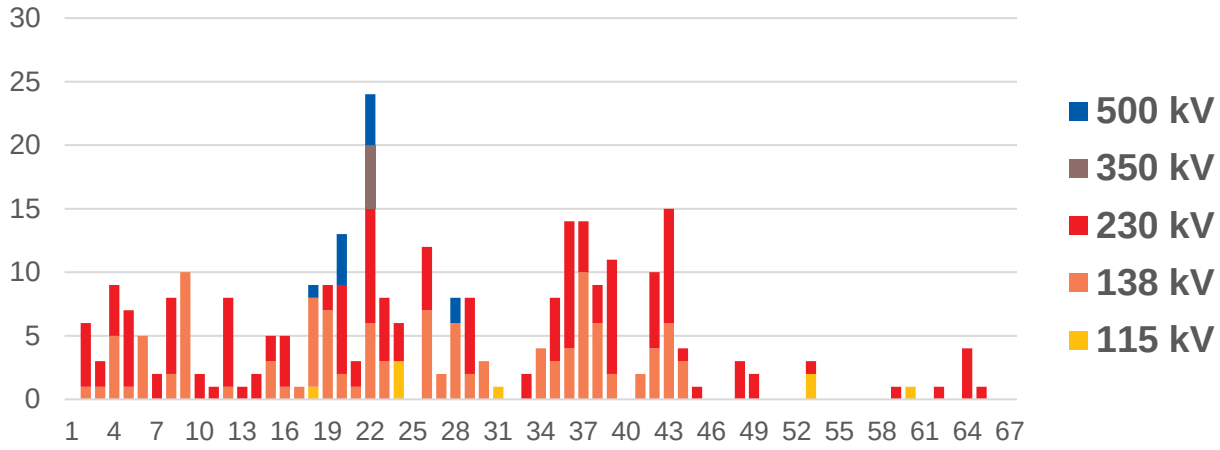


Figure 4.3: Overhead Transmission Line Age Profile

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. In the succeeding years, 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.

Chapter 5 – Emerging Technologies

5.1 Energy Storage System (ESS)

In August 2019, the DOE issued Department Circular No. DC2019-08-0012 entitled, "Providing a Framework for Energy Storage System in the Electric Power Industry", establishing a policy on the operation, connection and application of ESS among others. It recognizes that the ESS technologies are applied to serve variety of functions in the generation, transmission and distribution of electric energy, which include Energy Generation, Peak Shaving and Ancillary Services (AS). The increasing integration of VREs in the transmission system necessitates the recognition of ESS as one of the technologies to manage the intermittent operation of the VRE-generating plants' output to ensure stability. Moreover, ESS will be one of the key elements in the proposed Smart Grid Roadmap towards power system modernization.

The ESS refers to a facility acting as a load and a generator, which is designed to receive, store and convert such energy to electricity. ESS shall include:

a) Battery Energy Storage System (BESS);

b) Compressed Air Energy Storage (CAES);

c) Flywheel Energy Storage (FES); and

d) Pumped-Storage Hydropower (PSH)

The DOE may identify, adopt, and recognize any other ESS technologies that may be developed in the future.

As stated in the Department Circular, NGCP is mandated to undertake the following:

a) Incorporate in the TDP the recommended sizing and siting of ESS;

b) Consider ESS as an alternative solution to transmission congestion;

c) Develop Testing Standard and Procedure for ESS; and

d) Develop accreditation process on the approval of ESS as AS provider

5.1.1 Applications of BESS

BESS is a new technology that has various applications for a transmission system, such as provision of AS, transmission facility upgrades deferment and transmission congestion relief.

The increasing penetration of VREs has the potential to cause significant degradation of the power system performance due to their intermittent nature, which necessitates an increase in the required AS. With focus on large scale wind and solar power generation connected to the grid, rapidly varying power output depending on many factors result in many challenges in the System Operations. BESS is now being widely used to mitigate the effects of integrating RE resources. BESS is capable of absorbing and delivering both real and reactive power in a millisecond time frame. With such

capability, BESS is being used in addressing the challenges on the intermittency brought by RE, i.e., solar and wind energy sources on their ramp rate, frequency, and power quality.

Moreover, the applications considered for the BESS also include frequency regulation, RE fluctuation stabilization, etc. The system inertia, governor droop and damping capability of the BESS can be set (dynamically) according to the power system requirements. Thus, BESS appears to offer one of the most flexible providers of AS to the transmission system.

Furthermore, BESS when connected to appropriate nodes may defer the need for additional transmission facility upgrades by supplying the peak demand of grid/end-users through BESS. It can also mitigate or eliminate the congestion when demand for power exceeds the transmission network capability that may lead to a violation of thermal or voltage stability.

5.1.2 NGCP's Recommended Sites and Capacities for BESS

5.1.2.1 Methodology

The methodology used in determining the recommended capacities and sites of BESS involved load flow analyses to determine the maximum capacity that each site can accommodate during charging and discharging states of BESS with unity power factor.

The scenarios considered in the system simulation were base case peak demand. To test the available capacity of NGCP substation/facilities, the worst generation dispatch was used to see the total power flowing to the connection points. The generation dispatch scenarios discussed in Section 2.2 were considered in the system simulation involving BESS.

The following criteria are considered for normal and N-1 conditions:

a) No overloading of the existing and future equipment and facilities once the BESS are connected and operating as a load and as a generator;

b) The resulting voltages are within the PGC prescribed limits; and

c) Substation termination is available

5.1.2.2 Application

NGCP initially identified BESS's application as a provision for AS, particularly as a reserve. Considering the forthcoming transition to new AS classifications, i.e., primary, secondary, and tertiary reserves and with BESS's fast response and flexibility, it is initially seen to be well suited as a primary reserve. Further studies will be conducted to explore other applications of BESS including adoption of the best practices in other jurisdictions in determining additional reserves due to rapidly increasing VRE penetration in the grid.

5.1.2.3 List of Recommended Capacities and Sites

The following are the initial lists of recommended capacities and sites of BESS as a primary reserve in Luzon, the Visayas, and Mindanao Grids:

Table 5.1: Initial Recommended BESS Capacities and Sites

Substation	Voltage Level	Recommended BESS Capacity (MW)
LUZON GRID		
Masinloc	69 kV	20
Daraga	69 kV	40
Laoag	69 kV	40
San Rafael	69 kV	20
Labo	69 kV	20
Mexico	69 kV	20
San Manuel	69 kV	20
Bay	69 kV	20
Labrador	69 kV	20
Lamao	230 kV	30
Lumban	69 kV	40
	Total Capacity	290
VISAYAS GRID		
Kabankalan	138 kV	10
Ormoc	69 kV	20
Samboan	69 kV	10
Sta. Barbara	138 kV	10
Compostela	230 kV	20
	Total Capacity	**70**
MINDANAO GRID		
Villanueva	138 kV	10
Davao	69 kV	20
Maco	69 kV	20
Kibawe	69 kV	20
Butuan	69 kV	20
	Total Capacity	**90**

5.1.3 Committed BESS

Several BESS power plants were included in the DOE list of Committed power plants as of August 2020 as shown in Figures 5.1 to 5.3.

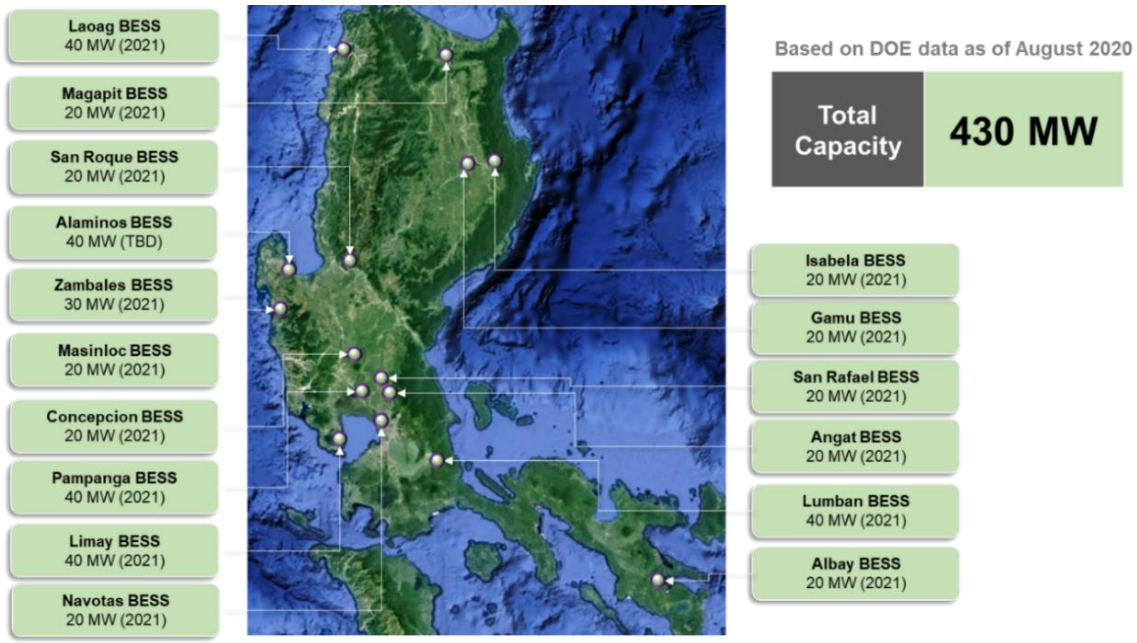


Figure 5.1: Committed BESS in Luzon



Figure 5.2: Committed BESS in Visayas

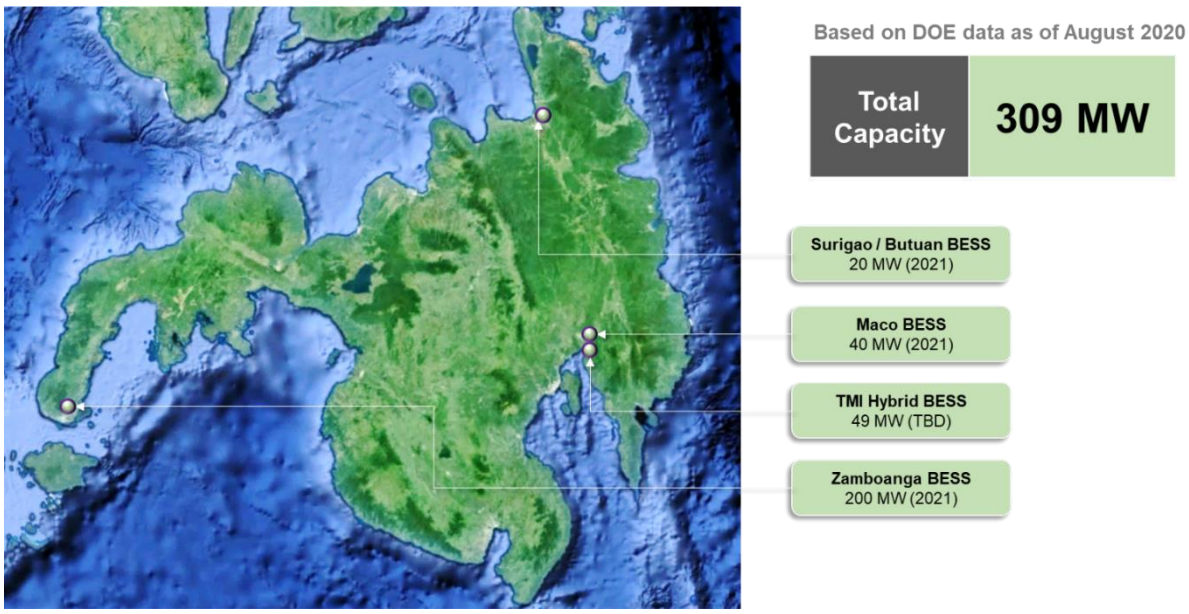


Figure 5.3: Committed BESS in Mindanao

5.2 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.

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 technological innovation, business growth and job creation thereby enhancing the regional and global competitiveness of the Philippines.

On 6 February 2020, the DOE promulgated the Department Circular DOE DC 2020-02-0003 entitled “Providing a National Smart Grid Policy Framework for the Philippine Electric Power Industry and Roadmap for Distribution Utilities”. It envisions the Philippines to reach a level of Smart Grid development capable of (1) Self-healing grid; (2) Full implementation of Retail Competition and Open Access (RCOA), Renewable Portfolio Standards (RPS), Green Energy Option (GEOP), and Net Metering; (3) Full Customer Choice, (4) Demand Response and Peak Load Management; (5) Optimized Energy Storage Systems (ESSs), Energy Management Systems (EMSs), and Distribution Energy Resources (DERs) Management Systems; Virtual Power Plant Integration; and (6) Smart Homes and Cities.

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 can provide real time feedback.[8]

[8] From IEC Definition of Smart Grid

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 component and subsystem 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.[9]

Over the past 10 years, NGCP has implemented several smart grid initiatives including the upgrade of Supervisory Control and Data Acquisition-Energy Management System (SCADA-EMS), establishment of the Overall Command Center, implementation of Microprocessor-Based Substation Control (MBSC), 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 broad areas: transformation, consolidation, and standardization.

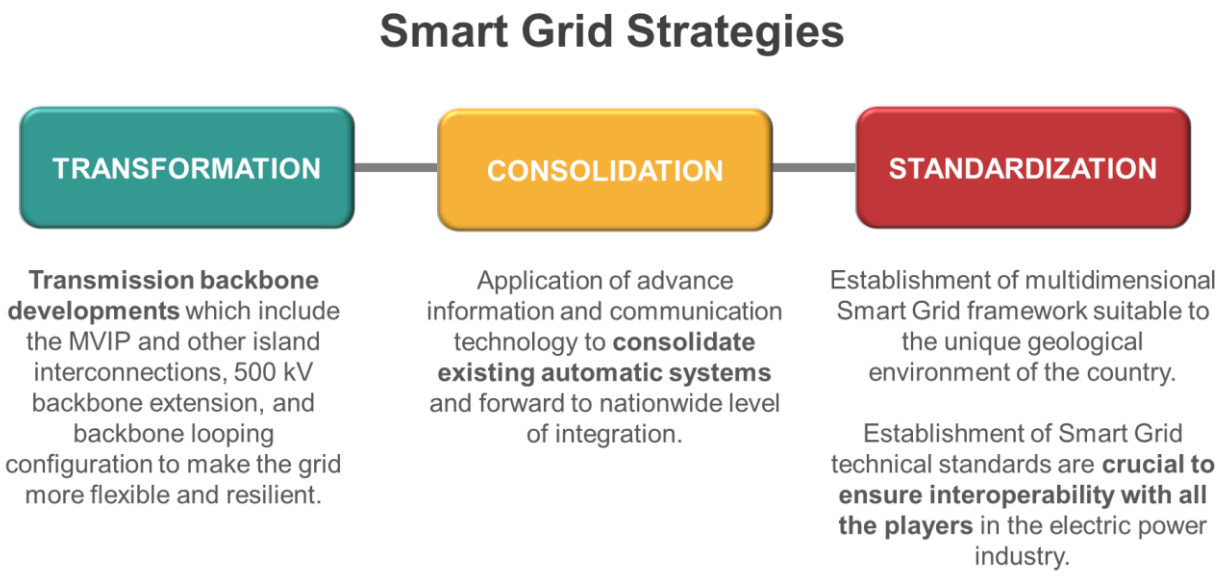


Figure 5.4: Smart Grid Strategies

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.

The Pasay Substation is the pilot substation with applied smart grid technology as shown in the Figure 5.5 below.

[9] From IEC Smart Grid Standardization Roadmap

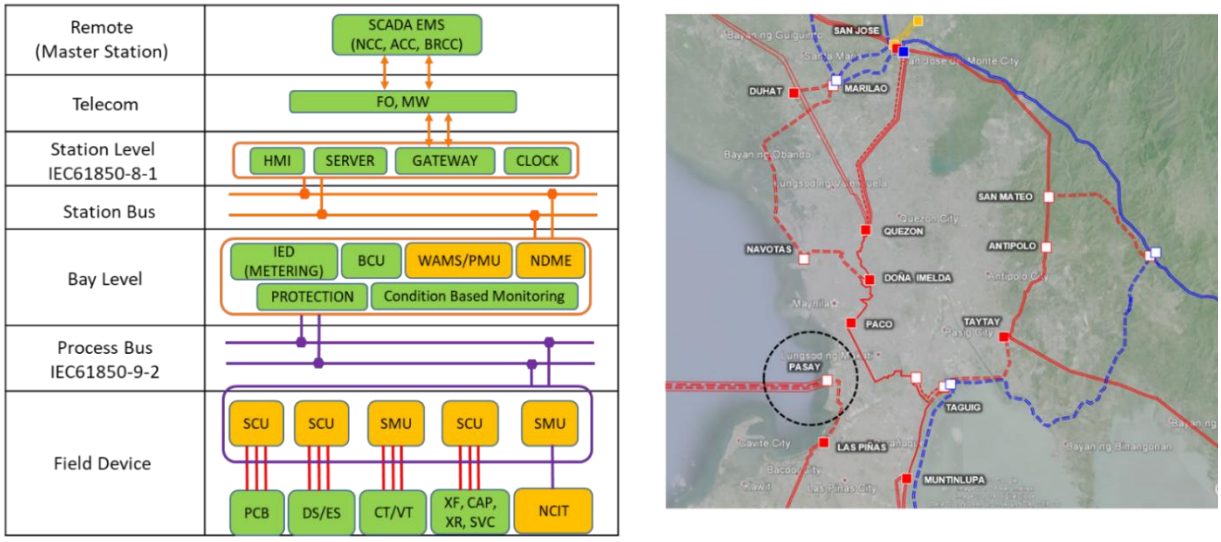


Figure 5.5: Pasay Substation with SMART Grid Technology

5.3 Static VAR Compensator (STATCOM)

STATCOM is a kind of Flexible AC Transmission System (FACTS) devices with parallel reactive power compensation. The use of FACTS devices in a power system can potentially overcome limitations of the present mechanically controlled transmission system.
STATCOM is being proposed to help in the mitigation of the looming voltage problem in areas with inadequate local generation. Application of STATCOM in Zamboanga Peninsula is being proposed to augment voltage support in the area.

Proposed installation of STATCOM in Zamboanga Peninsula

Zamboanga Peninsula is located at the load end of the radially configured Northwestern Mindanao Area network and most of the customer feeders are radially connected with long lines. Moreover, the absence of local generation makes the Zamboanga Peninsula very fragile and susceptible to low voltage and voltage fluctuation during normal and contingencies. On the other hand, installation of additional capacitor banks in Gen. Santos and Tacurong Substations will provide additional reactive power support in the network to maintain the system voltage within the nominal voltage during normal condition and contingencies. The installation of reactive power compensating device is proposed based on the following reasons:

1. To balance the reactive power in the system and attain better voltage regulation;

2. To accept the import of power from distant sources, and;

3. To achieve rapid and smooth power factor correction preventing voltage spikes.

The installation of reactive power compensating devices is proposed in Zamboanga Peninsula with 200 MVAR STATCOM in Zamboanga substation and additional capacitor banks in Naga and Pitogo substations.

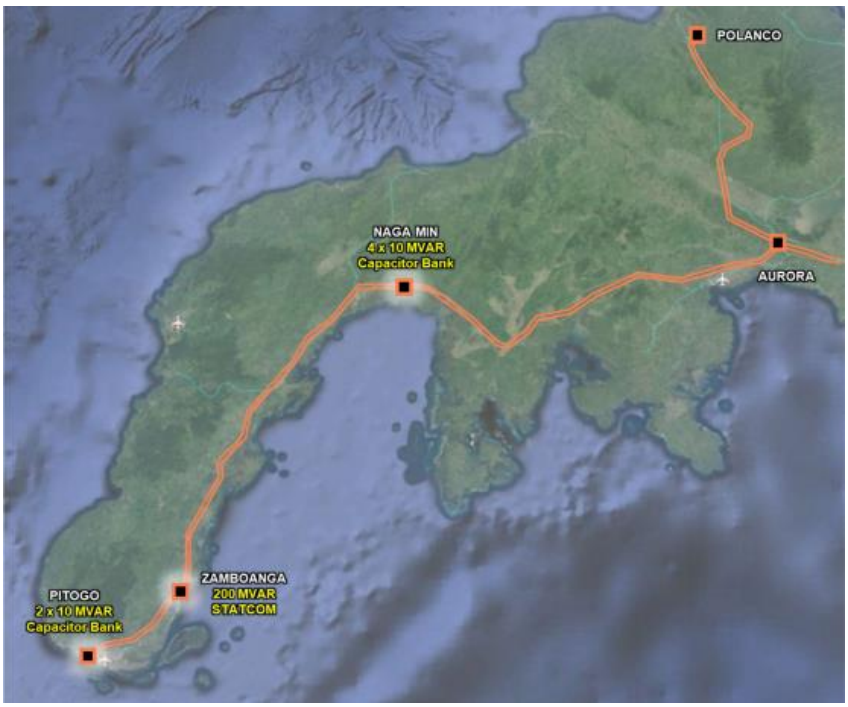


Figure 5.6: Proposed installation of reactive power compensating devices in Zamboanga Peninsula

5.4 Other Technology

With the continuous advancement in technology, NGCP is open to the adaption of new and developing technologies that have substantial application to the operations and maintenance of the transmission system. Various pilot studies have been conducted to check the viability of these new technologies. The following sections below will introduce the application in the operations and maintenance.

5.4.1 Aerial Drone for Transmission Line Inspection

The pilot application of transmission line drone inspection showed positive results in terms of the reduction of inspection time compared to the manual inspection. The output of the drone was sufficiently enough to identify common line hardware defects in a fast and efficient manner. With this, NGCP plans to procure a more advanced drone to address the limitations encountered that will be used by transmission line groups all over the country.

5.4.2 Online Monitoring of HVEs

In order to remotely check the status of critical transmission assets, NGCP plans to install various online monitoring devices. Transformers and Power Circuit Breakers were chosen as the ideal assets for the online monitoring as these are the most vital equipment in the substation. The following are the online monitoring devices that will be installed:

a. Online Bushing Monitor
b. Oil/Winding Temperature
c. Online Dissolved Gas Analysis
d. Online Infrared Scanning
e. Online SF6 Monitor

The installation of online monitoring will enable technical personnel far from substations to assess the physical condition of the equipment.

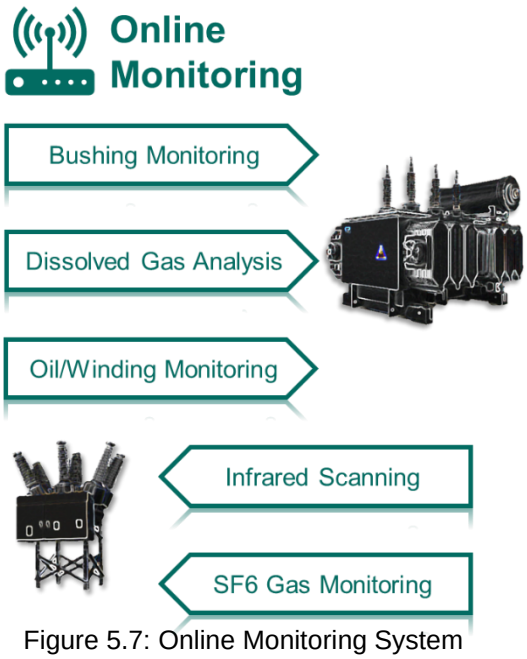


Figure 5.7: Online Monitoring System framework

5.4.3 Centralized Operation of Substations

As part of its continuing drive to uphold its vision, NGCP will be implementing centralization of operation of its substations. The result of this centralization will be the unmanning of substations across the country. The unmanned substations will be clustered, and the operation management of these clusters will be in one strategically located control center per area. NGCP believes that by implementing the centralization, it will improve the operational performance of the substations by simplifying the process coordination and by reducing the manpower involvement in monitoring and switching operation.

In order for the project to be realized, the technical requirements must be met: all substations should be MBSC compliant, all manually operated disconnecting/earthing switches (DS/ES) should be replaced with motorized-operated DS/ES, all manually reset lockouts should be replaced with electrical reset lockout relays, and all connections should be properly wired to prevent mis-operation.

As part of its pilot implementation, NGCP has already identified key substations under the Cebu and Misamis Oriental area. The Central Control and Monitoring System (CCMS) that will have the overall control over these pilot substations will be located in Cebu and Cagayan de Oro, respectively. The CCMS facilities will be manned by engineers on a shifting basis, 24/7.

From 2021 to 2025, 13 CCMS will be implemented and will be using the existing facility of Area Control Center (ACC). On the other hand, eight CCMS will be co-located at major substations for those areas without ACC.

Chapter 6 – Competitive Renewable Energy Zone

6.1 Philippine Competitive Renewable Energy Zone

Available indigenous RE resources could significantly contribute to the country's vision to ensure sustainable, secure, sufficient, and affordable energy. Thus, the initiative to work on the Philippine Competitive Renewable Energy Zone (CREZ) process, which aims to encourage the transmission upgrades and expansion towards the optimal utilization of the country's indigenous RE resources. The CREZ process was adopted from the Texas model that was successfully implemented in the Unites States of America (USA). The DOE together with the United States Agency for International Development (USAID) – National Renewable Energy Laboratory (NREL) partnership lead the group of power sector decision makers in the conduct of CREZ process which will be integrated in the TDP process.

6.2 General Principles and Objectives

On 13 September 2018, the DOE issued the Department Circular No. 2018-09-0027 entitled, "Establishment and Development of Competitive Renewable Energy Zones in the Country." The circular is intended to enhance the planning process and implementation of the PEP, PDP, TDP, and National Renewable Energy Program (NREP). To achieve this, the DOE, in partnership, with other stakeholders, i.e., NGCP, TransCo, ERC, PEMC/IEMOP, NEA, and NAMRIA are required to perform as follows:

a. Identify candidate RE Zones and low-cost RE potential;

b. Identify set of transmission expansion and/or upgrade scenarios that enhance the deliverability of energy originating from candidate RE Zones;

c. Analyze the economic, operational, environmental and other cost and benefits; and

d. Specify cost effective transmission line enhancements.

6.3 CREZ Transmission Planning

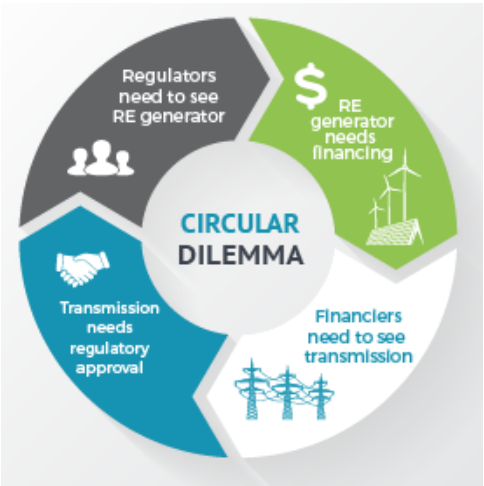


Figure 6.1: Circular Dilemma

Traditional transmission planning could not efficiently support RE developments mainly due to the misalignment in terms of planning and construction time of RE and transmission facilities. Solar PV and Wind Farms are location-based and potential power generation needs to be harnessed on sunny and windy places, which are almost always far from the load centers. Accessing such power from VRE requires more than 5 years for the transmission system to plan and construct. Meanwhile, VRE generation projects only take about 2-3 years. Financers will not provide funding when such RE do not have transmission access. Likewise, transmission developments will not push through when regulators cannot see a definite need for the

dedicated/associated lines for the incoming VREs. These relationships are shown in Circular Dilemma in Figure 6.1.

6.4 CREZ Process

Table 6.1 shows the outline of the CREZ Transmission Planning Process that applies to RE expansion that is constrained by the lack of existing transmission. It is an approach to plan, approve, and build transmission infrastructure that connects REZs to the power system.

Table 6.1: CREZ Transmission Planning Process

Steps	Process/Output	Detailed Tasks	Timeline
Step 1. Process Design and Vision Statement			Jun 2018 – Jun 2020
Step 2. RE Resource Assessment	**Process:** Select areas with highest potential **Output:** Study areas map and supply curves	▪ Assess resource ▪ Screen exclusion areas ▪ Identify the areas with the highest quality, developable resource	
Step 3. Candidate Zones Selection	**Process:** Identify zones with highest probability of development **Output:** Candidate zone map and supply curves (one per area)	▪ Gauge commercial interest ▪ Identify areas where high quality resources intersect with commercial interest	
Step 4. Transmission Options Development	**Process:** Bundle candidate zones and conduct analyses of the options **Output:** Cost, benefit, and reliability impacts for each transmission alternative	▪ Select scenario creation (bundling) methodology ▪ Conduct cost-benefit analysis of options ▪ Steady-state, dynamic stability, production cost, and reliability analysis	
Step 5. Final Transmission Plan Designation	**Process:** Select transmission option according to pre-set criteria **Output:** Final transmission order	▪ Select transmission option that best complies with predetermined criteria, including reliability standards, economic benefits, and environmental goals	Jul 2020 – Jun 2021
Step 6. Transmission System Upgrade			2021 Onwards

6.5 Selection of Candidate CREZ

An RE Zone (REZ) is a geographical area that enables the development of profitable, cost-effective, grid-connected RE (large-scale). As shown in Figure 6.2, REZs must have high quality RE resources, suitable topography and land-use designations, and demonstrated interest from developers.

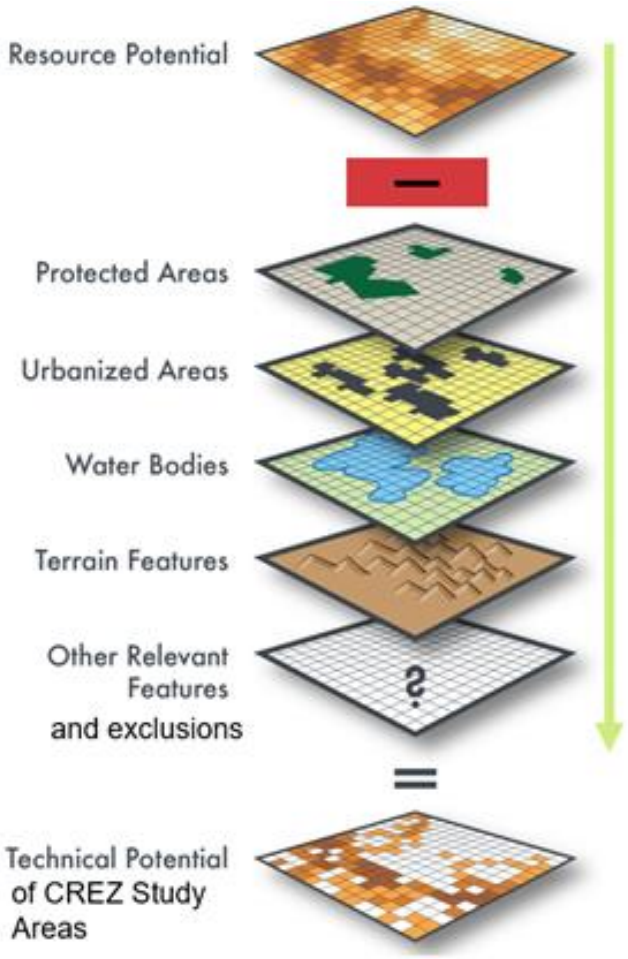


Figure 6.2: Selection Criteria for CREZ[10]

The Zone Working Group (ZWG) was tasked to identify CREZ study areas with the objective to pinpoint the areas that are off limits to RE development and which the remaining areas have the highest concentrations of high-quality wind and solar resources. Overall, the ZWG initially identified a total of 34 CREZ study areas and the zones with the highest production potential and highest level of demonstrated commercial interest (through service contract coverage). A total of 25 CREZ were selected in the Philippines based on the selection criteria.

6.6 System Modeling Approach

With the objective of identifying and characterizing a set of implementable transmission development plans that could provide transfer capacity to deliver power from the candidate CREZ to load throughout the Philippines, the modeling process flow is used for the CREZ process, as shown in Figure 6.4.

[10] Lopez, Anthony. 2016. "High-Level Overview of Data Needs for RE Analysis." Presentation NREL/PR-6A20-67835. Golden, CO: National Renewable Energy Laboratory (NREL). http://www.nrel.gov/docs/fy17osti/67835.pdf.

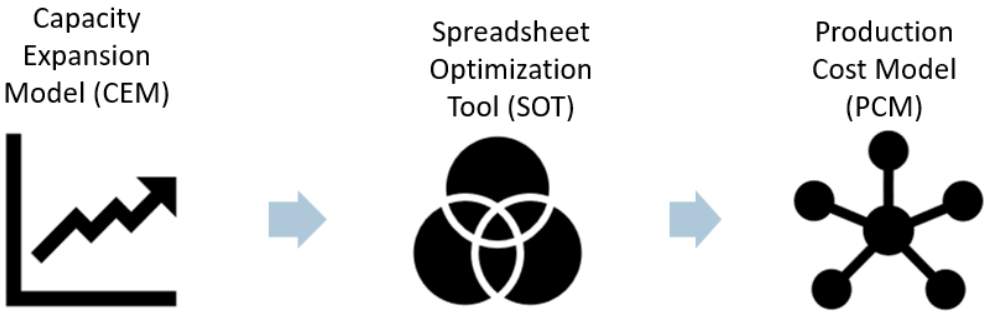


Figure 6.3: Philippine System Modelling Approach

The Philippine DOE is responsible in the preparation of the Capacity Expansion Model (CEM), while NGCP is responsible for implementing the Spreadsheet Optimization Tool (SOT) and the preparation of the Production Cost Model (PCM)

6.7 Scenarios

In the CEM, two cases are considered. Case 1 deals with a transmission network wherein Luzon, the Visayas, and Mindanao Grids are treated as isolated systems with no interconnections among them. The existing Luzon-Visayas HVDC Interconnection System and the upcoming Mindanao-Visayas HVDC Interconnection are disregarded. Case 2 incorporates the interconnections among the grids with corresponding limits. Both cases were simulated but focus was given to Case 2: Interconnected Systems since it considers the constraints in the transfer capacities between grids. Scenarios considered for the CREZ process are summarized in Figure 6.5.

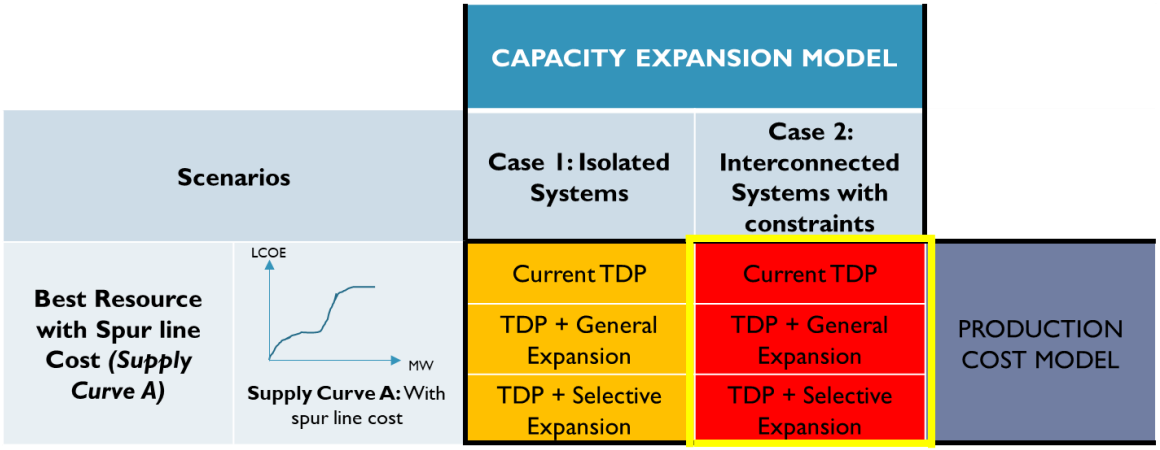


Figure 6.4: Scenarios Considered for Philippine CREZ Process

For the PCM, three scenarios are considered:

A. Base
   1. Current TDP – No additional transmission reinforcements aside from those included in TDP 2016-2040

B. TDP + Expansion – Additional Grid reinforcements
   2. TDP + General Expansion: Directly increasing the capacity of the lines and transformers with violations

3. TDP + Selective Expansion: Upgrading selected facilities with thermal violations (≥5% interval)

Note that in the PCM Scenario 1, transmission lines and transformers can have power flows greater than their thermal limits with corresponding penalty values to be used in the optimization. Lines and transformers which exhibited thermal violations are the ones subjected for upgrades in scenarios 2 and 3.

6.8 Capacity Expansion Model

A CEM attempts to determine the optimal build out of new generation over a considered planning horizon to meet demand and required reserve requirements. For the Philippine CREZ Process, it is assumed that the CEM is a pure generation build out and does not consider transmission build out. Thus, the transmission network considered for the CEM is simplified and lumped to three nodes, with each node representing the Luzon, Visayas, and Mindanao Grid. Inputs to the CEM include generation build out cost, fuel cost, heat rates, demand growth rate, etc. The selected 25 candidate CREZ have corresponding wind and solar capacity factors each. The major output of the CEM is the generation build out per year per technology and the total wind and solar capacity build out.

Shown in Table 6.2 are the resulting capacity addition by 2040 based from the output of the CEM for case 2: interconnected systems.

Table 6.2: Capacity Addition by 2040

Generator Type[11]	Luzon	Visayas	Mindanao	Philippines
New ICE – Diesel	1,040	80	160	1,280
New ICE – LNG	8,540	3,980	1,240	13,760
New CCGT	11,400	1,500	4,200	17,100
New OCGT	400	100	200	700
New Biomass	300	300	260	860
New Hydro	0	300	0	300
New VRE	20,931	7,425	6,278	34,634
Total	**42,611**	**13,685**	**12,338**	**68,634**

6.9 Spreadsheet Optimization Tool

The generation build out output of the CEM is used as the generation addition input for the PCM. However, the allocation of capacity per CREZ needs further optimization due to factors listed below:

a) Only one build out cost each for VRE is considered across Luzon, the Visayas, and Mindanao;

[11] ICE – Internal Combustion Engine; CCGT – Combined Cycle Gas Turbine; OCGT – Open Cycle Gas Turbine

b) The build out cost does not consider spur (connection asset) line cost;

c) Only one capacity profile, i.e., representative capacity factor for VRE in a CREZ; and

d) Temporal resolution (time interval) of the CEM may not fully represent the difference between CREZs.

The SOT is used to incorporate the detailed supply curve per CREZ, which results to the CREZ capacities optimized with the use of the Levelized Cost of Electricity (LCOE). Shown in Table 6.3 is the resulting allocation per CREZ based on the output of the SOT, while Figure 6.5 shows the approximate locations.

Table 6.3: CREZ Capacity Addition with LCOE Optimization in MW/Interconnected Systems

CREZ	PV (MW)	WIND (MW)	Associated Transmission Project
LUZON			
L1	985	1,280	▪ San Antonio 500 kV Substation ▪ Baras–San Antonio 500 kV Transmission Line
L2	651	654	▪ Castillejos 230 kV Substation ▪ Western Luzon 500 kV Backbone
L3	496	544	
L4	1,046	1,047	▪ Capas 230kV Substation
L5	536	531	▪ Western Luzon 500 kV TL Stage 2 ▪ Palauig 500 kV Substation
L6	101	356	▪ Balaoan–Laoag 500 kV Transmission Line ▪ Northern Luzon 230 kV Loop Transmission Line
L7	926	834	▪ Northern Luzon 230 kV Loop Transmission Line ▪ Kabugao 500 kV Substation
L8	1,070	1,072	▪ Kalinga–Kabugao 500 kV Substation ▪ Kabugao 500 kV Substation
L9	1,109	1,239	▪ Santiago–Nagsaag 500 kV Transmission Line ▪ Kalinga 500 kV Substation ▪ Santiago 500 kV Substation
L10	765	752	▪ Pagbilao 500 kV Substation
L11	811	675	
L12	707	708	▪ Tagkawayan 500 kV Substation
L13	486	502	▪ Luzon Visayas HVDC Bipolar Operation
Mr1	130	386	▪ Batangas-Mindoro Interconnection Project
Mr2	213	324	
Total	**10,032**	**10,904**	
VISAYAS			
B1	506	443	▪ Cebu–Bohol 230 kV Interconnection ▪ Bohol–Leyte 230 kV Interconnection
N1	355	708	▪ CNP 230 kV Backbone ▪ Cebu–Negros 230 kV Interconnection Line 3 and 4 ▪ Luzon–Visayas HVDC Bipolar Operation ▪ Mindoro–Panay Interconnection Project
N2	854	551	
Py1	579	693	▪ CNP 230 kV Backbone ▪ Negros–Panay 230 kV Interconnection Line 2 ▪ Cebu–Leyte 230 kV Interconnection Lines 3 and 4 ▪ Luzon–Visayas HVDC Bipolar Operation ▪ Mindoro–Panay Interconnection Project
Py2	908	676	
S1	513	644	▪ Calbayog–San Isidro 138 kV Transmission Line ▪ Cebu–Leyte 230 kV Interconnection Lines 3 and 4 ▪ Luzon–Visayas HVDC Bipolar Operation
Total	**3,715**	**3,715**	▪ Cebu–Bohol 230 kV Interconnection ▪ Bohol–Leyte 230 kV Interconnection

MINDANAO			
Mn2	1	560	• Lala–Naga–Zamboanga 230 kV Transmission Line
Mn4	522	1,263	• Balo-I-–Villanueva– Maramag 230 kV Transmission Line
Mn7	705	788	• Eastern Mindanao 230 kV Transmission Line
Mn8	969	1,472	• Kabacan Substation
Total	**2,197**	**4,083**	
PHILIPPINES			
Total	**15,944**	**18,702**	
	34,646		

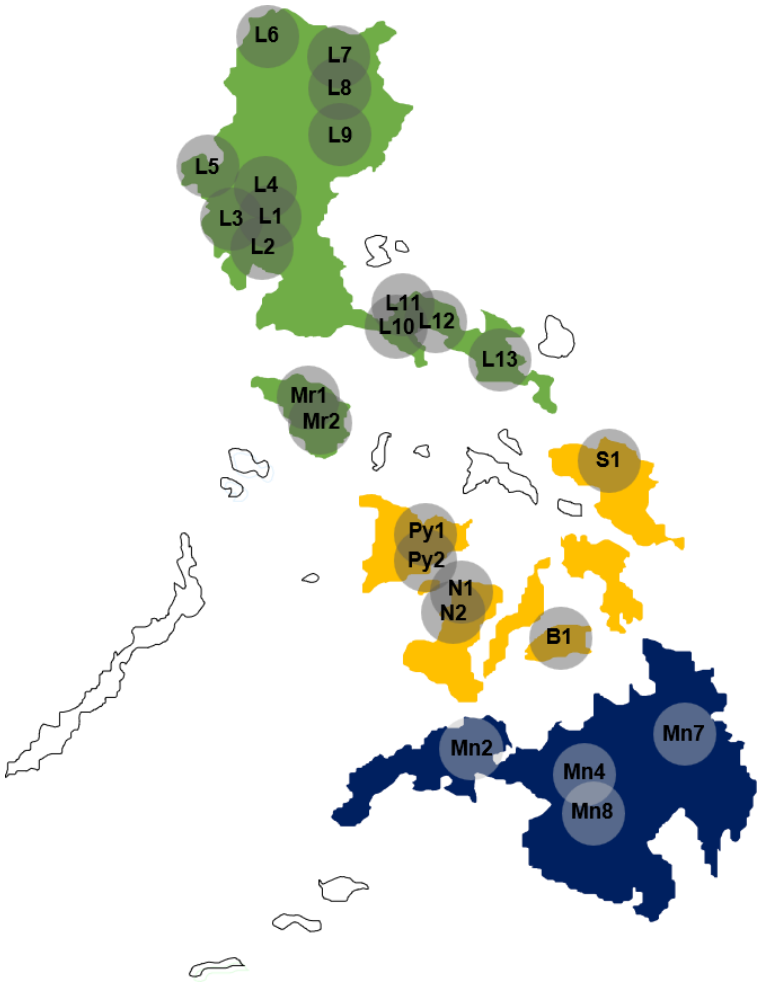


Figure 6.5: Approximate Location of the 25 CREZ

6.10 Production Cost Model

A production cost model optimizes the day-ahead dispatch schedule of generating units subject to physical and economic constraints of the system. Physical constraints include thermal limits of transmission lines and generators' operational requirements such as ramp rates, minimum number of hours units should be on or off, and minimum stable output if on. Economic parameters include inputs pertaining to cost assumptions. The DOE provided the production cost data for all generator types including other generator parameters.

The 2040 transmission network considered for the PCM already reflects all planned transmission network enhancements as stated in TDP 2016-2040 Volume 1. Corresponding additional grid reinforcements are reflected for both cases of general and selective expansion in the PCM. For the additional generating capacities, committed power plants included in the list of PSIPP as of December 2017 are considered as well as the output generation build out from the CEM.

To simplify the model and reduce run-times, only thermal limits of transmission lines with voltage rating greater than or equal to 138 kV are considered. It was observed that considering such limit maintains the accuracy in terms of transmission line flows and reasonable run-times. In addition, a lossless system is considered, while N-1 contingency provision is not considered, and no transmission line, transformer, and generator outages are included. However, future modeling exercises can consider these additional inputs.

6.11 Initial Assessment

The CREZ' Transmission Working Group conducted simulations and produced results of a scenario following a complete REZ process as outlined in Section 6.4. Thus, only preliminary results which are subject for changes and/or improvements are presented.

Shown in Figures 6.6 and 6.7 below are the resulting Capacity Mix and Energy Mix by 2040, respectively, when CREZ are included in the system.

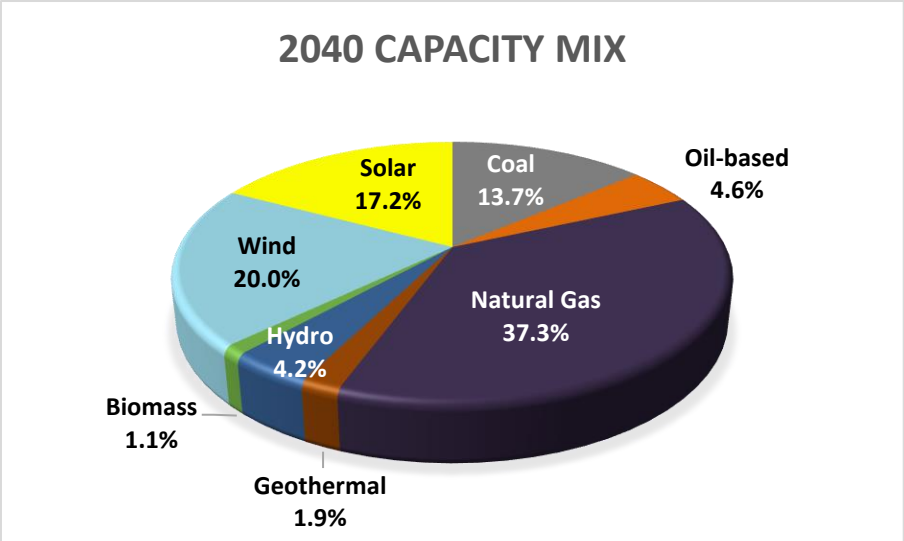


Figure 6.6: 2040 Philippine Capacity Mix with CREZ

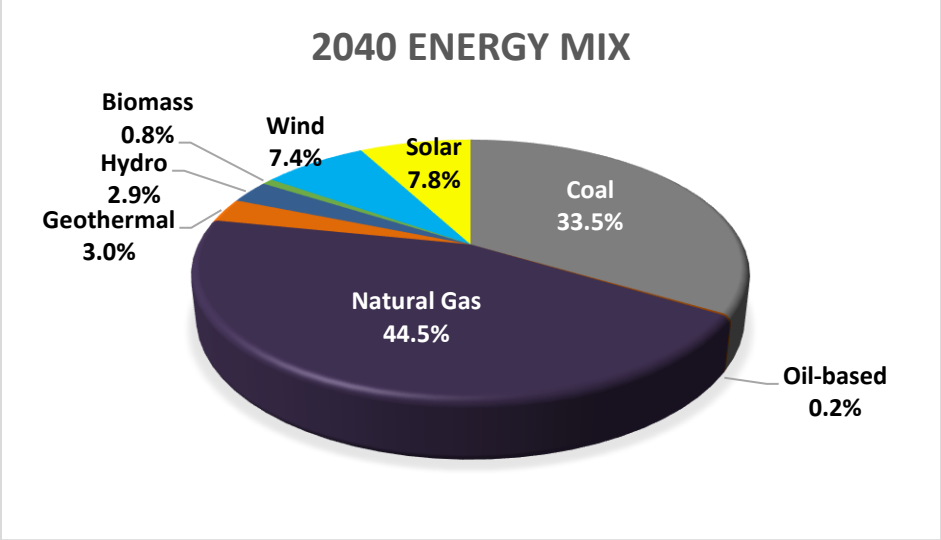


Figure 6.7: 2040 Philippine Energy Mix with CREZ

With majority of generation addition based from the CEM output are generating facilities utilizing Liquefied Natural Gas (LNG) as fuel, the part of Natural Gas plants for both capacity and energy mixes is largest among power plants with other fuel types comprising of about 37.3% and 44.5%, respectively. VRE constitutes to about 37.2% of the capacity mix. However, due to its intermittent outputs, it could only contribute about 15.2% in the energy mix. The overall RE contribution in the capacity mix is about 44.4%

Table 6.4: 2040 Comparative RE and CREZ Energy Share and CREZ Curtailment

Scenario	RE Energy Share (%)	CREZ Energy Share (%)	CREZ Curtailment) (%)
TDP 2016-2040	21.3	14.0	4.7
TDP and General Grid Expansion	21.8	14.6	0.7
TDP and Selective Grid Expansion	21.5	14.3	2.4

Table 6.4 shows that by 2040, the total RE share can be brought to about 21.8% with the VRE (CREZ) contributing about 14.6%. When no transmission enhancements aside from TDP 2016-2040 are considered, curtailment level from CREZ is about 4.7%. Through general expansion, this level can be brought down to as much as 0.7%

Listed below are some notes for consideration:

a. The PCM results do not consider intra-hour VRE generation variation. Hence, the impact of such amount of capacity in terms of real-time supply-demand balancing, i.e., frequency regulation, may be considered in a separate study;

b. The impact of such amount of capacity in terms of voltage regulation, stability, among others will be best investigated on a separate reliability study/analysis; and

c. The aggregate VRE capacity by 2040 may only be realized upon the completion of transmission projects considered in the system model.

6.12 Way Forward

Enumerated below are possible scenarios for consideration in future simulations under the Philippine CREZ process:

a. Incorporate in the CEM and PCM the BESS for AS and other applications;

b. Instead of letting the CEM optimize capacity build outs for VRE, set capacity target for VRE by 2040, i.e., 40 GW by 2040;

c. Test additional Transmission Scenario build outs to increase VRE share, i.e., new transmission corridors and island interconnections;

d. Combine various “flexibility options” in increasing VRE share, i.e., adding flexible generation (GT), Demand-Side Management through BESS, transmission expansion, etc.; and

e. Conduct separate study for intra-hour variation of VRE for System Operations

Chapter 7 – 69 kV Facilities

7.1 Background

The EPIRA provides that the 69 kV facilities or the subtransmission assets shall be operated and maintained by TransCo until their divestment to qualified distribution utilities which are in a position to take over the responsibility for operating, maintaining, upgrading, and expanding said assets. TransCo shall negotiate with and thereafter transfer such functions, assets, and associated liabilities to the qualified distribution utility or utilities connected to such subtransmission facilities not later than two (2) years from the effectivity of the EPIRA or the start of open access, whichever comes earlier.

The ERC also issued the Guidelines to the Sale and Transfer of the TransCo's Subtransmission Assets and the Franchising of Qualified Consortiums on October 17, 2003 to establish the approval process of the sale and transfer of subtransmission assets to distribution utilities. This is later amended by ERC Resolution no. 15, series of 2011 with objectives to:

a. Ensure continued quality, reliability, security, and affordability of electric service to end-users;

b. Ensure the transparent and reasonable prices of electric service in a regime of free and fair competition and to achieve greater operational and economic efficiency;

c. Enhance the inflow of private capital and broaden the ownership base of subtransmission assets; and

d. Provide for the orderly and transparent sale and transfer of subtransmission assets of TransCo or NGCP to qualified buyers.

Further, the Final Determination issued by the ERC for the 2nd Regulatory Period (2006 – 2010) for the TransCo states that:

"The ERC does not anticipate that TransCo will be financing anymore subtransmission projects in 3-4 years time. Considering that the cost of these sub transmission assets shall be solely borne by connected customers, who shall eventually acquire these assets, projects such as these shall already be undertaken by the concerned customers requiring installation/upgrade."

Thus, NGCP highly encourages the distribution utilities to invest and focus on subtransmission assets' future development.

7.2 Age Distribution of 69 kV Lines Nationwide

Majority of NGCP-operated 69 kV Lines nationwide are composed of Wood Pole Structures that already exceeded its 25-year asset life, as seen in Figure 7.1. Although these assets are part of Wood Pole Replacement Program of NGCP, it is still highly encouraged that Distribution Utilities take the responsibility to operate, maintain, upgrade, and expand these assets.

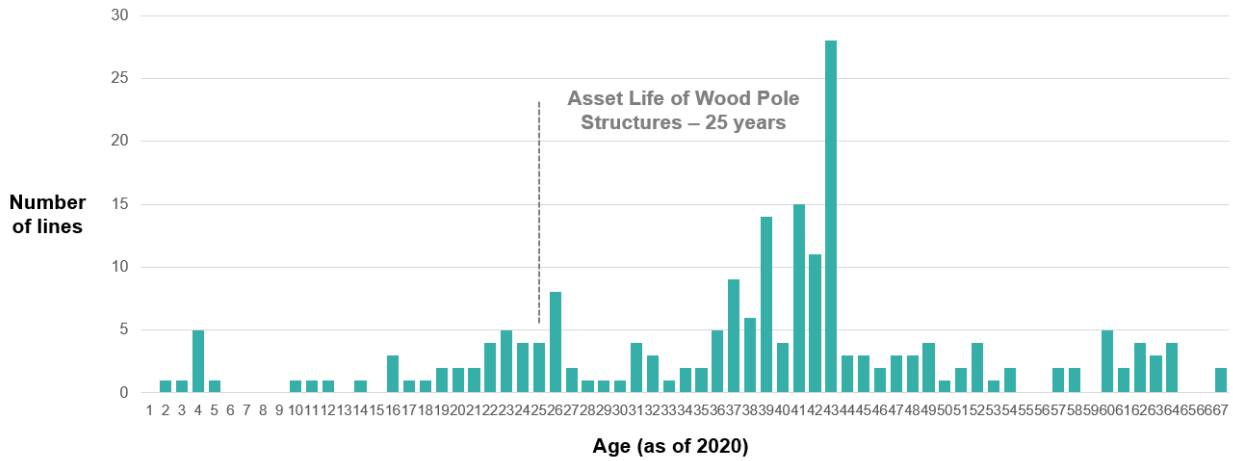


Figure 7.1: Age Distribution/Profile of NGCP-operated 69 kV Lines Nationwide

7.3 Way Forward

As a way forward, short and long-term plans need to be realized to comply with the EPIRA and transmission regulations set by the ERC.

Short-Term

a. Co-location of NGCP-operated 69kV capacitor at DUs load-end substations;

b. Implementation of new 69 kV lines or reconductoring of existing lines;

c. Installation of RTUs at load-end substations to support the market operation; and

d. Relocation of metering location pursuant to ERC Resolution 23, S. 2016.

Long-term

a. NGCP to develop new 230/69 kV or 138/69 kV substations to serve as alternate source of the DUs;

b. For all new load-end substations to be developed by DUs – capacitor installation to be considered or at least with space provision; and

c. Encourage the distribution utilities to implement additional outgoing 69 kV lines from existing NGCP 69 kV substations.

Chapter 8 – ERC Approved Projects

In September 2020, NGCP completed a total of 96 circuit-km of overhead transmission lines, installed 100 MVA additional substation capacities, and added 355 MVAR for voltage improvement (refer to Appendix 5 for NGCP's completed projects from 2009 to 2020). Other projects approved by the ERC are currently in various stages of implementation. The approvals for the projects were obtained either during the regulatory reset process or through a separate application to the ERC. For the Fourth and Fifth Regulatory Periods, which is from 2016 to 2020 and 2021 to 2025, respectively, a combined regulatory reset process is expected for the ERC's further review of the capital expenditure. For a summary of projects for implementation and other proposed projects, please refer to Appendix 6. Also, a summary of the changes in the components and ETC of the projects from the TDP 2020-2040 to TDP 2021-2040 is shown in Appendix 7.

8.1 Luzon Grid

The list below summarized the updates on the ERC-approved projects with ETC by 2019 onwards with their implementation status as of September 2020.

Table 8.1: 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 2020
		Study Components: ▪ *Power System Study*; ▪ *Feasibility Study.* Bulk Cost Estimate: 194 Million Pesos Status: ERC-approved	
Luzon PCB Replacement	SR	To replace old power circuit breakers and improve the substation reliability of San Jose, Labo, Malaya and Gumaca Substation.	Mar 2021
		Substation Components: ▪ *San Jose Substation*, 9-115 kV PCBs and associated equipment. ▪ *Malaya Substation,* 4-230 kV PCBs and associated equipment. Bulk Cost Estimate: 30 Million Pesos Status: 88.28% complete	
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.	Mar 2021
		Stage 1: *Substation Components:* ▪ *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; Stage 2: *Substation Components:*	

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; ▪ *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; ▪ *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. Bulk Cost Estimate: 3,383 Million Pesos Status for Stage 1: Baler LES: 37.11%, Camiling LES: 22.28%, Umingan LES: 32.24% Status for Stage 2: Lal-lo S/S: 96.46%, San Esteban S/S: 73.94%, Quezon S/S: 91.13%, Taytay S/S: 85.41%	
Calamba 230 kV Substation	LG	To accommodate the intensive load growth of MERALCO's Laguna Sector.	Mar 2021
		<u>*Substation Components:*</u> ▪ *Calamba 230 kV Substation*, 10-230 kV PCBs and associated equipment. <u>*Transmission Components:*</u> ▪ *Bus-in Lines,* 230 kV Transmission Line, SP-DC, 2-610 mm^2 TACSR/AS, 1.5km. Bulk Cost Estimate: 1,069 Million Pesos Status: Supply (T/L): 100% complete; Erection (T/L): 38.08% complete; Supply (Primary Equipment): 100% complete; Turnkey (Secondary Equipment & Erection of Primary Equipment): 80.81% complete	
North Luzon 230 kV Substation Upgrading Project	SR	To cater the load growth and provide N-1 contingency to various substations in the North Luzon Region.	Mar 2021
		Stage 1: <u>*Substation Components:*</u> ▪ *Bauang 230 kV Substation (Replacement),* 1x100 MVA 230/115/69-13.8 kV Power Transformer and accessories, 7-230 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; 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;	

Project Name	Driver	Purpose and Components	ETC
		▪ *Labrador 230 kV Substation (Replacement),* 1x100 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 Bulk Cost Estimate: 5,778 Million Pesos Status for Stage 1: Bayombong S/S: 94.53%, Gamu S/S: 85.59%, San Jose S/S: 89.04%, Bauang S/S: 89.81%, Hermosa S/S: 88.9%, Malaya S/S: 92.85%, Gamu S/S (Secondary Devices): 69.03%, Bayombong S/S (Secondary Devices) : 95.15%, San Jose S/S (Secondary Devices) : 100%, Bauang S/S (Secondary Devices) : 48.03%, Hermosa S/S (Secondary Devices) : 35.87%, Malaya S/S (Secondary Devices): 51.15%, San Jose S/S Turnkey (S/S): 100%, San Jose S/S (Protection System) Turnkey (S/S): 100%, Malaya S/S Turnkey (S/S): 43.44% Status for Stage 2: Substation: Bacnotan S/S: 51.09%, Balingueo S/S: 56.10%; Labrador S/S: 61.07%	
Tower Structure Upgrading of Bicol Transmission Facilities	SR	To reconstruct the affected transmission lines and transmission towers and structures marred by Typhoon Nina.	May 2021
		<u>*Transmission Components:*</u> ▪ *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 Status: 95.41% complete	
San Jose–Angat 115 kV Line Upgrading	SR	To address the old age condition and reliability issues in the existing line serving the Angat Hydroelectric Power Plant.	Jun 2021
		<u>*Substation Components:*</u> ▪ *San Jose 115 kV Substation,* 2-115 kV PCBs and associated equipment. <u>*Transmission Components:*</u> ▪ *San Jose-Angat 115 kV Transmission Line,* ST-DC, 2-795 MCM ACSR, 18 km. Bulk Cost Estimate: 307 Million Pesos Status: Turnkey (S/S): 100% complete; Remaining works associated with the completion of T/L	
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 2021
		<u>*Transmission Components:*</u> ▪ *Hermosa–Duhat 230 kV Transmission Line,* 230 kV, SP-SC, 2-795 MCM, 20 steel poles. Bulk Cost Estimate: 222 Million Pesos Status: Erection (Bored Pile Foundation): 53.51% complete	
Western Luzon 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 2021
		<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, 4-410 mm^2 TACSR/AS, 34 km. Bulk Cost Estimate: 2,631 Million Pesos Status: Erection (T/L): 64.79% complete	

Project Name	Driver	Purpose and Components	ETC
South Luzon 230 kV 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	Sep 2021
		Stage 1: <u>*Substation Components:*</u> ▪ *Las Piñas 230 kV Substation, 1x300 MVA, 230/115 kV 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 accessories, 1-230 kV PCB and associated equipment, 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, 3-69 kV PCBs and associated equipment*;* ▪ *Labo 230 kV Substation,* Line terminations reconfiguration*.* Bulk Cost Estimate: 2,175 Million Pesos Status for Stage 1: Las Pinas S/S: 69.62%; Others: Checking of manufacturer's drawings Status for Stage 2: ERC-Approved	
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.	Oct 2021
		<u>*Substation Components:*</u> ▪ *Mariveles 500 kV Switching Station (New),* 12-500 kV PCBs and associated equipment. ▪ *Hermosa 500 kV Substation,* 2-500 kV PCBs and associated equipment. <u>*Transmission Components:*</u> ▪ *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, 1-2/0 MCM ACSR, 3.28 km. Bulk Cost Estimate: 6,057 Million Pesos Status: Erection (T/L): 66.23% complete; Turnkey (Secondary Equipment & Erection of Primary Equipment): 14.76% complete	
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.	Dec 2021
		<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	

Project Name	Driver	Purpose and Components	ETC
		Bulk Cost Estimate: 1,467 Million Pesos Status: Supply (Primary Equipment): 100% complete; Turnkey (Secondary Equipment): 88.83% complete; Erection (Primary Equipment): 29.45% complete	
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.	Dec 2021
		<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 Status: Erection (T/L): No approved final route. The original route was affected by Malolos–Clark Railway Project.; Turnkey (S/S): 93.76% complete	
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 2021
		<u>*Substation Components:*</u> ▪ *New Hermosa 500 kV Substation,* 2x1,000 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; 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 Status: Erection (T/L): 15.60% complete; Turnkey (Secondary Equipment & Erection of Primary Equipment): 19.53% complete	
Luzon Voltage Improvement 4	SR	To address the anticipated undervoltage problem during peak condition at various substations in the Luzon Grid.	Dec 2021
		Stage 1: <u>*Substation Components:*</u> ▪ *Irosin 69 kV Substation*, 3x2.5 MVAR, 69 kV Capacitor Banks and accessories, 4-69 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. ▪ *Tanauan Load-end 69 kV Substation,* 3x5 MVAR, 69 kV Capacitor Banks and accessories, 4-69 kV PCBs and associated equipment*;* Stage 2: <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; ▪ *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; ▪ *San Roque Load-end 69 kV Substation,* 3x7.5 MVAR, 69 kV Capacitor Banks and accessories, 4-69 kV PCBs and associated equipment; ▪ *Taysan Load-end 69 kV Substation,* 3x5 MVAR, 69 kV Capacitor Banks and accessories, 5-69 kV PCBs and associated equipment; Bulk Cost Estimate: 3,122 Million Pesos	

Project Name	Driver	Purpose and Components	ETC
		Status for Stage 1: Lagonoy LES: 13.65%, Sorsogon LES: 21.21% Status for Stage 2: ERC-Approved	
Pagbilao 500 kV Substation	GE	To develop new 500 kV substation that aims to accommodate the connection of incoming power plants in Quezon Province	Mar 2022
		<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; ▪ *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 Status: Erection (T/L): 81.00% complete; Turnkey (S/S): 10.45% complete	
Tuguegarao–Lal-lo 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.	Mar 2022
		<u>*Substation Components:*</u> ▪ *Lal-lo 230 kV Substation,* 2x100 MVA 230/69-13.8 kV Power 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 Status: Erection (T/L): 52.12% complete; (S/S): 84.93% complete	
Antipolo 230 kV Substation	LG	To accommodate the demand increase in Metro Manila and maintain the N-1 contingency provision for Taytay Substation.	Apr 2022
		<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 Status: Site Development (S/S): 39.45%, Turnkey (Secondary Equipment): 65.82% complete	
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 2023
		<u>*Substation Components:*</u> ▪ *Ambuklao 230 kV Substation,* 6-230 kV PCBs and associated equipment. <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 Status: Turnkey (S/S): 94.35% complete	
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 2023
		<u>*Substation Components:*</u>	

Project Name	Driver	Purpose and Components	ETC
		▪ *San Manuel 230 kV Substation,* 2-230 kV PCBs and associated equipment. <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 Status for Stage 1: Turnkey (S/S): 91.76% complete Status for Stage 2: Turnkey (S/S): 95.02% complete	
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.	Dec 2023
		<u>*Substation Components:*</u> ▪ *Navotas 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 Navotas Substation,* 230 kV, ST/SP-DC, 4-795 MCM ACSR/AS, 20 km. Bulk Cost Estimate: 3,486 Million Pesos Status: Turnkey (S/S): 86.03% complete	
Taguig 500 kV Substation	LG	To alleviate the anticipated overloading of San Jose EHV Substation and to relieve the criticality of Quezon–Muntinlupa 230 kV Line during N-1 contingency.	Dec 2023
		<u>*Substation Components:*</u> ▪ *Taguig 500 kV Substation,* 2x1,000 MVA, 500/230-13.8 kV Power Transformers and accessories, 1x90 MVAR, 500 kV Shunt Reactor and accessories, 3x100 MVAR, 230 kV Capacitor Banks and accessories, 8-500 kV PCBs (GIS) and associated equipment, 10-230 kV PCBs (GIS) and associated equipment. <u>*Transmission Components:*</u> ▪ *Taguig Cut-in to San Jose–Tayabas 500 kV Transmission Line,* 500 kV, ST-DC, 4-795 MCM ACSR/AS, 37 km; ▪ *Taguig bus-in to Muntinlupa–Paco 230 kV Transmission Line,* 230 kV, SP-DC1, 2-410 mm^2 TACSR/AS, 2x2.4 km. Bulk Cost Estimate: 9,529 Million Pesos Status: Taguig Bus-in to Muntinlupa-Paco T/L: 24.13%; Taguig–Baras T/L: 28.48%; Taguig 500 kV S/S: 26.17%	
Tuy 500/230 kV Substation Project (Stage 1)	GE	To allow the connection of the 2x350 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.	Mar 2023
		<u>*Substation Components:*</u> ▪ *Tuy Substation,* 1x100 MVA,500/230-69 kV Power Transformer and accessories,12-230 kV PCBs and associated equipment, 3-69 kV PCBs and associated equipment, ▪ *Dasmariñas Substation Expansion,* 2-230 kV PCBs and associated equipment ▪ *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.	

Project Name	Driver	Purpose and Components	ETC
		Bulk Cost Estimate: 8,454 Million Pesos Status: Erection (T/L): For issuance of Notice to Proceed; Erection (S/S): 40.66% complete	
Eastern Albay 69 kV Line Stage 2	SR	To provide the looping configuration for the 69 kV line in eastern Albay.	Oct 2023
		<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 Status: Turnkey (S/S): 75.97% complete	
La Trinidad–Calot 69 kV Transmission Line	SR	To improve the reliability and increase the transfer capacity of the 69 kV transmission line serving the load-end substations of BENECO and HEDCOR's Asin and Ampohaw.	Nov 2025
		<u>*Substation Components:*</u> ▪ *La Trinidad 69 kV S/Y Expansion,* 1-69 kV PCB and associated equipment. <u>*Transmission Components:*</u> ▪ *La Trinidad–Calot 69 kV Transmission Line*, ST/SP-DC, 1-795 MCM ACSR/AS, 21 km; ▪ *69 kV Line Tapping Points, 5-72.5 kV,* 3-way Air Break Switch. Bulk Cost Estimate: 410 Million Pesos Status: ERC-Approved	
Pasay 230 kV Substation	LG	To accommodate the intensive load growth of MERALCO's Sector 3.	Dec 2025
		<u>*Substation Components:*</u> ▪ *Pasay 230 kV Substation,* 9-230 kV PCBs (GIS) and associated equipment. <u>*Transmission Components:*</u> ▪ *Las Piñas–Pasay 230 kV Transmission Line,* 230 kV Double Circuit Underground Cable, 2-2,500 mm^2 XLPE (1-core), 9.0 km. Bulk Cost Estimate: 12,871 Million Pesos Status: ERC-Approved	
Navotas–Doña Imelda 230 kV Transmission Line	SR	<u>*Transmission Components:*</u> ▪ *Manila/Navotas–Dona Imelda 230 kV Transmission Line,* SP-DC, 2-610 mm^2 TACSR, 4.6 km, 2-2,500 mm^2 XLPE (1-core), 4.7 km. Bulk Cost Estimate: 3,514 Million Pesos Status: ERC-Approved	Jan 2028

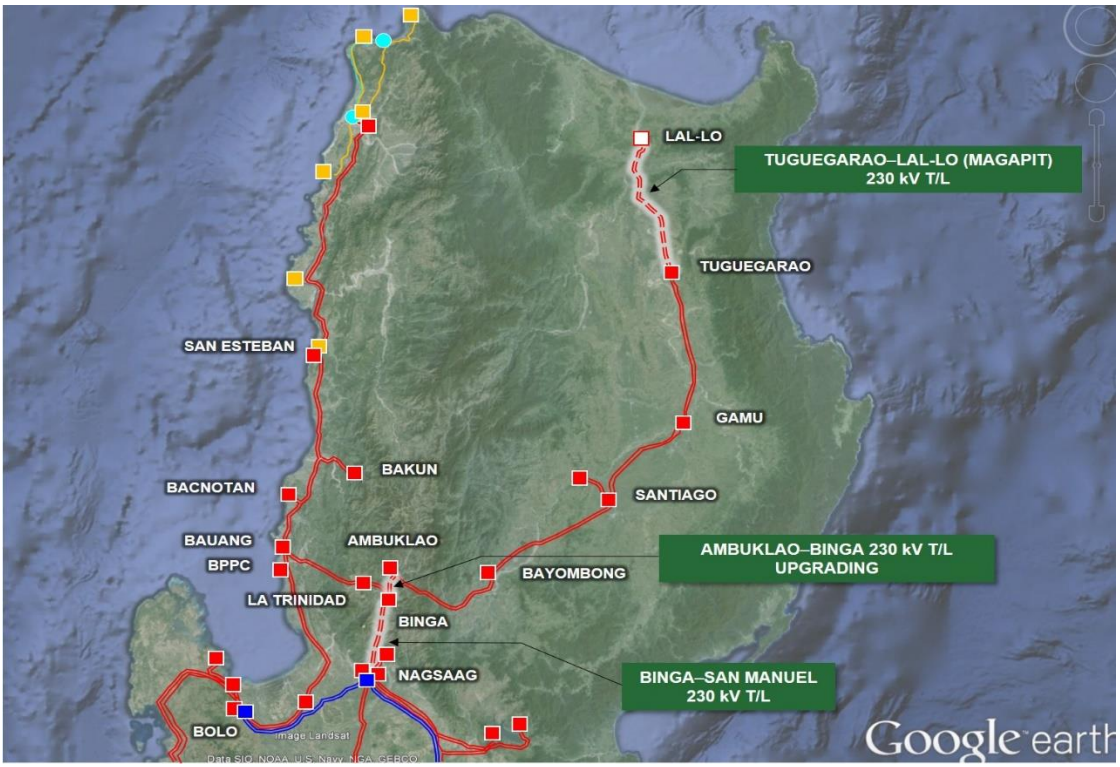


Figure 8.1: Ongoing Projects in North Luzon



Figure 8.2: Ongoing Projects in Central Luzon



Figure 8.3: Ongoing Projects in Metro Manila



Figure 8.4(a): Ongoing Projects in South Luzon

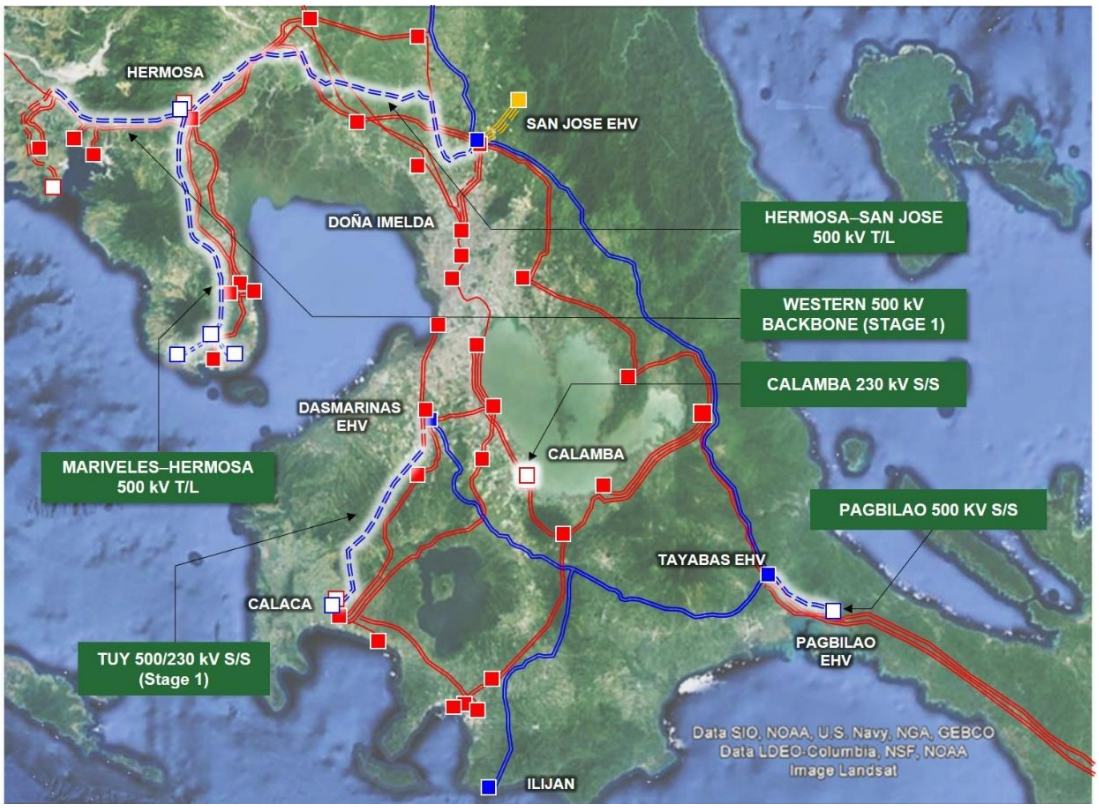


Figure 8.4(b): Ongoing Projects in South Luzon



Figure 8.5: Ongoing Projects in Bicol Region

8.1.1 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.

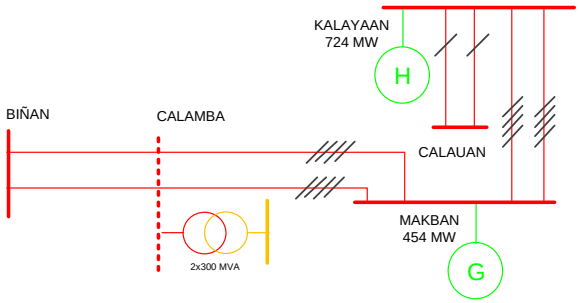
8.1.2 Luzon PCB Replacement

The Luzon PCB Replacement Project improves 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.

8.1.3 Luzon Voltage Improvement Project 3

The Luzon Voltage Improvement Project 3 addresses 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, Baler, Pantabangan, Umingan, Camiling, San Esteban, Botolan, Itogon, Antipolo and Bayambang Substations.

8.1.4 Calamba 230 kV Substation



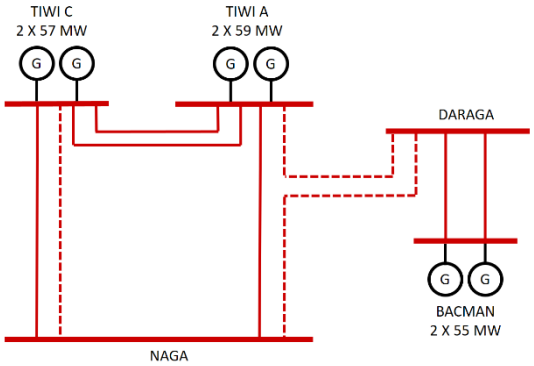
The Calamba 230 kV Substation Project caters to the load growth in the Laguna Sector of MERALCO. This will address the single-outage contingency overloading in other adjacent 230 kV drawdown substations such as the Sta. Rosa and Calauan Substation, and the Calauan–Los Baños 115 kV distribution line. 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.

8.1.5 North Luzon 230 kV Substation Upgrading Project

The North Luzon Substation Upgrading Project caters to 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.

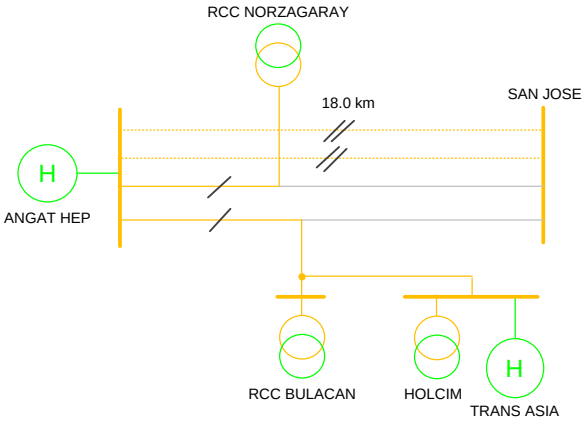
8.1.6 Tower Structure Upgrading of Bicol Transmission Facilities

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.



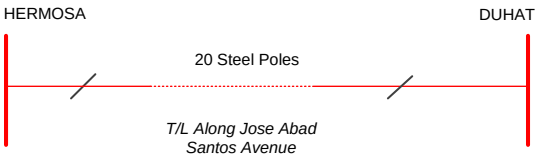
8.1.7 San Jose–Angat 115 kV Line Upgrading

The San Jose–Angat 115 kV Line Upgrading Project ensures 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.



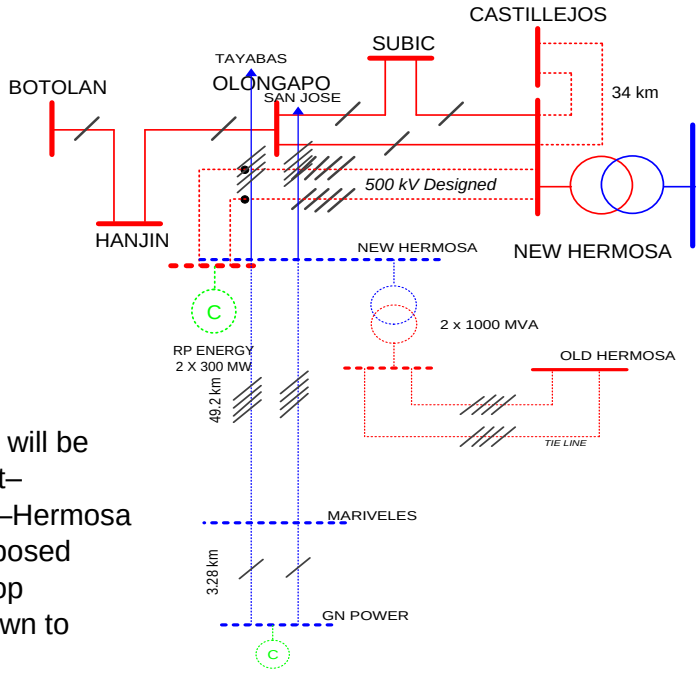
8.1.8 Relocation of Steel Poles along Hermosa–Duhat 230 kV Transmission Line

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.



8.1.9 Western Luzon 500 kV Backbone (Stage 1)

The Western Luzon Backbone (Stage 1: Castillejos–Hermosa 500 kV Transmission Line Project) provides 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.



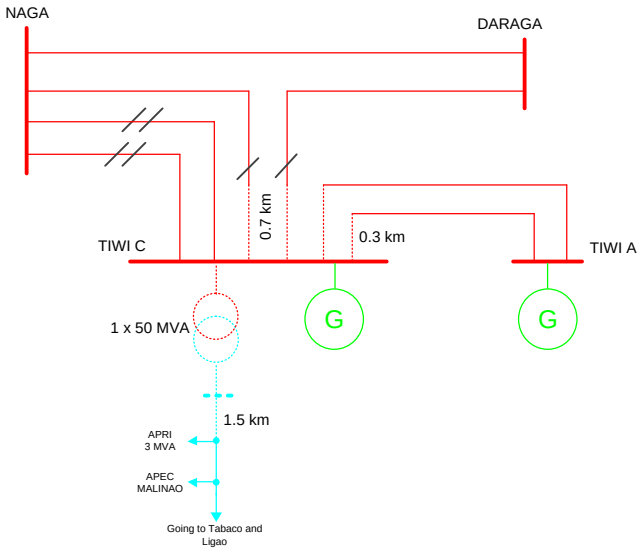
8.1.10 South Luzon 230 kV Substation Upgrading Project

The South Luzon Substation Upgrading Project caters to 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.

8.1.11 Mariveles–Hermosa 500 kV Transmission Line

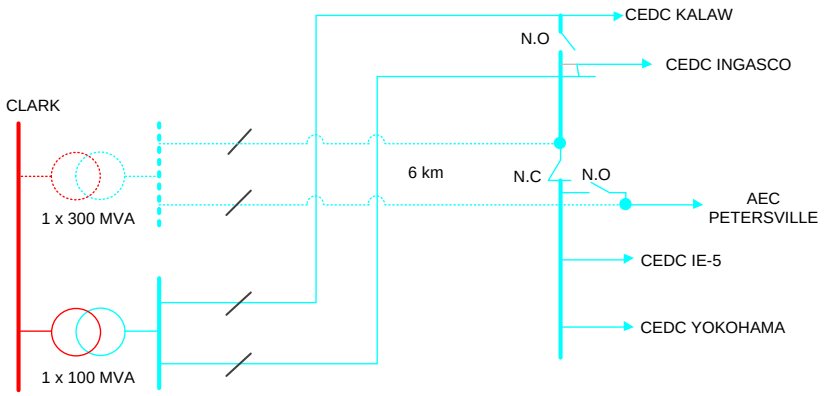
The Mariveles–Hermosa 500 kV Transmission Line Project allows the connection of incoming generations in Bataan Peninsula which include 2x668 MW GN Power Dinginin CFPP and 8x150 MW SMC Consolidated Power Corporation CFPP. While the Bataan 230 kV Grid Reinforcement Project can increase the capacity of the existing 230 kV corridor in the area, the huge generation capacity addition 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.

8.1.12Tiwi Substation Upgrading



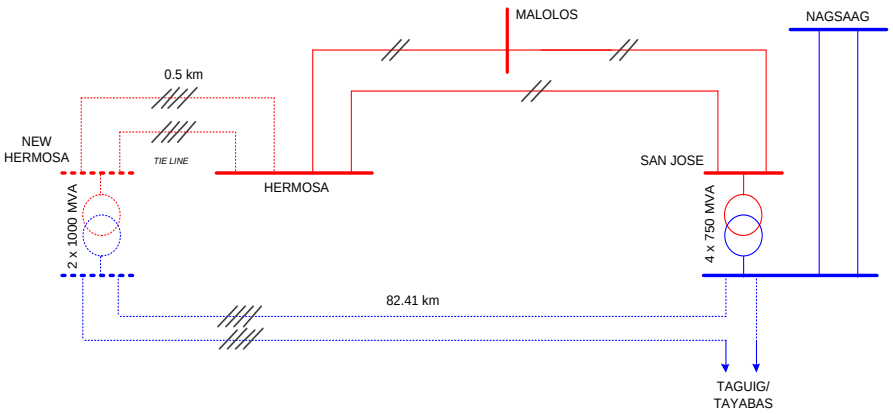
The project upgrades the old and deteriorated substation equipment at Tiwi A and C Substations to improve the reliability of the system. It will also augment the power requirement of Malinao/Ligao LES by installation of additional power transformer at Tiwi C Substation and will clearly identify asset 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.

8.1.13 Clark–Mabiga 69 kV Transmission Line



The Clark–Mabiga 69 kV Line Project provides transmission capacity reinforcement to 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.

8.1.14 Hermosa–San Jose 500 kV Transmission Line

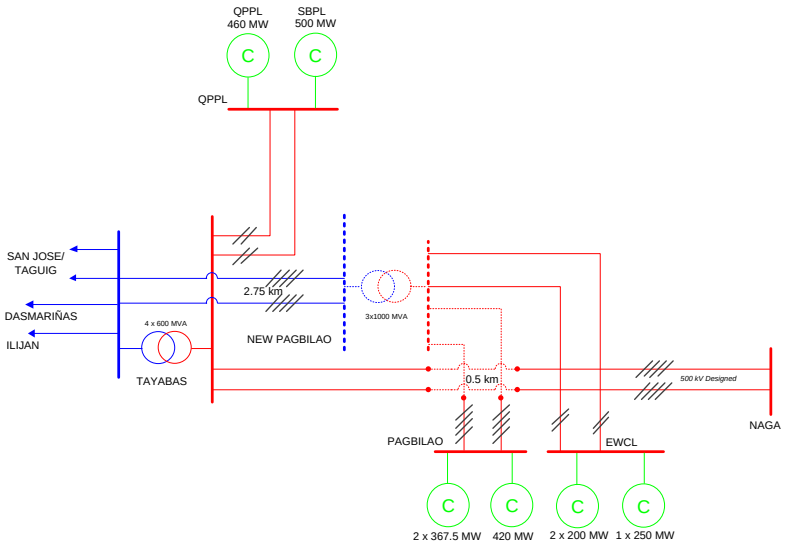


The Hermosa–San Jose 500 kV Transmission Line Project accommodates the generation capacity additions in Bataan and Zambales area. The Project will serve as a new 500 kV corridor for the bulk power generation coming from the existing Limay CCPP, Petron RSFF, Subic Enron DPP, Mariveles CFPP and the programmed 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.

8.1.15 Luzon Voltage Improvement Project 4

The Luzon Voltage Improvement Project 4 addresses the anticipated undervoltage problem during peak load condition at various 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. The capacitor installation will be implemented in Ligao, Iriga, Irosin, Mabini, Cuenca, Taysan, San Juan, and Lagonoy 69 kV Load End Substations.

8.1.16 Pagbilao 500 kV Substation

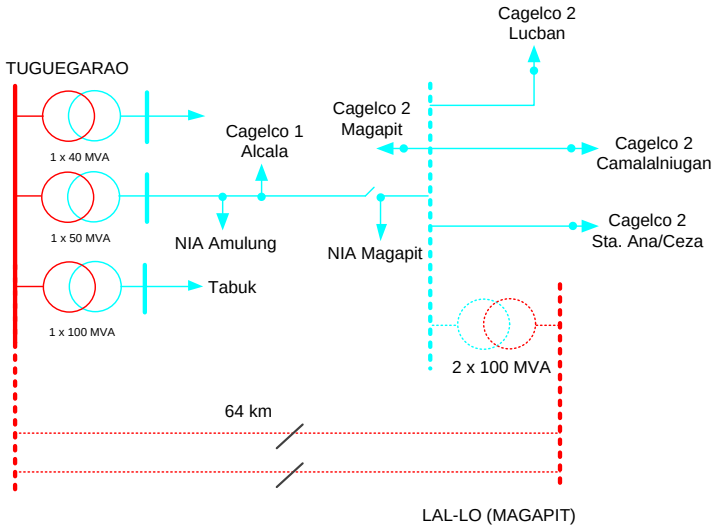


The Pagbilao 500 kV Substation Project accommodates the connection of incoming power plants in Quezon Province which include the 420 MW Pagbilao Coal-Fired Power Plant (CFPP) Expansion, 500 MW San Buenaventura Power Ltd. Co. (SBPL) Coal-Fired Power Plant and 600 MW Energy World Corporation (EWC) Combined-Cycle 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.

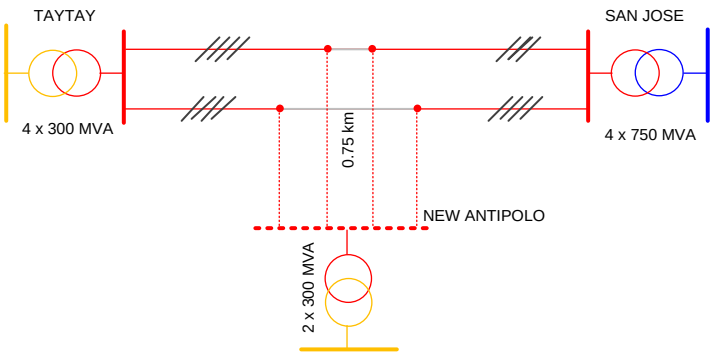
8.1.17 Tuguegarao–Lal-lo (Magapit) 230 kV Transmission Line

The Tuguegarao–Lal-lo (Magapit) 230 kV Transmission Line project addresses 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.



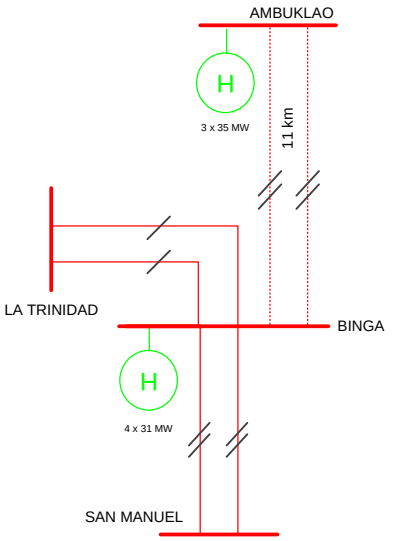
8.1.18 Antipolo 230 kV Substation

The Antipolo 230 kV Substation caters to 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.



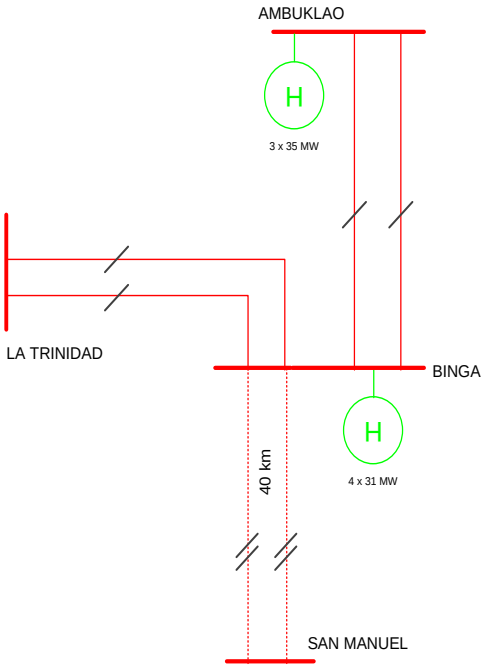
8.1.19 Ambuklao–Binga 230 kV Transmission Line Upgrading

The Ambuklao–Binga 230 kV Transmission Line Upgrading project upgrades 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.

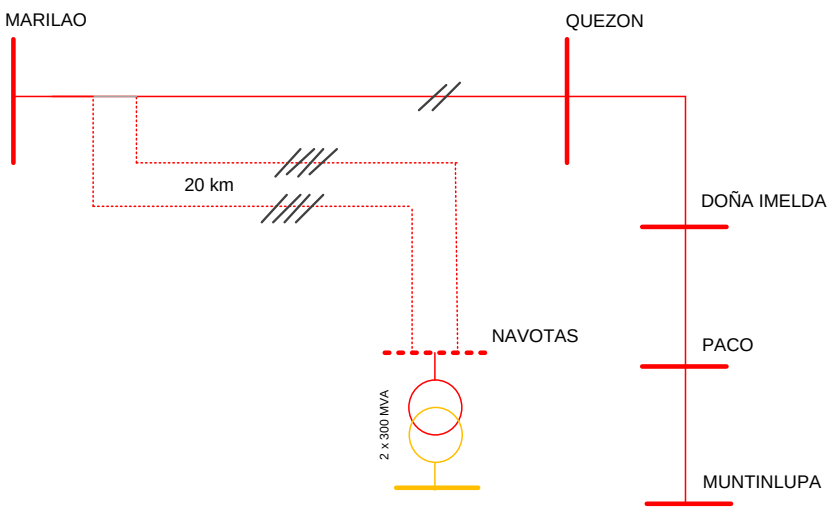


8.1.20 Binga–San Manuel 230 kV Transmission Line

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.

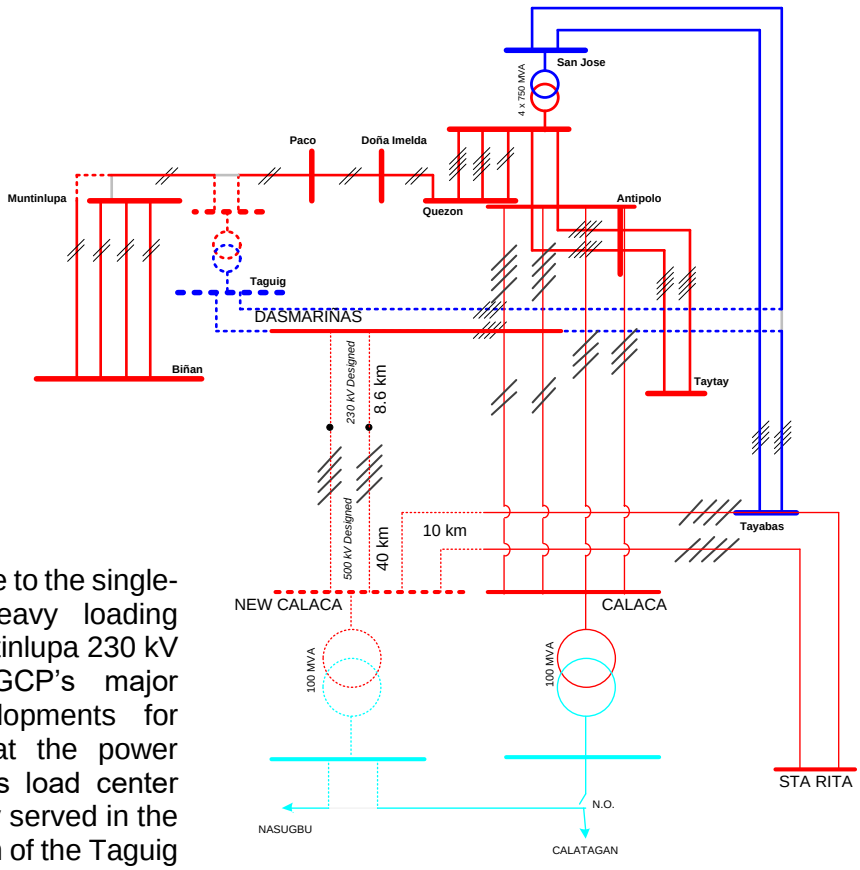


8.1.21 Navotas 230 kV Substation



The Navotas 230 kV Substation caters to 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 Navotas 230 kV Substation will be initially linked to the grid through cut-in connection along the existing Marilao–Quezon 230 kV Transmission 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.

8.1.22 Taguig 500 kV Substation



The Taguig 500 kV Substation provides 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

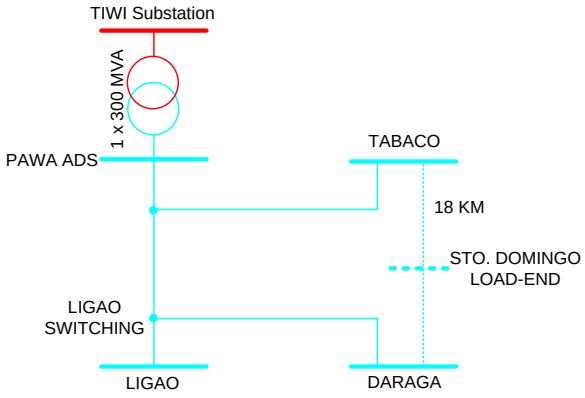
500 kV Substation will improve the reliability of the transmission network by providing direct power injection within Metro Manila through the Muntinlupa–Paco 230 kV Transmission Line segment. The Project also involves the construction of 500 kV supply line that will be connected through cut-in along 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.

8.1.23 Tuy 500/230 kV Substation Project (Stage 1)

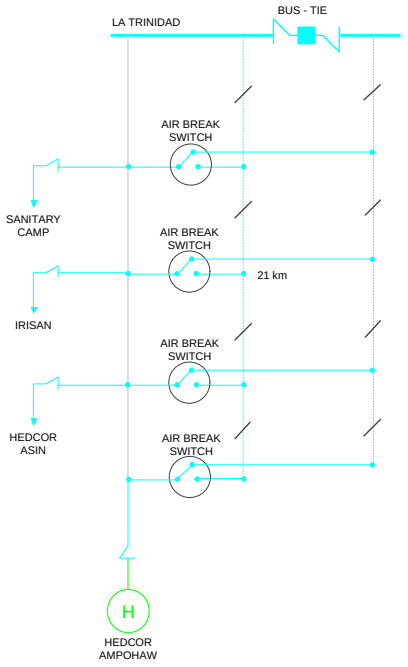
The Tuy 500 kV Substation (Stage 1) accommodates the connection of the 2x350 MW SRPGC Coal Plant and allow full dispatch of bulk generation capacity additions in Batangas. The generation capacity additions will turn Calaca Substation into a merging point of more than 2,000 MW of power generation. The 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 involves the development of Tuy 500 kV Substation which will initially involve 230 kV facilities only. The project will also invove the development of Tuy–Dasmariñas 500 kV designed transmission line but will 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.

8.1.24 Eastern Albay 69 kV Transmission Line Stage 2



The Eastern Albay 69 kV Line Project provides 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 1-336.4 MCM ACSR/AS conductor. 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 1-336.4 MCM ACSR/AS conductor.



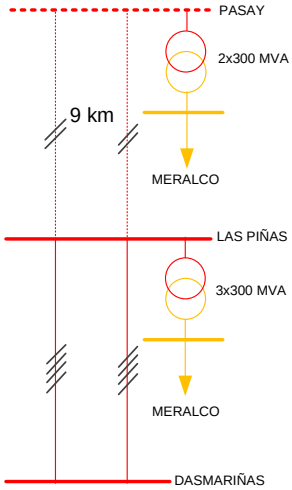
8.1.25 La Trinidad–Calot 69 kV Transmission Line

The La Trinidad–Calot 69 kV Transmission Line Project improves 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.

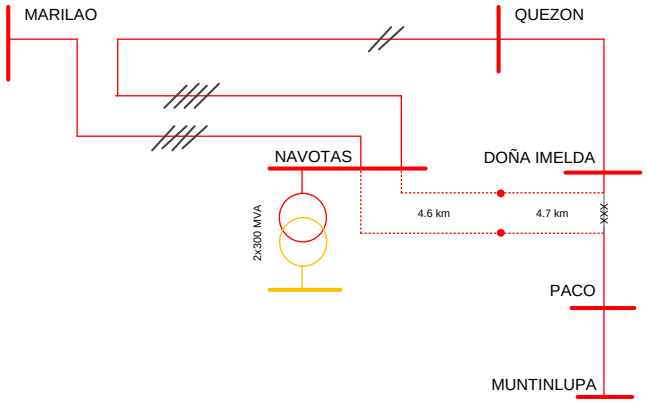
8.1.26 Pasay 230 kV Substation

The Pasay 230 kV Substation Project caters to 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.



8.1.27 Navotas–Doña Imelda 230 kV Transmission Line

This project provides an 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.



8.2 Visayas Grid

Table 8.2: Projects for Implementation in Visayas

Project Name	Driver	Purpose and Components	ETC
Cebu–Negros–Panay 230 kV	GE, SR	To increase transfer capacity of the existing corridor and maintain the N-1 contingency provision.	Apr 2021

Project Name	Driver	Purpose and Components	ETC
Backbone Project - Stage 1		<u>*Substation Components:*</u> ▪ *Bacolod Substation Expansion*, 2-138 kV PCBs and associated equipment. <u>*Transmission Line Components:*</u> ▪ *Bacolod–E. B. Magalona, 230 kV Transmission Line (initially energized at 138 kV)*, ST-DC, 2-795 MCM ACSR, 39 km. Bulk Cost Estimate: 6,104 million Pesos Status: Bacolod-E. B. Magalona T/L: 86.39%; Bacolod S/S: 100%	
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.	May 2021
		<u>*Substation Components:*</u> ▪ *Panitan 138 kV Substation,* 1-138 kV PCB and associated equipment; ▪ *Nabas 138 kV Substation,* 3-138 kV PCBs and associated equipment. <u>*Transmission Components:*</u> ▪ *Panitan–Nabas 138 kV Transmission Line,* ST-DC (2nd circuit stringing), 1-795 MCM ACSR, 95 km. Bulk Cost Estimate: 634 million Pesos Status: T/L: 100%; Substation: 53.05%	
Visayas Substation Reliability Project II	SR	To add substation capacity to provide N-1 contingency in various substations in the Visayas Grid.	Jun 2021
		<u>*Substation Components:*</u> ▪ *Mandaue 138 kV Substation 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 Substation Expansion,* 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV GIS Switch Bay, 1-69 kV GIS Switch Bay; ▪ *Bacolod 138 kV Substation Expansion,* 1-69 kV PCBs and associated equipment; ▪ *Sta. Barbara 69 kV Substation Expansion,* 2-69 kV PCBs and associated equipment. Bulk Cost Estimate: 532 million Pesos Status: S/S: 97.40%	
Sta. Rita–Quinapondan 69 kV Transmission Line	SR	To provide a more reliable and quality transmission service to Eastern Samar.	Jun 2021
		<u>*Substation Components:*</u> ▪ *Sta. Rita Substation Expansion,* 2-69 kV PCBs and associated equipment; ▪ *Quinapondan Substation Expansion,* 2-69 kV air break switches. <u>*Transmission Components:*</u> ▪ *Sta. Rita–Quinapondan 69 kV Transmission Line,* ST-SC, 1-336.4 MCM, 95 km. Bulk Cost Estimate: 363 million Pesos Status: T/L: 99.67%	
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.	Sep 2021
		<u>*Substation Components:*</u> ▪ *Tagbilaran 69 kV Substation (New),* 1x10 MVA 69/13.8 kV power transformer and accessories and 1-69 kV PCB and associated equipment; ▪ Construction of New Control Room. Bulk Cost Estimate: 534 million Pesos Status: S/S: 78.15%	
New Naga (Colon) Substation Project	LG	To upgrade existing substation to meet load growth	Dec 2021
		<u>*Substation Components:*</u>	

Project Name	Driver	Purpose and Components	ETC
(Remaining Works)		▪ *Colon 138 kV Substation*, 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. <u>*Transmission Components:*</u> ▪ *Transfer of Sibonga and VECO Naga 69 kV Feeder from Naga Substation to Colon Substation*, SP-DC, 1-795 MCM ACSR, 1.5 km. Bulk Cost Estimate: 313 million Pesos Status: 94.12%	
Naga (Visayas) Substation Upgrading Project	SR	To replace and upgrade the existing antiquated and aging primary and secondary equipment and devices in Naga Substation.	Dec 2021
		<u>*Substation Components:*</u> ▪ *Naga 138 kV Substation,* 6-138 kV PCBs and associated equipment; ▪ *Construction of New Control Room;* ▪ *Dismantling of Primary and Secondary Equipment at Naga Substation.* Bulk Cost Estimate: 481 million Pesos Status: 81.96%	
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 2022
		<u>*Substation Components:*</u> ▪ *Magdugo 230 kV Substation,* 3x300 MVA 230/138-13.8 kV Power Transformer and accessories, 2x70 MVAR 230 kV Line Reactors, 17-230 kV PCBs, 15-138 kV PCBs and associated equipment; ▪ *Calatrava 230 kV Substation*, 2x100 MVA 230/69-13.8 kV Power Transformer and accessories, 1x70 MVAR 230 kV Bus Reactor, 1x70 MVAR 230 kV Line Reactor, 12-230 kV PCBs, 8-69 kV PCBs; ▪ *Cadiz 230 kV Substation,* 2x150 MVA 230/138-13.8 kV Power Transformer and accessories, 10-230 kV PCBs, 7-138 kV PCBs and associated equipment; ▪ *E. B. Magalona Switching Station,* 1x70 MVAR 230 kV Line Reactor 9-230 kV PCBs and associated equipment; ▪ *Barotac Viejo 230 kV Substation,* 3x300 MVA 230/-13.8 kV Power Transformer and accessories, 1x70 MVAR 230 kV Line Reactor, 8-230 kV PCBs, 6-138 kV PCBs and associated equipment; ▪ *Bacolod 230 kV Substation,* 2x300 MVA 230/138-13.8 kV Power Transformer and accessories, 6-230 kV PCBs, 1-138 kV PCB and associated equipment; ▪ *Colon 138 kV Substation,* 2-138 kV PCBs and associated equipment. ▪ *San Carlos 69 kV SWS,* 11-69 kV PCBs and associated equipment. ▪ *Quiot 138 kV S/S,* Uprating of 4-138 kV PCBs and associated equipment ▪ *Cebu 138 kV S/S,* Uprating of 2-138 kV PCBs and associated equipment <u>*Transmission Components:*</u> ▪ *Magdugo–Cebu 230 kV Transmission Line,* ST-DC, 4-795 MCM ACSR, 35 km; ▪ *Talavera–Magdugo 230 kV Transmission Line,* ST-DC, 4-795 MCM ACSR, 6 km; ▪ *Cadiz–Calatrava 230 kV Transmission Line,* ST-DC, 4-795 MCM ACSR, 80 km; ▪ *E. B. Magalona–Cadiz 230 kV Transmission Line,* ST-DC, 4-795 MCM ACSR, 45 km; ▪ *Transfer of the CEDC 138 kV Line from AYA Substation to Colon Substation*; ▪ *Calatrava CTS–Calatrava Substation*, ST-DC, 4-795 MCM ACSR, 1.5 km; ▪ *Reconductoring of the Cebu–Quiot–Colon 138 kV Transmission Corridor*; ▪ *Bundling of termination at Cebu–Quiot–Colon 138 kV Transmission Corridor*; ▪ *Calatrava–San Carlos 69 kV Transmission Line,* ST-DC, 1-795 MCM ACSR, 5 km. <u>*Submarine Cable Components:*</u> ▪ *Calatrava–Talavera 230 kV Submarine Cable,* Double Circuit, 6-1,600 mm^2 XLPE, 29 km; ▪ *Talavera CTS,* Cable Sealing End; ▪ *Calatrava CTS,* Cable Sealing End.	

Project Name	Driver	Purpose and Components	ETC
		Bulk Cost Estimate: 44,563 million Pesos Status of Phase 1: Submarine Cable: 96.65%, Reconductoring/Bundling of 138 kV T/L: 100%; E. B. Magalona–Cadiz–Calatrava 230 kV Erection T/L: 0.60%, Cadiz–Calatrava 230 kV Supply T/L: 100% Magdugo–Cebu (TVI) 230 kV T/L: 53.62%, Barotac Viejo S/S: 84.34%; Bacolod S/S: 36.72% Status of Phase 2: Cadiz S/S: For issuance to proceed, Calatrava S/S: 6.54%, E.B Magalona S/S: 1.50%, Magdugo S/S 0.53% Status of Phase 3: Cebu S/S (6-138kV PCB) and Quiot S/S (4-138kV PCB): 0.09% Status of Phase 4: Calatrava–San Carlos 69 kV T/L: For issuance to Notice to Proceed, S/S: For issuance of Notice to Proceed	
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 2022
		<u>*Substation Components:*</u> Stage 1 ▪ *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 69 kV S/S,* 3x5 MVAR, 69 kV Capacitor Banks and accessories, 3-69 kV PCBs and associated equipment. Stage 2 ▪ *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: 805 million Pesos Status of Stage 1: Compostela S/S (Capacitor Bank 1 & 2): Energized on Nov 2019 Corella S/S (Capacitor Bank 1, 2, & 3): Energized on Nov 2019 Cebu S/S (Capacitor Bank 1 & 2): Energized on Jan 2020 Status of Stage 2: S/S: Preparation of bidding documents	
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 2023
		<u>*Transmission Components:*</u> ▪ *Cebu–Umapad 230 kV Transmission Line,* ST/SP-DC, 2-410 mm^2 STACIR, 9 km. Bulk Cost Estimate: 1,884 million Pesos Status: T/L: Preparation of bidding documents, S/S 97.40%	

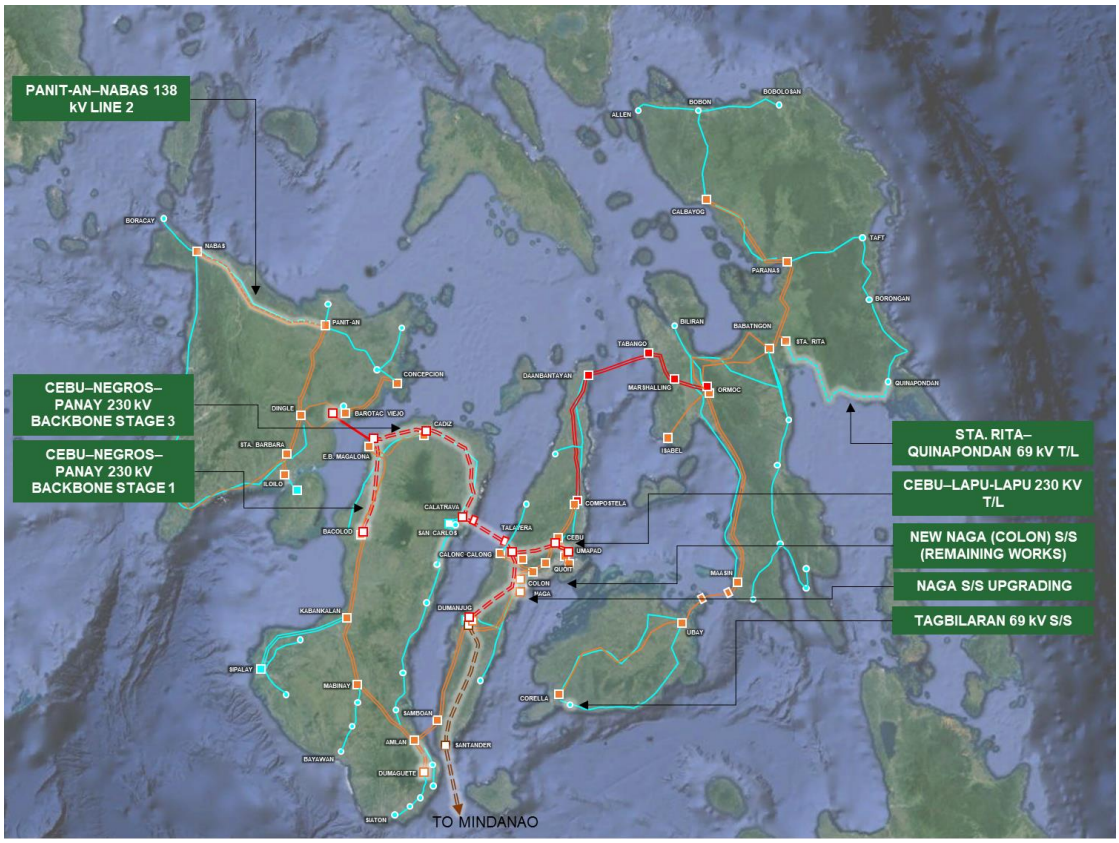


Figure 8.6(a): On-going Projects in Visayas

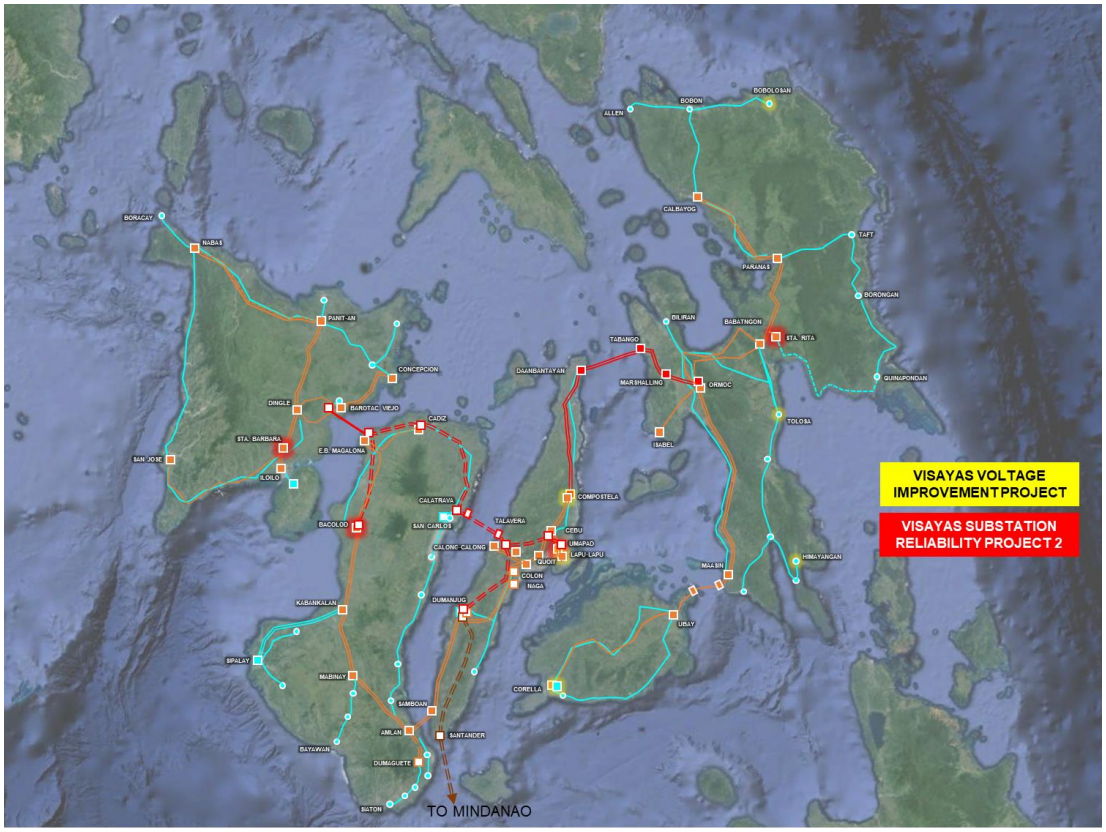
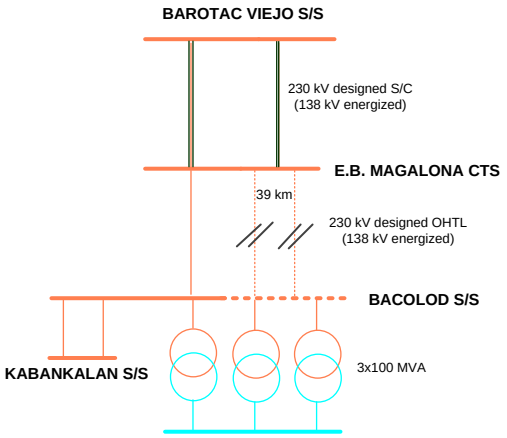


Figure 8.6(b): Ongoing Projects in Visayas

8.2.1 **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.

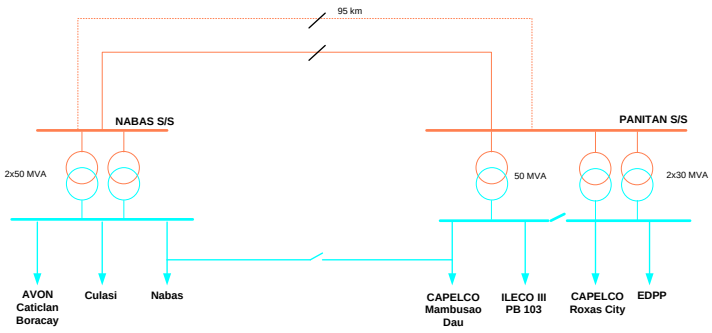


To ensure the effective transmission of excess power generation from Panay towards Negros, a high capacity transmission corridor is being proposed. Strategically, the project will be designed consistent with the long-term transmission master plan of having a 230 kV transmission backbone in the Visayas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

The project involves the development of transmission corridor from Barotac Viejo Substation to Bacolod Substation 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.

8.2.2 **Panitan–Nabas 138 kV Transmission Line 2 Project**

The northwestern part of Panay, which includes the Boracay Island, is served by Nabas Substation which normally draws power from the grid through the existing Panitan–Nabas 138 kV Transmission Line. The Nabas Substation is also linked to San Jose Substation by 69 kV transmission line. However, during the outage of the 138 kV line, the 69 kV line will have limited transmission capacity to cater the entire load of the area, hence, will result in power curtailment.



To cater the entire power requirement of Nabas Substation even during N-1 condition, a new 138 kV circuit will be installed from Panitan Substation and Nabas Substation. 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.

8.2.3 **Visayas Substation Reliability Project II**

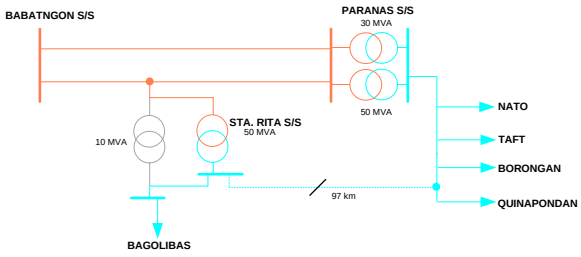
Various substations in the Visayas Grid have limited transformation capacity to provide continuous power delivery towards the load customers during single transformer outages, which will result in power curtailment.

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, Sta. Rita, Bacolod and Lapulapu Substations. Expansions in Lapulapu, Bacolod, Sta. Barbara and Mandaue are still ongoing while the expansions on the other substations are already completed.

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

8.2.4 **Sta. Rita–Quinapondan 69 kV Transmission Line**

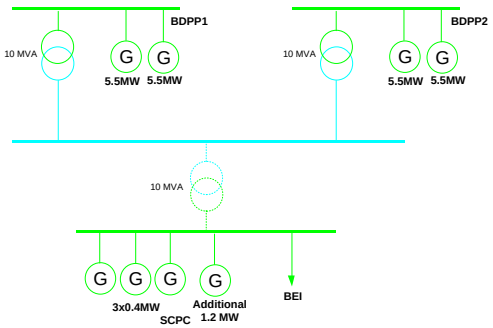
The Paranas–Taft–Borongan–Quinapondan 69 kV Line is a single circuit, 190.5 km line utilizing 336.4 MCM ACSR conductor. This is a radial line serving ESAMELCO, particularly the Taft, Borongan and Quinapondan Load-end Substations. Considering the length of the line, the Eastern Samar area has been prone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



This project involves the construction of a 95 km 69 kV line connecting Sta. Rita and Quinapondan Substation.

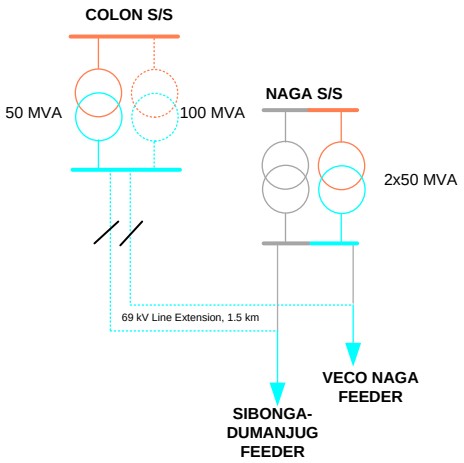
8.2.5 **Tagbilaran 69 kV Substation Project**

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 Sta. Clara Power Corp. (SCPC). 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 SCPC is being disrupted. With the project, BEI and SCPC will have dedicated connection to Tagbilaran Substation and expansion of SCPC's Hydro Electric Power Plant will be catered.



8.2.6 **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 and VECO Naga 69 kV feeders which draws power from Naga Substation are proposed to be transferred to Colon Substation. However, the existing Colon Substation does not have sufficient capacity to cater the projected power demand upon the connection of new loads. Hence, there will be power curtailment.



To accommodate the projected demand of Colon Substation, there is a need to increase the substation capacity. The project involves the installation of 100 MVA transformer at Colon Substation and the transfer of the Naga–Sibonga–Dumanjug and VECO Naga 69 kV feeders from Naga Substation to Colon Substation, 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 and VECO Naga 69 kV feeders.

8.2.7 **Naga (Visayas) Substation Upgrading Project**

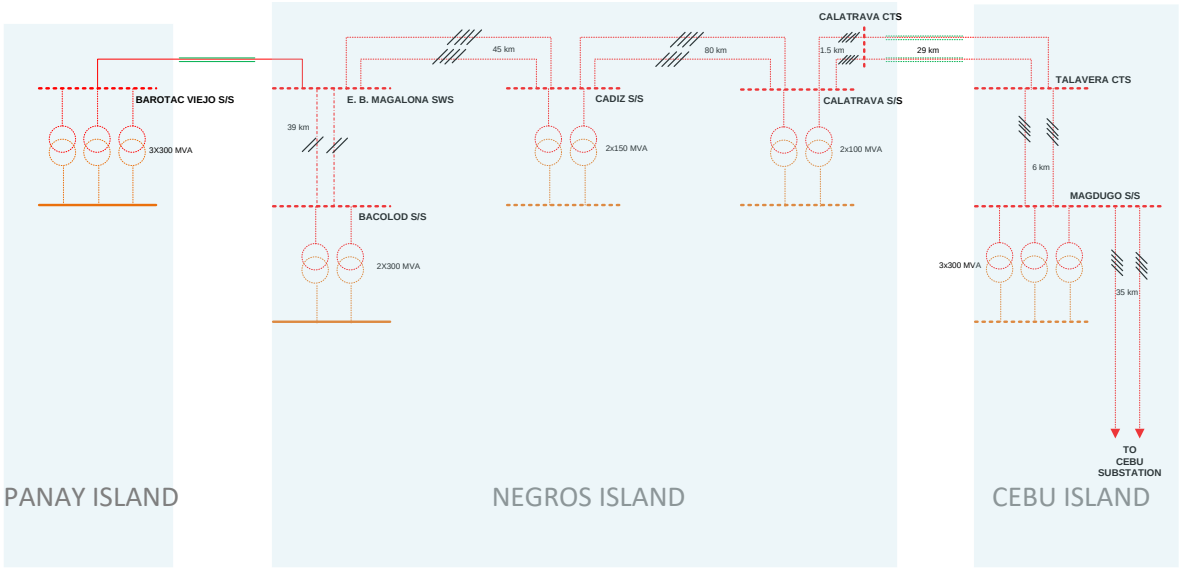
The equipment at Naga Substation, which was commissioned in 1977, is already antiquated and is difficult to maintain. Thus, outages due to equipment failure, maintenance and repair works are expected to occur more frequently and at longer duration. Accordingly, these outages may result in power curtailment.

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.

8.2.8 **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.

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.



8.2.9 **Visayas Voltage Improvement Project**

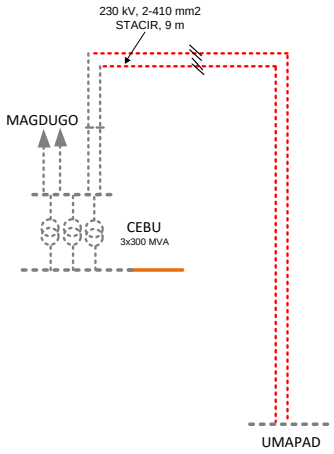
Various areas in Samar and Leyte are experiencing low voltage occurrences due to long 69 kV transmission lines. Likewise, areas in Cebu and Bohol are also experiencing low voltage occurrences due to high concentration of load. These low voltages may result in power curtailment.

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

8.2.10 **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–Lapulapu Transmission Corridor, the remaining circuit will be overloaded, therefore, to prevent damage to the equipment, power will be curtailed.

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 Substation and Lapulapu Substation.



8.3 Mindanao Grid

Table 8.3: Projects for Implementation in Mindanao

Project Name	Driver	Purpose and Components	ETC
MINDANAO			
Kauswagan–Lala 230 kV Transmission Line Project (Formerly Balo-i–Kauswagan–Aurora 230 kV Transmission Line Project (Phase 2)	GE, SR	To enhance reliability of power supply delivery towards Zamboanga Peninsula. This complements the transmission of power through Mindanao-Visayas Interconnection Project.	Sep 2021
		<u>*Substation Components:*</u> ▪ *Lala 230 kV Substation:* 2x300 MVA 230/138-13.8 kV Power Transformer and accessories, 6-230 kV PCBs, 6-138 kV PCB and associated equipment; ▪ *Aurora 138 kV Substation:* 3-138 kV PCBs and associated equipment <u>*Transmission Components:*</u> ▪ *Kauswagan-Lala 230 kV Transmission Line:* ST-DC, 4-795 MCM ACSR, 56 km; ▪ *Lala-Aurora 138 kV Transmission Line:* ST-DC, 2-795 MCM ACSR, 27.17 km. Bulk Cost Estimate: 5,040 Million Pesos Status: Ongoing ROW acquistion and supply of T/L – 71.68%	
Agus 2 Switchyard Upgrading Project	SR	To upgrade the existing antiquated and aging primary and secondary equipment and devices in Agus 2 Switchyard	Feb 2022
		<u>*Substation Components:*</u> ▪ *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: 741 Million Pesos Status: Ongoing civil works: 87.15%	
Mindanao Substation Upgrading Project (MSUP)	LG	To enhance the substation capacity and to comply to the N-1 of the grid code	Jun 2022
		<u>*Substation Components:*</u> ▪ *Polanco 138 kV Substation,* 1x75 MVA 138/69 kV Power Transformer and accessories, 3-138 kV PCBs, 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 CAIS, 1-69 kV CAIS, 2-69 kV PCBs and associated equipment ▪ *Agus 6 138 kV Substation,* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 3-69 kV PCBs and associated equipment; ▪ *Maramag 138 kV Substation,* 1x75 MVA 138/69 kV Power Transformer and accessories, 3-138 kV PCBs, 1-69 kV PCB and associated equipment; ▪ *Opol 138 kV Substation,* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-69 kV PCBs and associated equipment; ▪ *Butuan* 138 kV Substation, 3*x7.5 MVAR Shunt Capacitors, 5-138 kV PCBs, 3-69 kV PCBs and associated equipment; ▪ *Placer* 138 kV Substation,* 1x100 MVA 138/69 kV Power Transformer and accessories, 2x7.5 MVAR Shunt Capacitors, 2-138 kV PCBs, 5-69 kV PCBs and associated equipment; ▪ *Bislig* 138 kV Substation,* 1x50 MVA 138/69 kV Power Transformer and accessories, 3-138 kV PCBs, 6-69 kV PCBs and associated equipment; ▪ *San Francisco* 138 kV Substation,* 1x50 MVA 138/69 kV Power Transformer and accessories, 3x7.5 MVAR Shunt Capacitor, 4-138 kV PCBs, 1-69 kV PCB and associated equipment; ▪ *Kidapawan* 138 kV Substation,* 1x50 MVA 138/69 kV Power Transformer and accessories (from Culaman Substation), 1-69 kV PCB and associated equipment; ▪ *Gen. Santos* 138 kV Substation,* 1x100 MVA 138/69 kV Power Transformer and accessories, 1x7.5 MVAR Shunt Capacitor**, 1-138 kV PCB, 9-69 kV PCBs and associated equipment;	

Project Name	Driver	Purpose and Components	ETC
		▪ *Tacurong* 138 kV Substation,* 1x7.5 MVAR Shunt Capacitor**, 9-69 kV PCBs and associated equipment. * Substations included in the Stage 1 of MSUP has Estimated Time of Completion of May 2021 ** Shunt capacitors of General Santos and Tacurong 138 kV substations will be installed in Pitogo Substation. Bulk Cost Estimate: 5,016 Million Pesos Overall Status Ongoing civil works – 49.35%	
Mindanao Substation Rehabilitation Project (MSRP)	SR	To upgrade the obsolete and aging primary and secondary equipment and devices in various Mindanao Substations	Jun 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,* 6-138 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, 1-69 kV PCB and associated equipment; ▪ *Tagoloan 138 kV Substation,* 3-138 kV and 1-69 kV PCBs and associated equipment; ▪ *Pulangi 4 Substation,* 11-138 kV and 1-69 kV PCBs and associated equipment; ▪ *Nasipit* 138 kV Substation,* 2-138 kV PCB and associated equipment; ▪ *Davao* 138 kV Substation,* 4-138 kV and 2-69 kV PCBs and associated equipment; ▪ *Maco* 69 kV Substation,* 1x7.5 MVAR Shunt Capacitor, 1-69 kV PCB and associated equipment; ▪ *Bunawan* 138 kV Substation,* 5-138 kV PCBs and associated equipment; ▪ *Nabunturan* 138 kV Substation,* 1x7.5 MVAR Shunt Capacitor, 3-138 kV and 5-69 kV PCBs, and associated equipment; ▪ *Sultan Kudarat* 69 kV Substation,* 6-69 kV PCBs and associated equipment. * Substations that are included in the Stage 1 of MSRP with Estimated Time of Completion on October 2021 Bulk Cost Estimate: 3,418 Million Pesos Overall Status: Notice of Award	
Tacurong–Kalamansig 69 kV Transmission Line Project	SR	To connect the currently off-grid areas in Sultan Kudarat to the Mindanao Grid.	Jun 2023
		<u>*Substation Components:*</u> ▪ *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 2-69 kV PCBs and associated equipment. <u>*Transmission Components:*</u> ▪ *Tacurong-Kalamansig 69 kV Transmission Line,* ST-SC, 1-336.4 MCM ACSR, 100 km. Bulk Cost Estimate: 1,320 Million Pesos Status: Notice of Award	

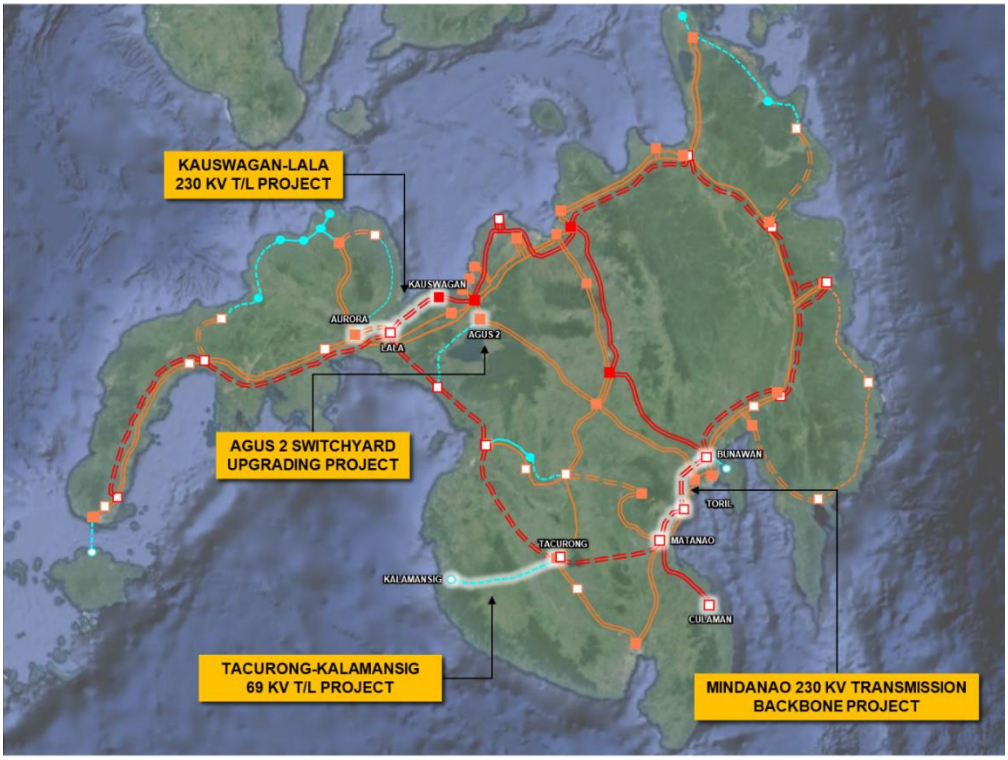
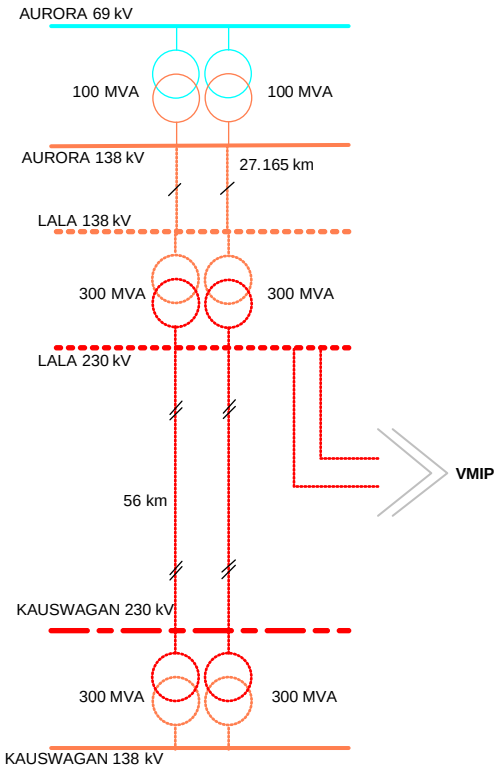


Figure 8.7: Ongoing Projects in Mindanao

8.3.1 Kauswagan – Lala 230 kV Transmission Line Project



The project connects the Kauswagan Substation to Lala Substation utilizing a double-circuit transmission line in a bundle-of-two power conductor configuration at 230 kV voltage level. The project includes the installation of two power transformers in Lala Substation to be linked to the existing Aurora Substation through a 138 kV transmission line. To complete the project, the installation of 6-230 kV and 9-138 kV power circuit breakers are needed in the involved substations.

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 condition. The project provides a reliable transmission network for Zamboanga Peninsula to achieve continuous normal grid operation. It is the extension of the planned Mindanao 230 kV transmission backbone facility which complements the Mindanao – Visayas Interconnection Project (MVIP).

8.3.2 Agus 2 Switchyard Upgrading Project

The Agus 2 Switchyard improves the operational capability of the substation, which can efficiently respond to any system disturbance. The project enhances the operational stability

of the grid that ensures the continuity of service of the power plant's transmission corridor. It provides clear demarcation of asset boundaries between NGCP and the power plant. The Agus 2 Switchyard is an old transmission facility experiencing difficulties in operation and maintenance. The obsolete 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 to have full control of the switchyard.

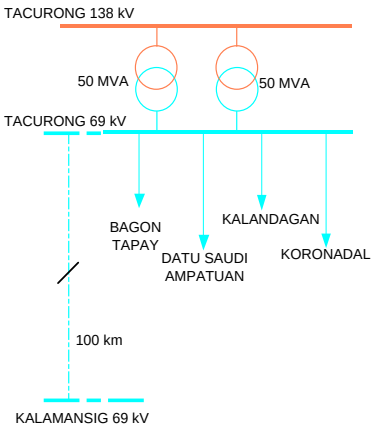
8.3.3 Mindanao Substation Upgrading Project (MSUP)

The existing transformer capacities in various substations in Mindanao are insufficient to accommodate the projected demand load 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.

MSUP provides additional transformers, install capacitor banks, and replace defective, old, obsolete and underrated power circuit breakers to ensure adequate, reliable, and high-quality power transmission system in Mindanao. It also involves installing a total of 875 MVA power transformers, 90 MVAR capacitor banks, 26-138 kV PCBs and 55-69 kV PCBs.

8.3.4 Mindanao Substation Rehabilitation Project (MSRP)

MSRP involves the to rehabilitation of various Mindanao substations by replacing 75 defective, deteriorated, obsolete, and low fault level capacity power circuit breakers with new ones for improved system reliability of the grid.



Additional six power circuit breakers are intended for Bunawan Substation to connect the feeders of Davao Light and Power Company (DLPC) while two definite purpose power circuit breakers are for the connection of capacitor banks in Sultan Kudarat Substation.

8.3.5 Tacurong – Kalamansig 69 kV Transmission Line Project

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

The project requires a 69 kV single-circuit line, expansion of the Tacurong Substation, and construction of the switching station in Kalamansig. The completion of the project ends the dependency of the customers from the SPUG and starts enjoying the reliable and cheaper power supply from the grid.

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 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 additional bulk generation, the development of the Luzon Grid is geared towards the implementation of new 500 kV transmission facilities that would allow power export from 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 the 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 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 most have capacity expansion limitations, thus, the development of new substations is very important in supporting load growth in the long-term.

Being the center of the 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 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 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 of the 69 kV transmission lines.

To help improve the 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 for the 500 kV system, upgrading of old transmission lines and substations as well as installation of reactive power compensation equipment at various substations.

9.1 Proposed Transmission Projects up to 2025

The major transmission projects covering the years 2019-2025 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.

In Batangas, the development of the Tuy 500 kV Substation (Stage 1) and Pinamucan 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.

In Cagayan and Cordillera Region, the generation development in the region will be addressed by the implementation of the Nagsaag–Santiago 500 kV Transmission Line.

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 in Taguig City, Marilao Bulacan, and Silang 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, 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, Capas 230 kV Substation in Tarlac, Plaridel 230 kV Substation in Bulacan, Sampaloc 230 kV Substation in Nueva Ecija, Castillejos 230 kV Substation in Zambales, Tanauan 230 kV Substation in Batangas, and Abuyog 230 kV Substation in Sorsogon.

For renewable energy developments particularly in the northern part of Luzon, the implementation of the Northern Luzon 230 kV Loop will provide the needed transmission capacity augmentation.

Shown in Table 9.1 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 9.

Table 9.1: Proposed Luzon Tranmission Outlook for 2025

Project Name/Driver(s)	Province(s) and Components	ETC
Generation Entry		
Santiago–Magat 230 kV Transmission Line Recoductoring Project	Isabela, Nueva Vizcaya	Dec 2022
	Transmission Components: ▪ *Santiago–Magat 230 kV Transmission Line,* ST-DC, 1-410 mm^2 TACSR, 14.47 km	
Malaya 230 kV Collector Station Project	Laguna	Dec 2022
	Substation Components: ▪ *Malaya 230 kV Substation, 3*-230 kV PCBs and associated equipment; ▪ *Malaya 230 kV Collector Station*, 17-230 kV PCBs and associated equipment; *Transmission Components:* ▪ *Bus-in connection along Malaya–Lumban Substation 230 kV Transmission Line,* 2-2500 mm^2 XLPE, 1 km.	
Pinamucan 500 kV Substation	Batangas	Jun 2024
	Substation Components: ▪ *Pinamucan 500 kV Substation*, 2x1,000 MVA, 500/230 kV Power Transformers and accessories, 12-500 kV PCBs and associated equipment; ▪ *Pinamucan 230 kV Substation,* 2x100 MVA 230/69 kV Power Transformers and accessories, 10-230 kV PCBs and associated equipment, 4-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Pinamucan 500 kV bus-in Transmission Line,* ST-DC, 4-795 MCM ACSR, 1 km; ▪ *Pinamucan–Taysan 69 kV Transmission Line,* SP-DC, 1-795 MCM ACSR, 10 km. Bulk Cost Estimate: 4,117 Million Pesos	
Pagbilao–Tayabas 500 kV Transmission Line	Quezon	Mar 2025
	Substation Components: ▪ *Pagbilao 500 kV Substation,* 4-500 kV PCBs and associated equipment 4-230 kV PCBs and associated equipment, 1x30 MVAR, 500 kV Line Reactor *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: 3,375 Million Pesos	
Load Growth		
Marilao 500 kV Substation	Bulacan	Jul 2023
	Substation Components: ▪ *Marilao 500 kV Substation,* 2x1,000 MVA, 500/230-13.8 kV Power Transformers and accessories, 16-500 kV PCBs and associated equipment, 12-230 kV PCBs and associated equipment, 2x90 MVAR, 500 kV Line Reactor and accessories, 2x100 MVAR Shunt Capacitor and accessories. *Transmission Components:* ▪ *Nagsaag–San Jose 500 kV Line Extension to Marilao 500 kV Substation,* ST-DC, 4-795 MCM ACSR/AS, 8.7 km; ▪ *Marilao Bus-in to Hermosa–San Jose 500 kV Line,* ST-DC, 4-410mm^2 TACSR/AS, 1.5 km;	

Project Name/Driver(s)	Province(s) and Components	ETC
	▪ *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: 6,060 Million Pesos	
Concepcion–Sta. Ignacia 69 kV Transmission Line	Tarlac	Aug 2022
	<u>*Transmission Components:*</u> ▪ *Concepcion–Sta. Ignacia 69 kV Transmission Line, 69 kV,* SP-DC, 1-795 MCM ACSR, 33 km. Bulk Cost Estimate: 896 Million Pesos	
Nagsaag–Tumana 69 kV Transmission Line	Pangasinan	Aug 2022
	<u>*Transmission Components:*</u> ▪ *Nagsaag–Tumana 69 kV Transmission Line,* 69 kV, ST/SP-DC1, 1-795 MCM ACSR, 23 km. Bulk Cost Estimate: 588 Million Pesos	
North Luzon Substation Upgrading 2	La Union, Ilocos Norte, Nueva Vizcaya, Isabela, Ilocos Sur, Pangasinan, Cagayan, Tarlac, Pampanga, Zambales, Nueva Ecija	Oct 2022
	Stage 1: <u>*Substation Components:*</u> ▪ *Nagsaag 230 kV Substation*, 2-69 kV PCBs and Associated Equipment ▪ *Balingueo 230 kV Substation*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; 2-230 kV PCBs and Associated Equipment; 1-69 kV PCBs and Associated Equipment ▪ *Tuguegarao 230 kV Substation (Replacement)*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; 2-230 kV PCBs and Associated Equipment 1-69 kV PCBs and Associated Equipment ▪ *Laoag 115 kV Substation (Replacement)*, 1x100 MVA 115/69-13.8 kV Power Transformer and associated equipment; 1-115 kV PCBs and Associated Equipment; 8-69 kV PCBs and Associated Equipment ▪ *Concepcion 230 kV Substation (Replacement),* 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; 22-69 kV PCBs and Associated Equipment ▪ *Pantabangan 230 kV Substation,* 4-230 kV PCBs and Associated Equipment ▪ *Mexico 69 kV Substation,* 18-69 kV PCBs and Associated Equipment ▪ *Masinloc 230 kV Substation,* 2-230 kV PCBs and Associated Equipment ▪ *Bolo 230 kV Substation,* 2-230 kV PCBs and Associated Equipment ▪ *Subic 230 kV Substation*, 1-230 kV PCBs and Associated Equipment ▪ *San Manuel 230 kV Substation,* 2x300 MVA, 230/69-13.8 kV Power Transformer and associated equipment; 13-69 kV PCBs and Associated Equipment ▪ *Bauang 230 kV Substation (Replacement)*, 1x100 MVA 230/115/69-13.8 kV Power Transformer and associated equipment; ▪ *Bayombong 230 kV Substation*, 2x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; 5-230 kV PCBs and Associated Equipment; 8-69 kV PCBs and Associated Equipment ▪ *Santiago 230 kV Substation*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; 5-69 kV PCBs and Associated Equipment ▪ *San Esteban 115 kV Substation,* 2x100 MVA 115/69-13.8 kV Power Transformer and associated equipment; 1-115 kV PCB and Associated equipment; 1-69 kV PCB and associated equipment. ▪ *Hermosa 230 kV Substation,* 21-230 kV PCBs and Associated equipment; ▪ *San Jose 230 kV Substation,* 28-230 kV PCBs and Associated equipment; 11-115 kV PCBs and associated equipment. Bulk Cost Estimate: 9,929 Million Pesos	

Project Name/Driver(s)	Province(s) and Components	ETC
Pinili 230 kV Substation	Ilocos Norte	May 2023
	Substation Components: ▪ *Pinili 230 kV Substation (New)*, 2x100 MVA 230/69-13.8 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 8-69 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, 2x1.0 km; ▪ *Pinili–Currimao 69 kV Transmission Line,* ST-DC, 1-795 MCM ACSR/AS, 7.0 km; Bulk Cost Estimate: 1,692 Million Pesos	
San Simon 230 kV Substation	Pampanga	May 2023
	Substation Components: ▪ *San Simon 230 kV Substation*, 2x300 MVA 230/69 kV Power Transformer and accessories, 2x100 MVAR 230 kV capacitor, 14-230 kV PCBs, 10-69 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/AS, 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/AS, 12.3 km; ▪ *STR 120D–PELCO 3 (Apalit Tap) 69 kV Line*, SP-SC, 1-410 mm^2 TACSR/AS, 2.52 km; ▪ *San Simon–SKK 69 kV Line*, SP-SC, 1-410 mm^2 TACSR/AS, 7.56 km; ▪ *San Simon–Melters 69 kV Line*, SP-SC, 1-410 mm^2 TACSR/AS, 4.75 km. ▪ *San Simon–Wan Chiong 69 kV Line, SP-SC, 1-795 MCM ACSR/AS, 6.8 km* Bulk Cost Estimate: 3,812 Million Pesos	
Abuyog 230 kV Substation	Sorsogon	Feb 2024
	Substation Components: ▪ *Abuyog 230 kV Substation,* 2x100 MVA 230/69-13.8 kV Power Transformer and accessories, 3x25 MVAR, 230 kV Shunt Capacitor and accessories, 3x25 MVAR, 230 kV Shunt Reactor and accessories, 12-230 kV PCBs and associated equipment, 5-69 kV PCBs and associated equipment. ▪ *Toblijon 230 kV Switching Station,* 10-230 kV PCBs and associated equipment. *Transmission Components:* ▪ *Toblijon-Abuyog 230 kV Transmission Line*, 2-795 MCM ACSR/AS, ST-DC, 25.4 km. ▪ *Toblijon-Daraga 230 kV Bus-in Transmission Line,* 2-795 MCM ACSR/AS, ST-DC, 0.86 km. ▪ *Toblijon-BacMan 230 kV Bus-in Transmission Line,* 1-795 MCM ACSR/AS, ST-DC, 0.86 km. ▪ *Abuyog-Gubat 69 kV Line Extensions,* 1-336.4 MCM ACSR, SP-SC, 0.20 km. ▪ *Abuyog-Balogo 69 kV Line Extensions,* 1-336.4 MCM ACSR, SP-SC, 0.20 km. ▪ *Abuyog-Irosin-Bulan 69 kV Line Extensions,* 1-336.4 MCM ACSR, SP-SC, 1.14 km. Bulk Cost Estimate: 3,326.197 Million Pesos	
South Luzon Substation Upgrading Project 2	Batangas, Laguna, Quezon, Camarines Norte, Albay, Rizal and Metro Manila	Dec 2023
	Substation Components: ▪ *Lumban 230 kV Substation (Replacement),* 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment;	

Project Name/Driver(s)	Province(s) and Components	ETC
	▪ *Gumaca 230 kV Substation (Replacement)*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Tuy 230 kV Substation,* 1x300 MVA, 230/69-13.8 kV Power Transformer and associated equipment*,* 1-69 kV PCBs and associated equipment; ▪ *Calaca 230 kV Substation (Replacement)*, 2x300 MVA, 230/69-13.8 kV Power Transformer and associated equipment; 7-69 kV PCBs and associated equipment ▪ *Labo 230 kV Substation (Replacement),* 1x100 MVA, 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Daraga 230 kV Substation (Replacement)*; 4-230 kV PCBs and associated equipment ▪ *Taytay 230 kV Substation,* 3x100 MVAR, 230 kV Capacitor Banks and accessories, 3-230 kV PCBs and associated equipment; ▪ *Quezon 230 kV Substation,* 1x100 MVAR, 230 kV Capacitor Banks and accessories, 1-230 kV PCBs and associated equipment; ▪ *Biñan 230 kV Substation*, 6-230 kV PCBs and associated equipment, 6-115 kV PCBs and associated equipment. ▪ *Dasmariñas 115 kV Substation*, 3-115 kV PCBs and associated equipment. ▪ *Naga 69 kV Substation,* 1-69 kV PCB and associated equipment ▪ *Muntinlupa 115 kV Substation*, 10-115 kV PCBs and associated equipment. Bulk Cost Estimate: 3,092 Million Pesos	
Tanauan 230 kV Substation	Batangas	Aug 2025
	Substation Components: ▪ *Tanauan 230 kV Substation,* 2x100 MVA, 230/69 kV Power Transformers 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: 2,435 Million Pesos	
Tuguegarao–Enrile 69 kV Transmission Line	Tuguegarao	Oct 2024
	Substation Components: ▪ *Tuguegarao 69 kV Substation, 2*-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Tuguegarao–Enrile 69 kV Transmission Line,* 1-795 MCM ACSR, SP-SC, 30 km. Bulk Cost Estimate: 734 Million Pesos	
Sampaloc 230 kV Substation	Nueva Ecija	Dec 2025
	Substation Components: ▪ *Sampaloc 230 kV Substation,* 2x100 MVA 230/69 kV Power Transformer and accessories, Control Room, 2x50 MVAR, 230 kV Shunt Capacitor, 12-230 kV PCBs and associated equipment, 5-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Sampaloc Bus-in to Cabanatuan-Pantabangan and Nagsaag-Pantabangan 230 kV Transmission Line,* ST-DC, 1-795 MCM ACSR/AS, 2 km; ▪ *Sampaloc Cut-in to Cabanatuan-Pantabangan 69 kV Transmission Line,* ST-DC, 1-336 MCM ACSR/AS, 1 km; ▪ *Sampaloc–SAJELCO 69 kV Transmission Line,* SP-SC, 1-410 mm^2 TACSR/AS, 7 km. Bulk Cost Estimate: 1,717.99 Million Pesos	

Project Name/Driver(s)	Province(s) and Components	ETC
Luzon Voltage Improvement Project 5	North Luzon	Dec 2025
	<u>*Substation Components:*</u> ▪ *Solana Load-end Substation,* 4x7.5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment ▪ *Bongabon Load-end Substation,* 4x5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment ▪ *Candelaria Load-end Substation,* 4x2.5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment ▪ *Bani Load-end Substation*, 4x5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment ▪ *San Fabian Load-end Substation,* 4x5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment ▪ *Aglipay Load-end Substation,* 4x5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment ▪ *Cauayan Load-end Substation,* 4x5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment ▪ *Ilagan Load-end Substation*, 4x2.5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment Bulk Cost Estimate: 2,599 Million Pesos	
Castillejos 230 kV Substation	Zambales	Feb 2024
	<u>*Substation Components:*</u> ▪ *Castillejos 230 kV Substation*, 2x100 MVA, 230/69 kV Power Transformer and accessories, 16-230 kV PCBs and associated equipment, 4-69 kV PCBs and associated equipment. <u>*Transmission Components:*</u> *Hermosa–Castillejos 500 kV Line Extension*, 4-410 mm^2 TACSR/AS, ST-DC, 5.5 km *Hanjin 230 kV Line Extension*, 1-795 MCM ACSR, ST-DC, 7 km *RP Energy 230 kV Line Extension*, 2-795 MCM ACSR, ST-DC, 7 km *Castillejos 69 kV Line Extension,* 1-410 mm^2 TACSR/AS, SP/ST-DC, 3km. Bulk Cost Estimate: 3,068 Million Pesos	
Capas 230 kV Substation	Tarlac	Oct 2025
	<u>*Substation Components:*</u> ▪ *Capas 230 kV Substation,* 2x300 MVA 230/69-13.8 kV Power Transformers and accessories, 3x100 MVAR 230 kV Shunt Capacitor and accessories; 11-230 kV PCBs and associated equipment, 14-69 kV PCBs and associated equipment; ▪ *Concepcion 230 kV Substation (Expansion),* 4-230 kV PCBs and associated equipment. <u>*Transmission Components:*</u> ▪ *Concepcion–Capas 230 kV Transmission Line,* ST-DC, 4-795 MCM ACSR, 15 km. Bulk Cost Estimate: 2,605 Million Pesos	
Porac 230 kV Substation	Pampanga	Dec 2023
	<u>*Substation Components:*</u> ▪ *Porac 230 kV Substation,* 2x300 MVA 230/69 kV Power Transformers and accessories, 3x100 MVAR, 230 kV Shunt Capacitor and accessories, 13-230 kV PCBs and associated equipment, 19-69 kV PCBs and associated equipment; ▪ *Hermosa 230 kV Substation (Expansion),* 2-230 kV PCBs and associated equipment; ▪ *Clark 230 kV Substation (Expansion),* 2x100 MVAR, 230 kV Shunt Capacitor and accessories, 8-230 kV PCBs and associated equipment, ▪ *Capas 230 kV Substation (Expansion),* 4-230 kV PCBs and associated equipment. <u>*Transmission Components:*</u>	

Project Name/Driver(s)	Province(s) and Components	ETC
	▪ *Hermosa–Porac–Capas 230 kV Transmission Line,* 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: 6,384 Million Pesos	
System Reliability		
Tower Resiliency of Bicol Transmission Facilities	Camarines Sur, Albay, Sorsogon	Dec 2025
	Transmission Components: ▪ *Naga–Tiwi A–Daraga 230 kV Transmission Line,* 2-795 MCM ACSR/AS, ST-DC, 105 km. ▪ *Naga–Tiwi C 230 kV Transmission Line,* 2-795 MCM ACSR/AS, ST-DC, 60 km. ▪ *Daraga–Tublijon 230 kV Transmission Line,* 2-795 MCM ACSR/AS, ST-DC, 35 km. Bulk Cost Estimate: 8,771 Million Pesos	
Western Luzon 500 kV Backbone (Stage 2)	Pangasinan, Zambales	Dec 2025
	Substation Components: ▪ Castillejos 500 kV Substation, 2x1,000 MVA, 500/230-13.8 kV Power Transformers and accessories, 2x90 MVAR, 500 kV Shunt Reactor and accessories, 2x60 MVAR, 500 kV Line Reactor and accessories, 12-500 kV PCBs and associated equipment; ▪ Castillejos 230 kV Substation, 2x200 MVAR, 230 kV Shunt Capacitor and accessories, 4-230 kV PCBs and associated equipment; ▪ Bolo 500 kV Substation, 6-500 kV PCBs and associated equipment; 4-230 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: 18,965 Million Pesos	
Taguig–Taytay 230 kV Transmission Line	Rizal, Metro Manila	Dec 2026
	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: 3,256 Million Pesos	

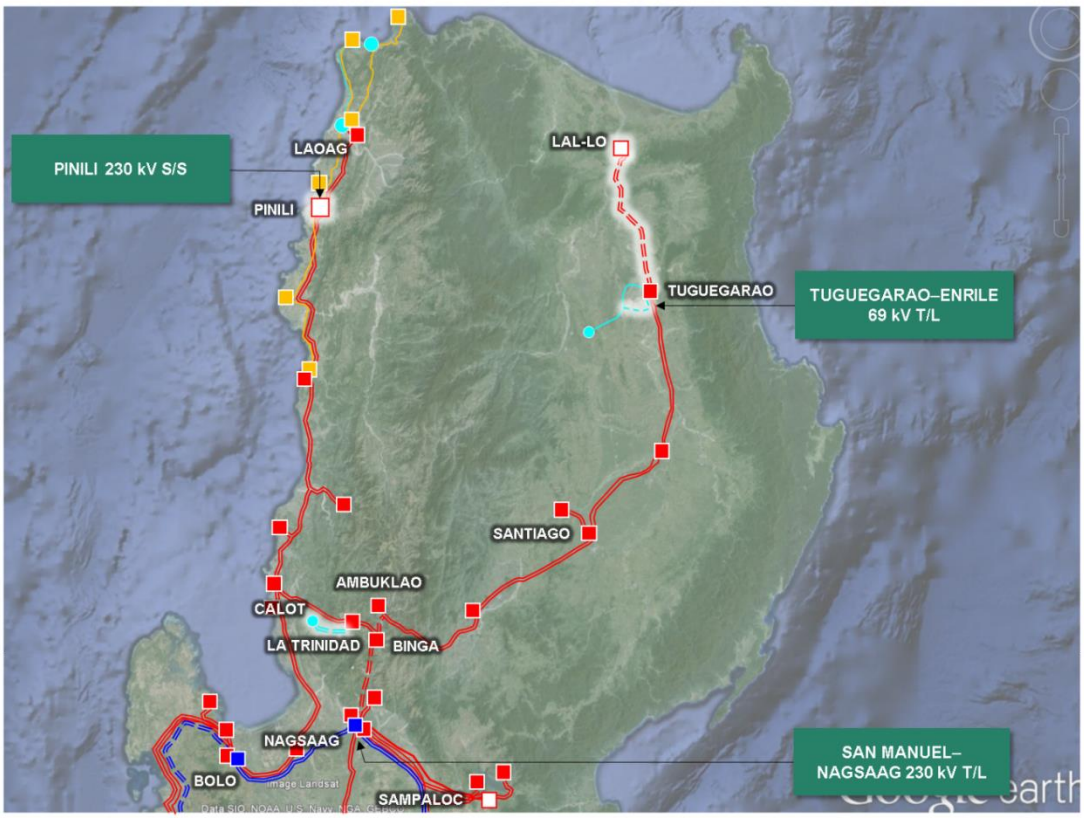


Figure 9.1: Proposed North Luzon Transmission Outlook for 2025

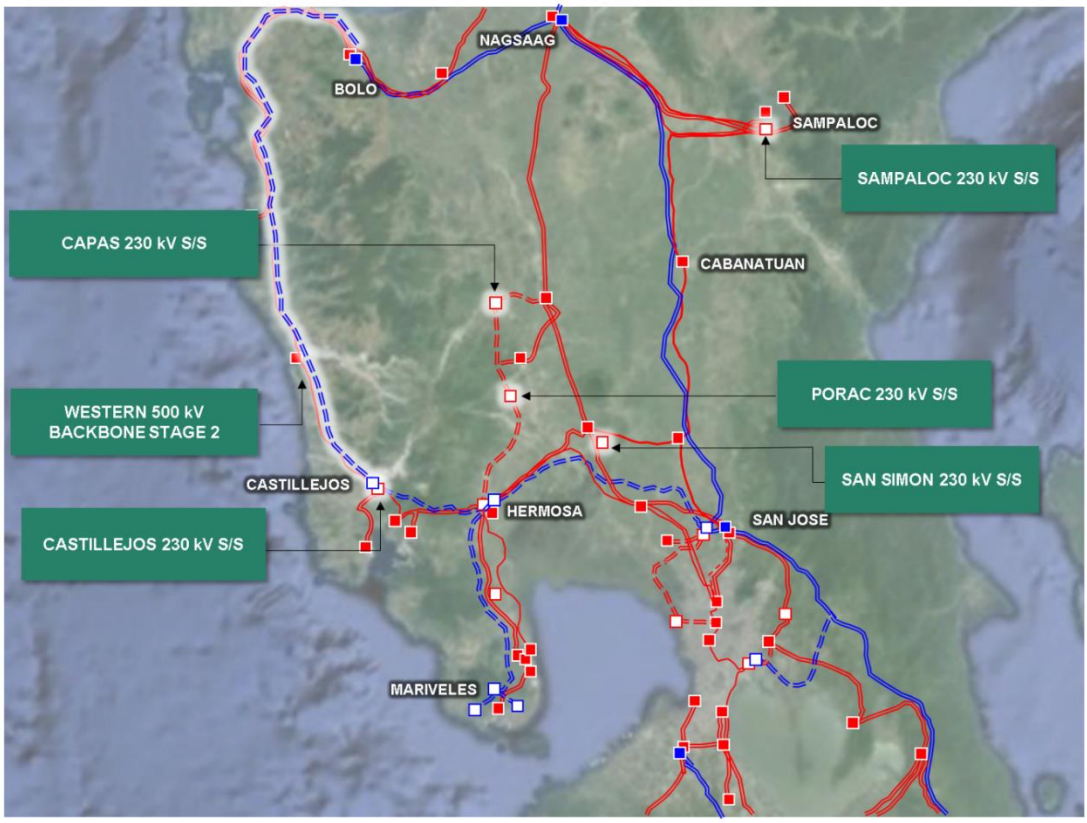


Figure 9.2: Proposed Central Luzon Transmission Outlook for 2025

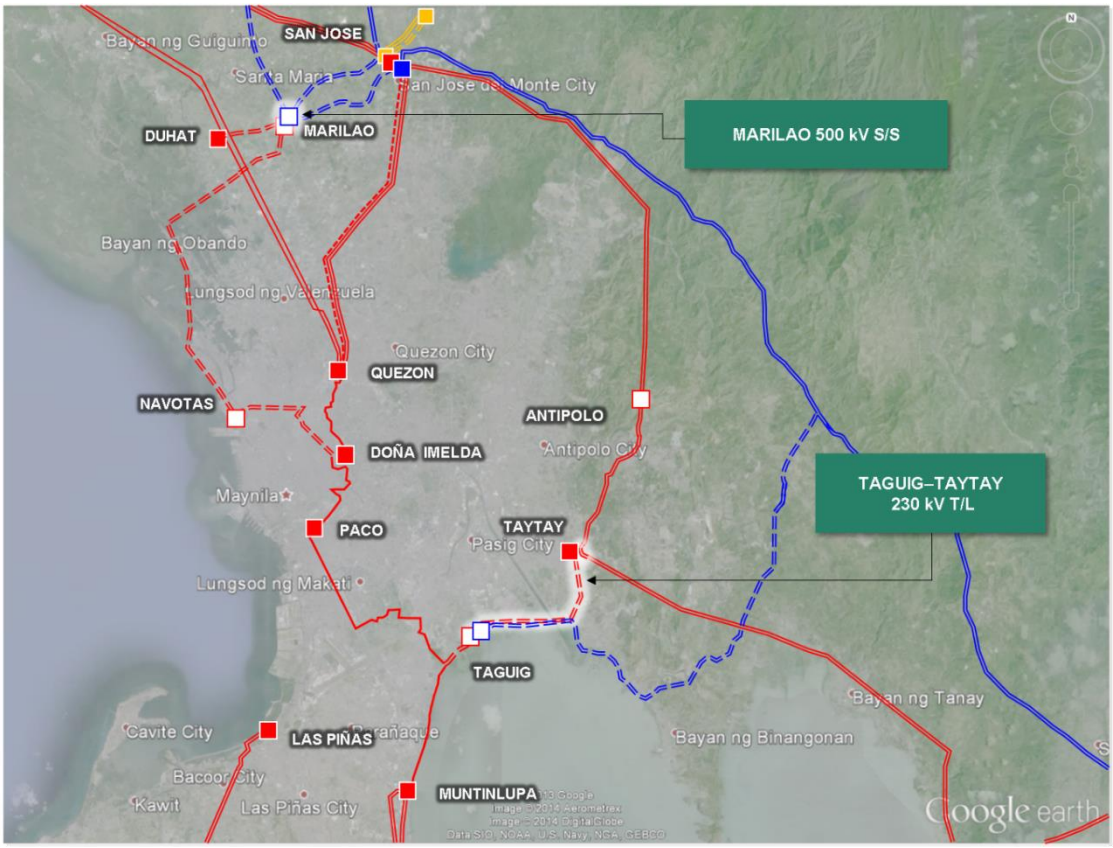


Figure 9.3: Proposed Metro Manila Transmission Outlook for 2025

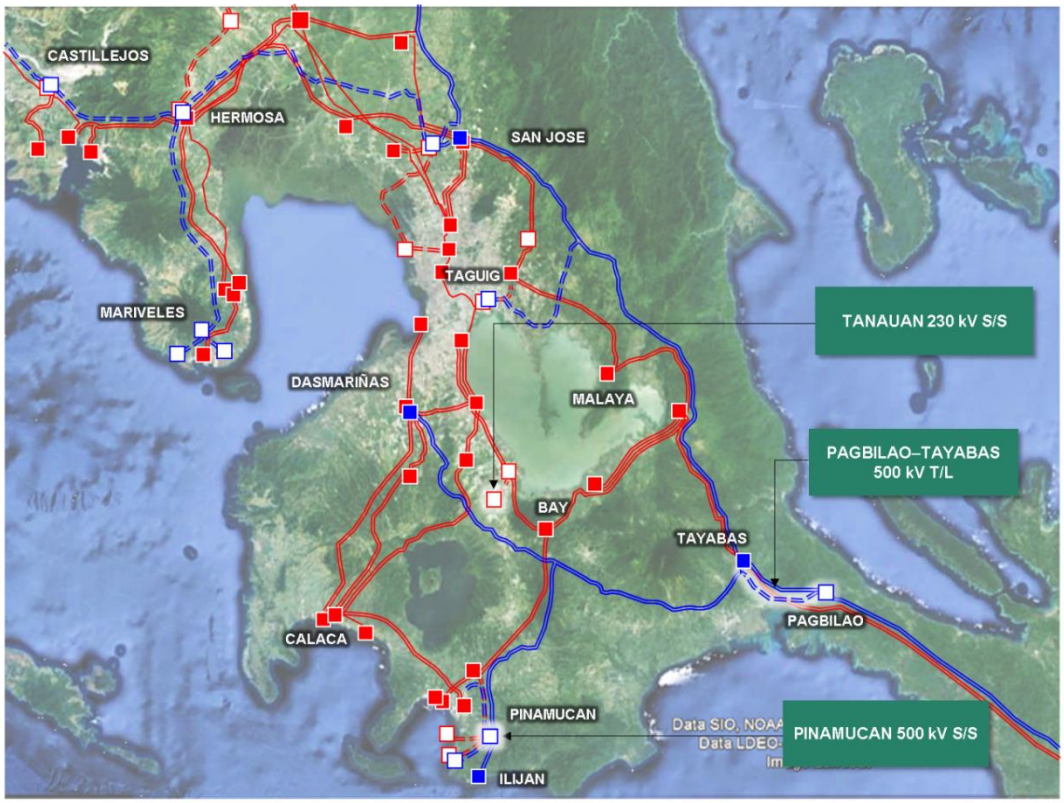


Figure 9.4: Proposed South Luzon Transmission Outlook for 2025

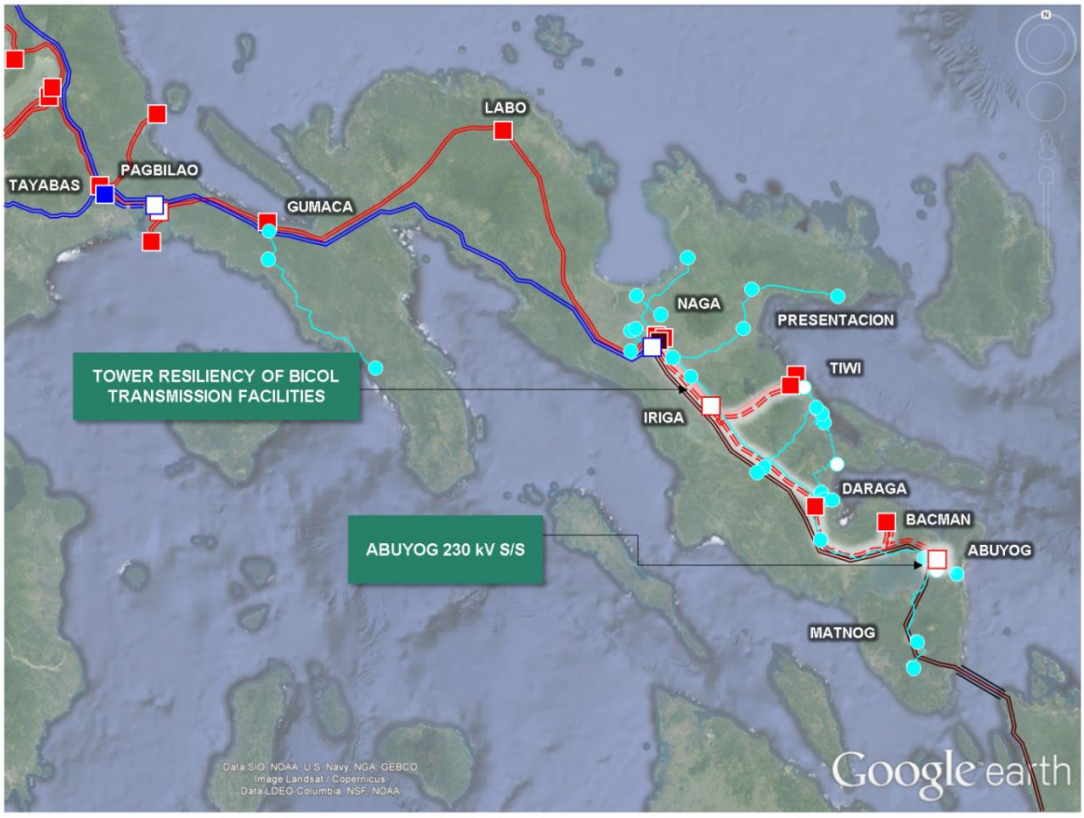
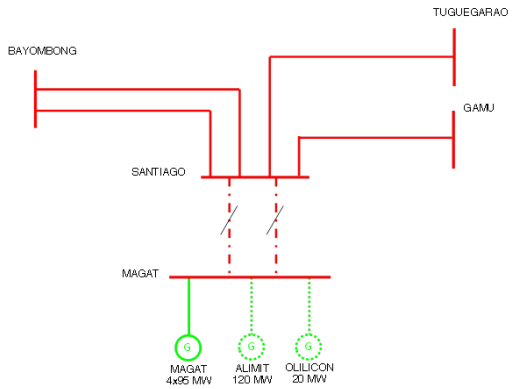


Figure 9.5: Proposed Bicol Region Transmission Outlook for 2025

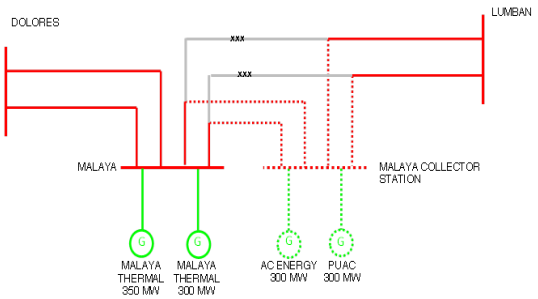
9.1.1 Santiago–Magat 230 kV Transmission Line Reconductoring Project

The Santiago–Magat 230 kV Transmission Line Reconductoring Project aims to upgrade the existing Santiago–Magat 230 kV Transmission Line to accommodate new generation plants that will be connected in Magat such as the 120 MW Alimit Hydro Plant and the 20 MW Olilicon Hydro Plant.

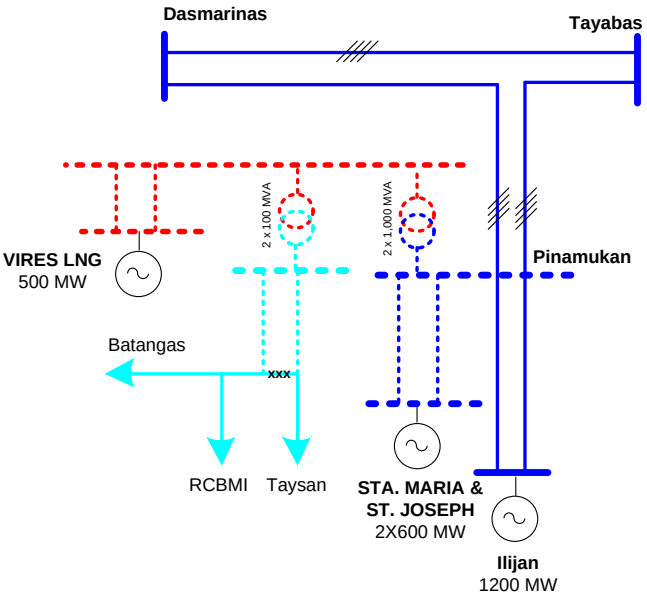


9.1.2 Malaya 230 kV Collector Station

The Malaya 230 kV Collector Station Project aims to accommodate the 300 MW Modular Diesel Plant of AC Energy as well as the 300 MW PUAC Laguna Bay 2 Solar Power Plant. Since the existing Malaya 230 kV Substation has insufficient space for expansion, the Malaya 230 kV Collector Station will serve as the connection point for all generation plants in the area. The Malaya 230 kV Collector Station will bus-in along the existing Malaya–Lumban 230 kV Transmission Line.



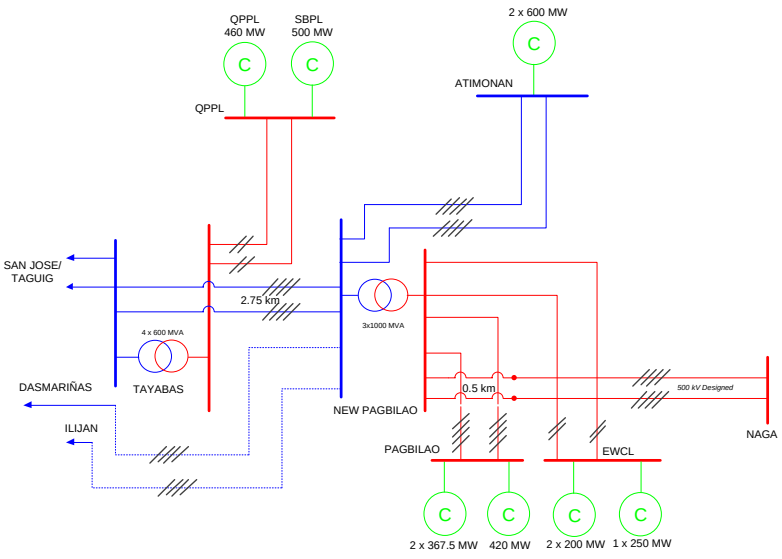
9.1.3 Pinamucan 500 kV Substation



The Pinamucan 500 kV Substation Project allows the connection of incoming bulk generation capacities in Batangas City Area which are mostly LNG-fired power plants. This substation will also serve as a new drawdown 230/69 kV drawdown substation for MERALCO and BATELEC II loads. 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.

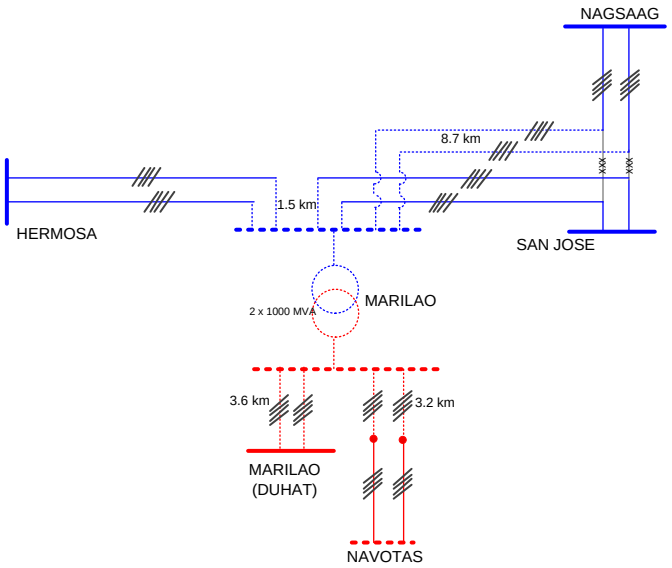
9.1.4 Pagbilao–Tayabas 500 kV Transmission Line



The Pagbilao–Tayabas 500 kV Transmission Line Project accommodates further generation capacity additions in the Quezon province and to provide additional reliability in the Luzon 500 kV Grid. The proposed 1,200 MW Atimonan CFPP which will connect to Pagbilao Substation is the next major generation addition in the area that triggered this project. 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 at Tayabas 500 kV Substation and will address the high 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.

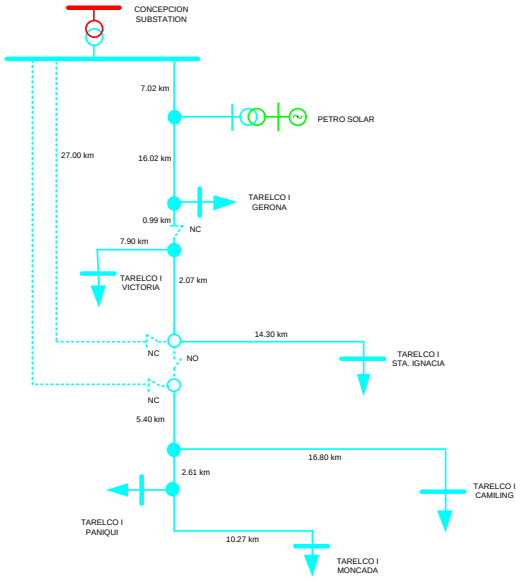
9.1.5 Marilao 500 kV Substation

The Marilao 500 kV Substation provides 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.

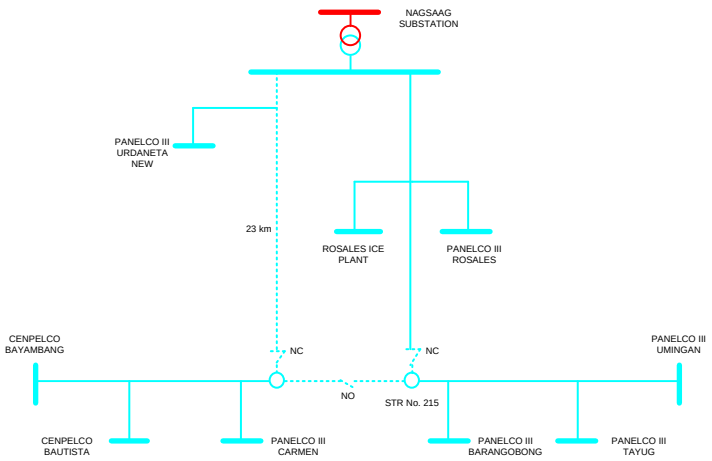


9.1.6 Concepcion–Sta. Ignacia 69 kV Transmission Line

The Concepcion–Sta. Ignacia 69 kV Transmission Line Project caters to the growing demand in Tarlac Area. The existing Concepcion–Camiling 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 double circuit 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.



9.1.7 Nagsaag–Tumana 69 kV Transmission Line

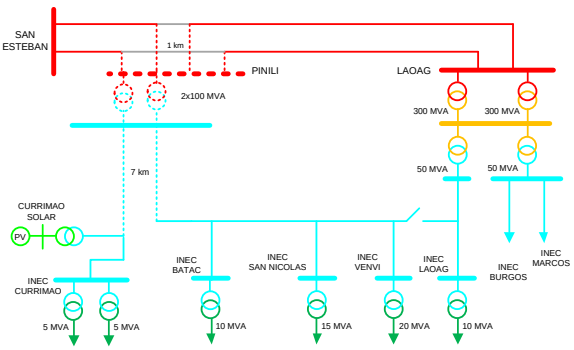


The Nagsaag–Tumana 69 kV Transmission Line Project caters to the growing demand in Pangasinan. The existing Nagsaag–Umingan 69 kV Transmission Line which delivers power to the loads of Pangasinan III Electric Cooperative (PANELCO III) and Central Pangasinan Electric Cooperative (CENPELCO) will already be overloaded. The Nagsaag–Tumana 69 kV Transmission Line Project involves the construction of a new 69 kV transmissionline 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.

9.1.8 North Luzon 230 kV Substation Upgrading Project 2

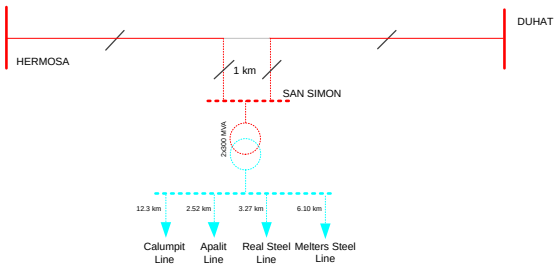
The North Luzon Substation Upgrading Project 2 addresses the load growth and provide N-1 contingency to various substations in NGCP's North Luzon Region such as Nagsaag, Balingueo, Tuguegarao, Laoag, Concepcion, Bauang, Bayombong, Santiago, San Esteban, Hermosa and San Jose Substations. The Project involves transformer installations, and replacement and rearrangements of power circuit breakers to ensure reliability and flexibility of operations on the concerned substations.

9.1.9 Pinili 230kV Substation



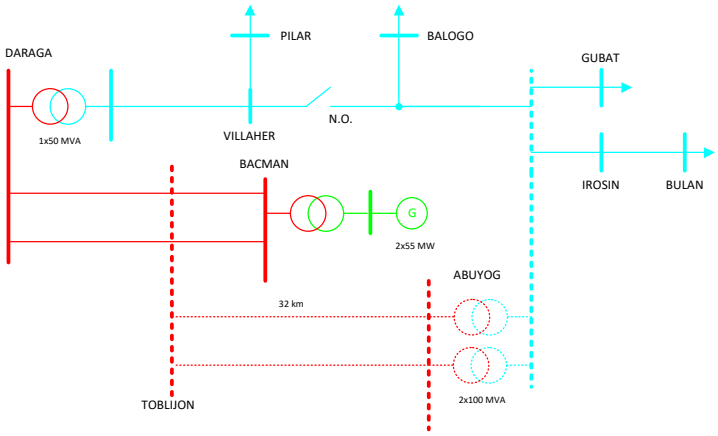
This Pinili 230 kV Substation will replace the existing Currimao 115 kV Substation as it can no longer be expanded due to space constraints. This project will accommodate the load growth and provide N-1 contingency for the loads of Ilocos Norte Electric Cooperative (INEC), Ilocos Sur Electric Cooperative (ISECO) and Abra Electric Cooperative (ABRECO). This will also serve 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 2x100 MVA, 230/69-13.8 kV Power Transformer, 10-230 kV PCBs, 5-69 kV PCBs and its associated equipment.

9.1.10 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.

9.1.11 Abuyog 230 kV Substation



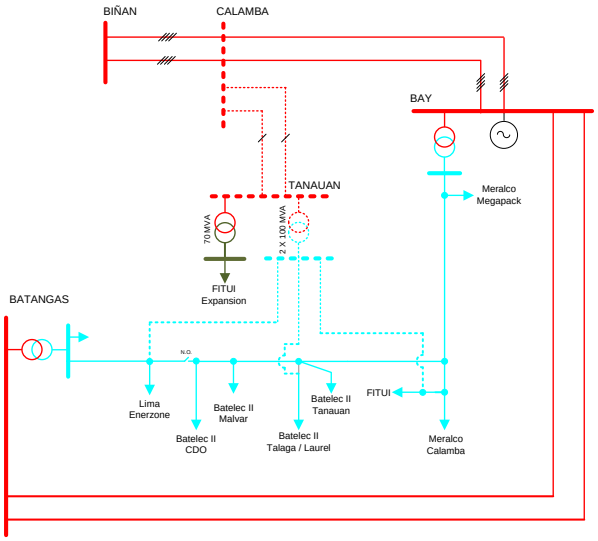
The Abuyog 230 kV Substation Project establishes a 230 kV drawdown substation closer to the loads in Sorsogon which will address the supply reliability issues, meet the long term projected demand and address the power quality issues at the load-end substations. Presently, the whole province of Sorsogon is solely relying on a single-circuit 69 kV line being supplied from Daraga Substation which is located in Albay. The proposed Abuyog 230 kV Substation will connect to a new switching station in Toblijon, Sorsogon through a 25.4 km ST-DC, 2-795 MCM ACSR transmission line. The switching station will bus-in along Daraga–Bacman 230 kV Line. The Abuyog Substation involves the installation of 2x100 MVA, 230/69-13.8 kV Power Transformer.

9.1.12 South Luzon 230 kV Substation Upgrading Project 2

The South Luzon Substation Upgrading Project 2 caters to the load growth and provide N-1 contingency to various substations in NGCP's South Luzon Region in Lumban, Gumaca, Tuy, Labo and Calaca Substations. The Project involves transformer installations to ensure the adequacy of transformer capacity to serve the loads. Furthermore, capacitor installations in Quezon and Taytay will be implemented to address power quality. Also, the Project involves replacement and installation of power circuit breakers in areas such as Biñan, Dasmariñas, Naga, and Muntinlupa Substations to ensure reliability and flexibility of operations on the concerned substations.

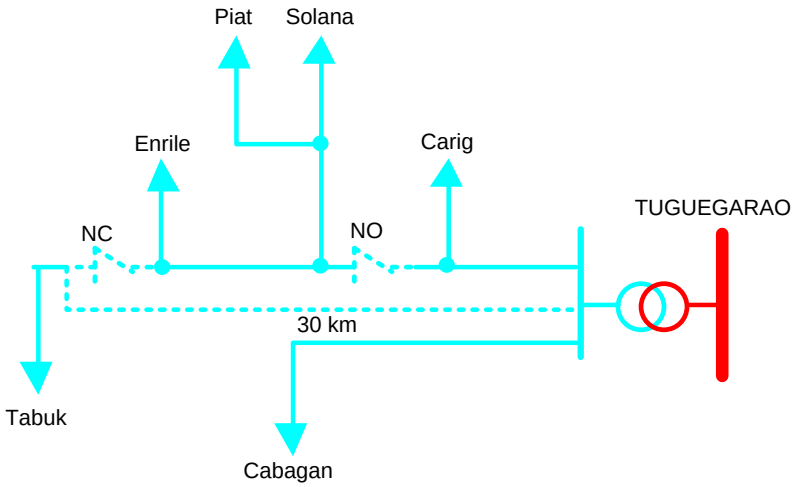
9.1.13 Tanauan 230 kV Substation

The Tanauan 230 kV Substation Project caters to the load growth of Batangas and Laguna Area particularly loads of MERALCO Calamba, BATELEC II and the industrial loads. 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 of supply 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.



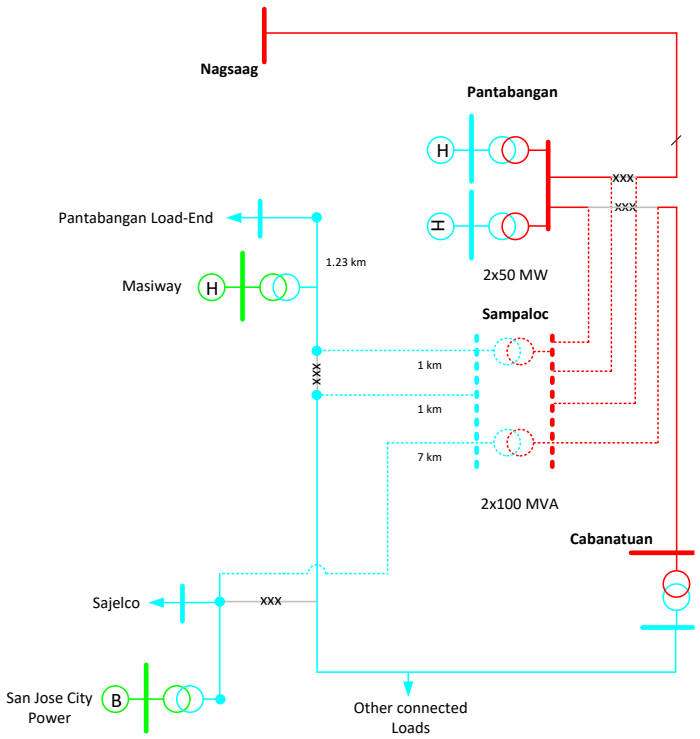
9.1.14 Tuguegarao–Enrile 69 kV Transmission Line

The Tuguegarao–Enrile 69 kV Transmission Line Project provides additional transfer capacity to address the load growth of CAGELCO I and KAELCO. The project will relieve the anticipated overloading of the existing Tuguegarao–Tabuk 69 kV Line. The project will involve the development of a new single circuit, 15 km 1-795 MCM ACSR 69 kV transmission line that will initially tap to the Tuguegarao–Cabagan 69 kV line. Ultimately, this will be terminated to Tuguegarao 69 kV Substation through the development of additional 15 km 1-795 MCM ACSR 69 kV transmission line.



9.1.15 Sampaloc 230 kV Substation

The Sampaloc 230 kV Substation Project establishes 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 Sampaloc 230 kV Substation will be connected to the Luzon Grid through a 'bus-in' along the Nagsaag–Pantabangan 230 kV Line and the Cabanatuan–Pantabangan 230 kV Line via a 2 km ST-DC 1-795 MCM ACSR/AS 230 kV Transmission Line with 2x100 MVA transformer capacity. Ultimately, this substation will be linked to Nagsaag and Cabanatuan 230 kV Substations through a new double circuit Sampaloc–Nagsaag–Cabanatuan 230 kV Transmission Line.

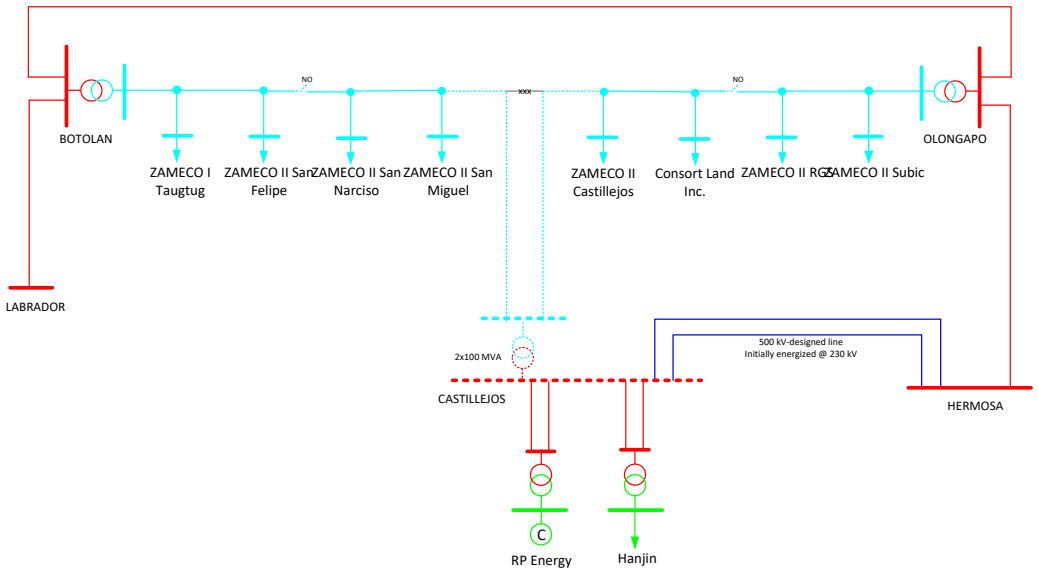


9.1.16 Luzon Voltage Improvement Project 5

The Luzon Voltage Improvement Project 5 addresses the anticipated undervoltage problem during peak load condition at various load-end substations in Cagayan, Tarlac, Nueva Ecija, Pampanga, Zambales, Pangasinan, Batangas, Quirino, Isabela, Nueva Viscaya, and Benguet.

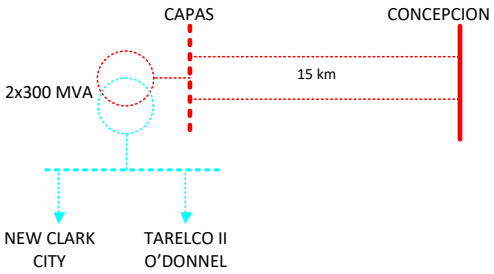
9.1.17 Castillejos 230 kV Substation

The Castillejos 230 kV Substation Project caters to the load growth in Zambales. The Castillejos Substation will have a transformer capacity of 2x100 MVA and will serve as an alternative source to loads of Botolan and Olongapo 230 kV Substations. The Castillejos 230 kV substation will also serve as the connection point of RP Energy CFPP and any other future bulk generation development in the area. The new substation will connect to the Hermosa 230 kV Substation thru the Castillejos–Hermosa 500 kV Transmission Line (initially energized at 230 kV).



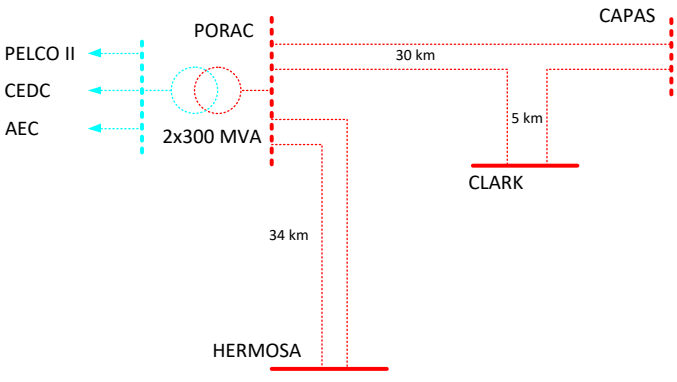
9.1.18 Capas 230 kV Substation

The Capas 230 kV Substation Project supports 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 15 km double circuit 230 kV transmission line from Concepcion to Capas 230 kV Substation.

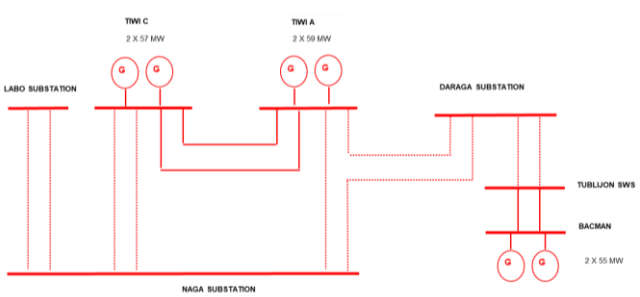


9.1.19 Porac 230 kV Substation

The Porac 230 kV Substation Project supports 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 2x300 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.

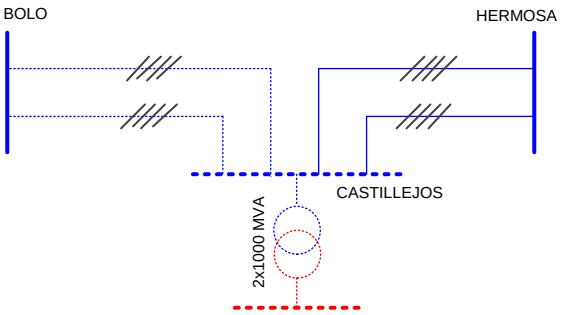


9.1.20 Tower Resiliency of Bicol Transmission Facilities



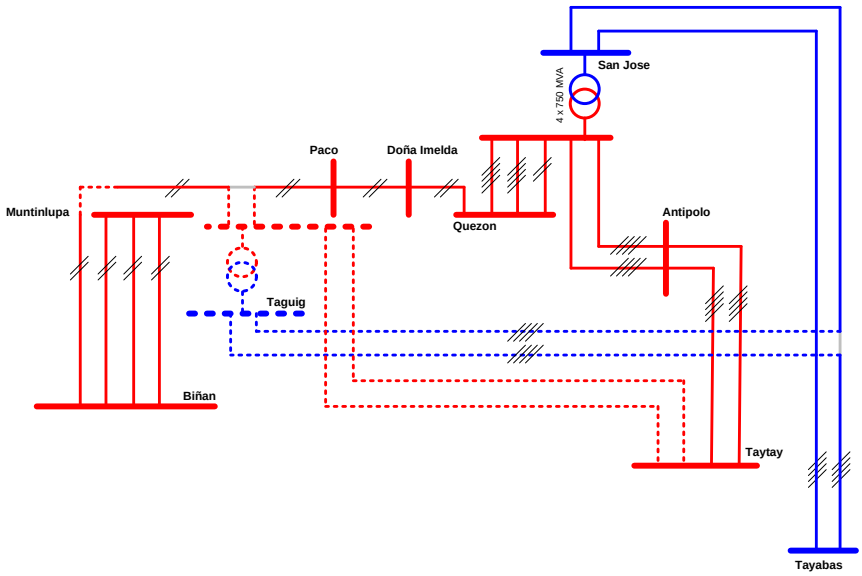
The Tower Structure of Bicol Transmission Facilities Project replaces the steel tower structure of Naga–Tiwi–Daraga, Naga-Labo and Daraga–Tublijon Transmission Lines to withstand strong typhoons. In November 2019, Typhoon Tisoy devastated many areas in Bicol Region which affected operation of several connected power plants. The typhoon caused permanent damage and destruction on the steel tower structures. In this project, all the toppled structure as well as the remaining 230 kV Tower Structure from Naga–Tiwi A–Daraga, Naga-Tiwi C, Naga-Labo and Daraga–Tublijon which has 185 kph and less wind speed design will be replaced into a more dependable and sturdier new design steel tower structures that can withstand 300 kph wind speed. The project will utilize a 1-410 mm^2 STACIR conductor which has a sufficient transmission capacity of 637 MVA. This will ensure the continuity of power supply in Bicol Region even during typhoons.

9.1.21 Western Luzon 500 kV Backbone (Stage 2)



This Western 500 kV Backbone (Stage 2) Project will complete the reinforcement of capacity of western transmission corridor presently consisting of a single-circuit line from Labrador down to Botolan to Hanjin then to Olongapo. The long-term development plan considers providing higher level of reliability up to N-2 contingency for the 500 kV backbone system of the Luzon Grid. It should be noted that the existing double-circuit 500 kV transmission line from Bolo to Nagsaag to San Jose is on common tower structures and that toppling of a tower 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 results in grid congestion due to the required curtailment to the base load coal-fired power plants in northern Luzon. The capacity expansion of Masinloc CFPP and the 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 transmission backbone. This project involves the construction of a 174 km double circuit 500 kV line from Bolo 500 kV Substation to Castillejos. It involves 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 a relatively long transmission lines may be divided into several stages during implementation.

9.1.22 Taguig–Taytay 230 kV Transmission 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.

9.2 Proposed Transmission Outlook for 2030

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 project also involves 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 Pinamucan 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. On the other hand, Ilocos Norte being within one of the CREZ in Northern Luzon, any additional generation will be addressed by both Bolo–Balaoan 500 kV Transmission Line and the Balaoan–Laoag 500 kV Transmission Line Projects.

To address the forecasted load growth, the development of new drawdown substations will be needed. These include the development of Magalang, Guagua and Apalit 230 kV Substations in Pampanga, Baler 230 kV Substation in Aurora, San Fabian 230 kV Substation in Pangasinan, Valenzuela 230 kV Substation in Metro Manila, Balanga 230 kV Substation in Bataan, Cabatuan 230 kV Substation in Isabela, San Isidro 230 kV Substation in Nueva Ecija, Malvar 230 kV Substation in Batangas, Iriga 230 kV Substation in Camarines Sur, Nuvali 230 kV Substation in Laguna and San Agustin 230 kV Substation in Tarlac. Furthermore, additional 69 kV transmission line capacities will be implemented to address the heavy loading of the existing 69 kV transmission lines.

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 230 kV transmission corridor, the Hermosa–Mexico 230 kV Transmission Line, and the Mexico–Clark 69 kV Transmission Line. In North Luzon, upgrading of the Bauang–La Trinidad 230 kV

Transmission Line will also be implemented. In Metro Manila, additional transmission corridors will be implemented such as the Limay–Pasay and Pasay–Taguig 230 kV lines.

Lastly, to effectively regulate the voltage in the grid, additional capacitors will be installed.

Table 9.1: Proposed Luzon Transmission Outlook for 2030

Project Name/Driver(s)	Province(s) and Components	ETC
Generation Entry		
Nagsaag–Santiago 500 kV Transmission Line	Isabela, Pangasinan	Aug 2027
	<u>*Substation Components:*</u> ▪ *New Santiago 500 kV Substation,* 2x1,000 MVA 500/230-13.8 kV Power Transformers and accessories, 10-500 kV PCBs and 22-230 kV PCBs and associated equipment, 2x90 MVAR, 500 kV Shunt Reactor and accessories, 2x60 MVAR, 500 kV Line Reactor and accessories; ▪ *Santiago 230 kV Substation,* 4-230 kV PCBs and associated equipment; ▪ *Nagsaag 500 kV Substation,* 2-500 kV PCBs and accessories. <u>*Transmission Components:*</u> ▪ *Nagsaag–Santiago 500 kV Transmission Line,* ST-DC, 4-410 mm^2 TACSR/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: 13,302 Million Pesos	
Tuy 500/230 kV Substation (Stage 2)	Batangas	Oct 2027
	<u>*Substation Components:*</u> ▪ *Tuy 500/230 kV Substation,* 3x1,000 MVA, 500/230 kV Power Transformers and accessories, 8-500 kV PCBs and associated equipment, 1-230 kV PCBs and associated equipment. ▪ *Silang 500 kV Substation,* 4-500 kV PCBs and associated equipment. Bulk Cost Estimate: 4,298 Million Pesos	
Northern Luzon 230 kV Loop	Ilocos Norte, Apayao, Cagayan	Dec 2027
	<u>*Substation Components:*</u> ▪ *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, 14-230 kV PCBs, 18-115 kV PCBs and associated equipment;4x50 MVAR, 115 kV Shunt Capacitor and accessories, 4x25 MVAR, 115 kV Shunt Reactor and accessories; ▪ *Sanchez Mira 230 kV Substation (New),* 2x300 MVA, 230/69-13.8 kV Power Transformers and accessories, 18-230 kV PCBs and associated equipment, 8-69 kV PCB's and associated equipment; 4x25 MVAR, 230 kV Shunt Capacitor and accessories, 4x25 MVAR, 230 kV Shunt Reactor and accessories; ▪ *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. <u>*Transmission Components:*</u> ▪ *Laoag–Bangui 230 kV Transmission Line,* ST-DC, 2-795 MCM, ACSR, 50 km; ▪ *Bangui–Sanchez Mira 230 kV Transmission Line*, ST-DC, 2-795 MCM, ACSR, 70 km; ▪ *Pudtol–Sanchez Mira 230 kV Transmission Line*, ST-DC, 2-795 MCM, ACSR, 57 km; ▪ *Lal-lo (Magapit)–Pudtol 230 kV Transmission Line*, ST-DC, 2-795 MCM, ACSR, 38 km. Bulk Cost Estimate: 16,928 Million Pesos	
La Trinidad–Sagada 230 kV Transmission Line	Benguet	Dec 2027
	<u>*Substation Components:*</u> ▪ *La Trinidad 69 kV Substation Expansion,* 2-69 kV PCBs and associated equipment;	

Project Name/Driver(s)	Province(s) and Components	ETC
	▪ *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.	
Palauig 500 kV Substation	Zambales	Dec 2027
	Substation Components: *Palauig 500 kV Substation,* 2x1,000 MVA, 500/230 kV Power Transformer and accessories, 12-500 kV PCB and associated equipment, 10-230 kV PCB and associated equipment.	
Cabanatuan–Sampaloc–Nagsaag 230 kV Transmission Line	Nueva Ecija, Pangasinan	Feb 2028
	Substation Components: ▪ *Sampaloc 230 kV Substation,* 4-230 kV PCBs and associated equipment; ▪ *Nagsaag 230 kV Substation Expansion,* 6-230 kV PCBs and associated equipment. ▪ *Cabanatuan 230 kV Substation Expansion,* 2-230 kV PCBs and associated equipment. *Transmission Components:* ▪ *Sampaloc–Nagsaag 230 kV Transmission Line*, ST-DC, 4-795 MCM ACSR/AS, 68 km. ▪ *Sampaloc–Cabanatuan 230 kV Transmission Line*, ST-DC, 4-795 MCM ACSR/AS, 53 km. Bulk Cost Estimate: 6,834.42 Million Pesos	
Luzon–Visayas HVDC Bipolar Operation	Camarines Sur and Leyte	Apr 2028
	Substation Components: ▪ *Naga Converter/Inverter StationUpgrading;* ▪ *Naga 500/230 kV Substation,* 2x750 MVA, 500/230 kV Power Transformers 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.*	
Bolo–Balaoan 500 kV Transmission Line	La Union, Pangansinan	Apr 2028
	Substation Components: ▪ *Balaoan 500 kV Substation,* 2x750 MVA, 500/230-13.8 kV Power Transformers and accessories, 20-500 kV PCBs and associated equipment, 21-230 kV PCBs and associated equipment 4x90 MVAR, 500 kV Shunt Reactor and accessories, 2x60 MVAR, 500 kV Line Reactor and accessories, 3x100, 230 kV Shunt Capacitor Banks and accessories. ▪ *Bolo 500 kV Substation, 4*-500 kV PCBs and associated equipment. *Transmission Components:* ▪ *Bolo–Balingueo 500 kV Transmission Line (Stage 1),* ST-DC, 4-410 mm^2 TACSR, 41 km; ▪ *Balingueo–Balaoan 500 kV Transmission Line (Stage 2),* ST-DC, 4-410 mm^2 TACSR, 89 km; ▪ *Bacnotan–Balaoan 230 kV Transmission Line*, ST-DC, 1-795 MCM ACSR, 11 km; ▪ *Balaoan–Bakun 230 kV Transmission Line*, ST-DC, 1-795 MCM ACSR, 13.7 km; ▪ *Balaoan Bus-in to Bauang–San Esteban 230 kV Transmission Line,* ST-DC, 1-795 MCM ACSR/AS, 2x0.6 km. Bulk Cost Estimate: 17,223 Million Pesos	
Balaoan–Laoag 500 kV Transmission Line	La Union, Ilocos Norte	Apr 2028
	Substation Components: ▪ *Laoag 500 kV Substation (new),* 2x1,000 MVA, 500/230-13.8 kV Power Transformers and accessories, 9-500 kV PCBs and associated equipment, 8-230 kV PCBs and associated equipment, 3x90 MVAR, 500 kV Shunt Reactor and accessories, 2x60 MVAR, 500 kV Line Reactor and accessories; ▪ *Laoag 230 kV Substation,* 2-230 kV PCBs and associated equipment. ▪ *New Bantay 230 kV Substation,* 2x100 MVA, 230/69 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 7-69 kV PCBs and associated equipment;	

Project Name/Driver(s)	Province(s) and Components	ETC
	Transmission Components: ▪ *Balaoan–Laoag 500 kV Transmission Line,* ST-DC, 4-410 mm^2 TACSR/AS, 175 km; ▪ *Laoag 230 kV Tie Line,* ST-DC, 4-795 MCM ACSR/AS, 1 km. ▪ *Bantay Bus-in 230 kV Line,* ST-DC,1-795 MCM ACSR, 2 km Bulk Cost Estimate: 20,808 Million Pesos	
Bolo 5th Bank	Pangasinan	Dec 2028
	Substation Components: ▪ *Bolo 500 kV Substation (Expansion),* 1x600 MVA, 500/230 kV Power Transformer and accessories, 3-500 kV PCBs and associated equipment.	
Pinamucan–Tuy 500 kV Line	Batangas, Laguna	Jan 2029
	Substation Components: ▪ *Pinamucan 500 kV Substation,* 10-500 kV PCBs and associated equipment; ▪ *Tuy 500 kV Substation,* 3-500 kV PCBs and associated equipment. *Transmission Components:* ▪ *Pinamucan–Tuy 500 kV Transmission Line,* ST-DC, 4-795 MCM ACSR/AS, 60.0 km. Bulk Cost Estimate: 4,298 Million Pesos	
Tagkawayan 500 kV Substation	Tagkawayan, Quezon Province	Dec 2028
	Substation Components: ▪ *Tagkawayan 500 kV Substation,* 2x1,000 MVA, 500/230-13.8 kV Power Transformer and Accessories, 2x90 MVAR, 500 kV Shunt Reactor and accessories, 12-500 kV PCBs, 10-230 kV PCBs and associated equipment. ▪ *Pagbilao 500 kV Substation*, 2-500 kV PCBs and associated equipment. ▪ *Tayabas 230 kV Substation*, 14-230 kV PCBs and associated equipment. *Transmission Components:* ▪ *Tagkawayan Bus-in to Pagbilao–Naga 500 kV Line,* ST-DC, 4-795 MCM ACSR/AS, 1 km. Bulk Cost Estimate: 5,128 Million Pesos	
Load Growth		
North Luzon 69 kV Transmission Line Upgrading 1	Ilocos Norte, Benguet, Isabela, Bataan, Nueva Ecija	Mar 2021
	Transmission Components: ▪ *Laoag–Laoag Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 2.29 km. ▪ *La Trinidad–Lamut Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 1 km. ▪ *Santiago–Cordon Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 5.03 km. ▪ *Limay–Mariveles Load-End 69 kV Transmission Line 1*, SP/ST-SC, 1-160mm^2 STACIR, 13.88 km. ▪ *Mariveles–AFAB Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 5 km. ▪ *Cabanatuan–Talavera Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 18 km.	
South Luzon 69 kV Transmission Line Upgrading 1	Batangas	Jun 2021
	Transmission Components: ▪ *Tuy–Nasugbu Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 15 km. ▪ *Calaca–Mataas na Kahoy Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 2.42 km.	
Marilao 500 kV Substation Expansion	Bulacan	Dec 2026
	Substation Components: *Marilao 500 kV Substation,* 1x1,000 MVA, 500/230 kV Power Transformer and accessories, 1-500 kV PCB and associated equipment, 1-230 kV PCB and associated equipment.	

Project Name/Driver(s)	Province(s) and Components	ETC
Taguig EHV Substation Expansion	Metro Manila	Dec 2027
	Substation Components: ▪ *Taguig 500 kV Substation,* 1x1,000 MVA, 500/230 kV Power Transformer and accessories.	
Plaridel 230 kV Substation	Bulacan	Feb 2026
	Substation Components: ▪ *Plaridel 230 kV Substation,* 12-230 kV PCBs and associated equipment, 2x100 MVAR, 230 kV Shunt Capacitor and accessories *Transmission Components:* ▪ *Plaridel 230 kV bus-in Transmission Line,* ST-DC, 2-795 MCM ACSR, 1 km. Bulk Cost Estimate: 1,078 Million Pesos	
Luzon Voltage Improvement Project 6	Pangasinan, Cagayan, Tarlac, Zambales, Bulacan, Laguna, Camarines Sur	Mar 2026
	Substation Components: ▪ *Bautista Load-end Substation,* 3x5 MVAR, 69 kV Capacitor Banks and accessories; 4-69 kV PCBs and associated equipment ▪ *San Jacinto Load-end Substation,* 4x5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment ▪ *Malasiqui Load-end Substation,* 4x5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment ▪ *Tabuk Load-end Substation*, 4x2.5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment ▪ *Moncada Load-end Substation,* 4x5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment ▪ *San Miguel Load-end Substation,* 3x2.5 MVAR, 69 kV Capacitor Banks and accessories; 4-69 kV PCBs and associated equipment ▪ *Libmanan Load-end Substation,* 4x2.5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment ▪ *San Rafael 230 kV Substation*, 2x100 MVAR, 230 kV Capacitor Banks and accessories; 2-230 kV PCBs and associated equipment ▪ *Calamba 230 kV Substation*, 2x100 MVAR, 230 kV Capacitor Banks and accessories; 2-230 kV PCBs and associated equipment Bulk Cost Estimate: 3,049 Million Pesos	
Kawit 230 kV Substation	Cavite	May 2026
	Substation Components: ▪ *Kawit 230 kV Substation,* 2x300 MVA, 230/115 kV Power Transformers and accessories; 2x100 MVAR 230 kV Shunt Capacitor and accessories; 12-230 kV PCBs and associated equipment, 6-115 kV PCBs and associated equipment; ▪ *Las Piñas 230 kV Substation (Expansion),* 4-230 kV PCBs GIS and associated equipment; ▪ *Silang 230 kV Substation,* 4-230 kV PCBs and associated equipment. ▪ *Rosario 115 kV Substation,* 2x100 MVA, 115/34.5 kV Power Transformers and accessories; 8-115 kV PCBs GIS and associated equipment; 10-34.5 kV PCBs GIS and associated equipment *Transmission Components:* ▪ *Silang–Kawit–Las Piñas 230 kV Transmission Line,* 4-795 MCM ACSR, SP-DC, 38 km; ▪ *Kawit–Rosario 115 kV Transmission Line,* 2-795 MCM ACSR, SP/ST-SC, 9 km; Bulk Cost Estimate: 8,807 Million Pesos	
Silang 500 kV Substation	Cavite	Feb 2027
	Substation Components: ▪ *Silang 500 kV Substation,* 2x1,000 MVA, 500/230 kV Power Transformers and accessories, 10-500 kV PCBs and associated equipment, 17-230 kV PCBs and associated equipment, 2x30 MVAR, 500 kV Line Reactor, 3x100 MVAR, 230 kV Shunt Reactor.	

Project Name/Driver(s)	Province(s) and Components	ETC
	Transmission Components: ▪ *Silang 500 kV Bus-in Transmission Line,* 500 kV, ST-DC, 4-795 MCM ACSR, 3 km; ▪ *230 kV Line diversion (initially energized at 230 kV),* 500 kV Transmission Line, ST-DC, 4-410 mm^2 TACSR/AS, 4.5 km; ▪ *Biñan 230 kV Transmission Line diversion,* ST-DC, 4-410 mm^2 TACSR/AS, 4.5 km. Bulk Cost Estimate: 4,148 Million Pesos	
Daraga–Bitano 69 kV Transmission Line	Albay	Jun 2027
	Substation Components: ▪ *Daraga 69 kV Substation,* 2-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Daraga–Bitano 69 kV Transmission Line,* SP-SC, 1-795 MCM ACSR, 6 km; Bulk Estimate: 201 Million Pesos	
Dasol 230 kV Substation	Zambales	Dec 2027
	Substation Components: ▪ *Dasol 230 kV Substation,* 2x100 MVA, 230/69-13.8 kV Power Transformer and accessories, 10-230 kV PCBs and 4-69 kV PCBs and associated equipment. *Transmission Components:* ▪ D*asol Bus-in to Masinloc–Kadampat 230 kV Transmission Line,* ST-DC, 4-795 MCM ACSR/AS, 2 km; ▪ *Dasol–Dasol (PANELCO I) 69 kV Transmission Line,* SP-SC, 1-795 MCM ACSR/AS, 17.7 km; ▪ *Dasol–Sta. Cruz 69 kV Transmission Line,* SP-SC, 1-795 MCM ACSR/AS, 17.3 km; Bulk Cost Estimate: 2,116 Million Pesos	
Magalang 230 kV Substation	Pampanga	Dec 2027
	Substation Components: ▪ *Magalang 230 kV Substation,* 2x300 MVA 230/69 kV Power Transformer and accessories, 8-230 kV PCBs and associated equipment, 8-69 kV PCB and associated equpment *Transmission Components:* ▪ *Magalang 'bus-in' to Concepcion–Mexico 230 kV Transmission Line*, ST-DC, 2-410 mm^2 TACSR/AS, 5 km;	
San Agustin 230 kV Substation	Tarlac	Dec 2027
	Substation Components: ▪ *San Agustin 230 kV Substation,* 2x300 MVA 230/69 kV Power Transformer and accessories, 3x50 MVAR, 230 kV Shunt Capacitor and accessories, 13-230 kV PCBs and associated equipment, 6-69 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.	
Apalit 230 kV Substation	Pampanga	Dec 2027
	Substation Components: ▪ *Apalit 230 kV Substation,* 2x300 MVA 230/69 kV Power Transformer and accessories, 3x100 MVAR, 230 kV Shunt Capacitor and accessories, 13-230 kV PCBs and associated equipment, 8-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Apalit Bus-in to Marilao–Mexico 230 kV Transmission Line*, ST-DC, 4-795 MCM ACSR/AS, 5 km. ▪ *Apalit–Apalit Load-end Substation 69 kV Transmission Line,* SP/ST-SC, 1-410 mm^2 TACSR, 2 km ▪ *Apalit–LINDE 69 kV Transmission Line,* SP/ST-SC, 1-410 mm^2 TACSR, 6 km	

Project Name/Driver(s)	Province(s) and Components	ETC
Valenzuela 230 kV Substation	Metro Manila	Dec 2030
	Substation Components: ▪ *Valenzuela 230 kV Substation,* 3x100 MVAR, 230 kV Shunt Capacitor and accessories, 9-230 kV PCBs and associated equipment; ▪ *Marilao 230 kV Substation,* 2-230 kV PCBs and associated equipment; *Transmission Components:* ▪ *Valenzuela–Marilao 230 kV Transmission Line,* ST-DC, 4-795 MCM ACSR, 8 km	
San Fabian 230 kV Substation	La Union	Mar 2028
	Substation Components: ▪ *San Fabian 230 kV Substation,* 2x100 MVA 230/69 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 4-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *San Fabian Bus-in to Bauang–BPPC–Balingueo 230 kV Transmission Line*, ST-DC, 1-795 MCM ACSR/AS, 3.76 km. ▪ *Bolo–Balingueo 230 kV Transmission Line (Upgrading),* ST-DC, 4-795 MCM ACSR, 40.67 km ▪ *San Fabian (NGCP)–San Fabian (LUELCO) 69 kV Transmission Line,* SP-SC, 1-795 MCM ACSR, 1.36 km ▪ *San Fabian (NGCP)–San Fabian (DECORP) 69 kV Transmission Line,* SP-SC, 1-795 MCM ACSR, 2.4 km Bulk Cost Estimate: 3,096 Million Pesos	
Iriga 230 kV Substation	Camarines Sur	Dec 2028
	Substation Components: ▪ *Iriga 230 kV Substation,* 2x300 MVA, 230/69-13.8 kV Power Transformer and accessories, 3x50 MVAR, 230 kV Shunt Capacitor and accessories, 13-230 kV PCBs and associated equipment, 6-69 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.	
Malvar 230 kV Substation	Batangas	Dec 2028
	Substation Components: ▪ *Malvar 230 kV Substation,* 2x300 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.	
Balanga 230 kV Substation	Bataan	Dec 2028
	Substation Components: ▪ *Balanga 230 kV Substation,* 2x300 MVA 230/69 kV Power Transformer and accessories, 3x100 MVAR, 230 kV Shunt Capacitor and accessories, 13-230 kV PCBs and associated equipment, 6-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Balanga Bus-in to BCCPP B–Hermosa 230 kV Transmission Line*, ST-DC, 2-410 mm^2 TACSR/AS, 2 km. ▪ *Balanga 69 kV Line Extension,* SP/ST-SC, 1-410 mm^2 TACSR, 1 km	
San Isidro 230 kV Substation	Nueva Ecija	Dec 2028
	Substation Components: ▪ *San Isidro 230 kV Substation,* 2x300 MVA 230/69 kV Power Transformer and accessories, 3x50 MVAR, 230 kV Shunt Capacitor and accessories, 13-230	

Project Name/Driver(s)	Province(s) and Components	ETC
	kV PCBs and associated equipment, 6-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *San Isidro Bus-in to Mexico–Cabanatuan 230 kV Transmission Line*, ST-DC, 4-795 MCM ACSR, 2 km. ▪ *San Isidro–Bulualto Load-end Substation 69 kV Transmission Line,* SP/ST-DC, 1-410 mm^2 TACSR, 5 km	
FBGC 230 kV Substation	Metro Manila	Dec 2028
	Substation Components: ▪ *FBGC 230 kV Substation,* 8-230 kV PCBs (GIS) and associated equipment. *Transmission Components:* ▪ *FBGC Cut-in to Taguig–Paco 230 kV Transmission Line*, SP-SC, 2-610 mm^2 TACSR/AS, 2 km. ▪ *Taguig–FBGC 230 kV Transmission Line,* SP-SC, 2-410 mm^2 TACSR/AS, 7.0 km	
Baler 230 kV Substation Project	Nueva Ecija, Aurora	Feb 2029
	Substation Components: ▪ *Baler 230 kV Substation,* 2x100 MVA, 230/69 kV Power Transformer and accessories, 11-230 kV PCB and associated equipment, 4-69 kV PCB and associated equipment, 3x25 MVAR 230 kV Shunt Capacitor and associated equipment, 2x25 MVAR Shunt Reactor and associated equipment. ▪ *Sampaloc 230 kV Subsation,* 2-230 kV PCB and associated equipment. *Transmission Components:* ▪ *Sampaloc–Baler 230 kV Transmission Line,* 2-795 MCM ACSR ST-DC, 57 km. ▪ *Baler (NGCP)–Baler (AURELCO) 69 kV Transmission Line,* 1-795 MCM ACSR SP-DC, 1.78 km. Bulk Cost Estimate: 4,607 Million Pesos	
Guagua 230 kV Substation	Pampanga	Dec 2029
	Substation Components: ▪ *Guagua 230 kV Substation,* 2x300 MVA 230/69 kV Power Transformer and accessories, 3x100 MVAR, 230 kV Shunt Capacitor and accessories, 13-230 kV PCBs and associated equipment, 12-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Guagua Bus-in to Hermosa–Mexico 230 kV Transmission Line*, ST-DC, 4-795 MCM ACSR/AS, 2 km. ▪ *Guagua–SFELAPCO Magdalena 69 kV Transmission Line,* SP/ST-SC, 1-410 mm^2 TACSR, 2 km ▪ *Guagua–Guagua Load-end Substation 69 kV Transmission Line,* SP/ST-SC, 1-410 mm^2 TACSR, 1 km ▪ *Guagua–Manibaug Load-end Substation 69 kV Transmission Line,* SP/ST-SC, 1-410 mm^2 TACSR, 16 km	
San Antonio 500 kV Substation	Zambales	Dec 2030
	Substation Components: ▪ *San Antonio 500 kV Substation,* 2x1000 MVA 230/69 kV Power Transformer and accessories. *Transmission Components:* ▪ *San Antonio–Palauig 500 kV Transmission Line*, ST-DC, 4-795 MCM, 60 km.	
Alaminos EHV Substation	Laguna	Dec 2030
	Substation Components: ▪ *Alaminos EHV Substation,* 2x1,000 MVA, 500/230-13.8 kV Power Transformers and accessories, 14-500 kV PCBs and associated equipment, 10-230 kV PCBs and associated equipment. *Transmission Components:*	

Project Name/Driver(s)	Province(s) and Components	ETC
	▪ *Alaminos Bus-in to Dasmariñas–Ilijan–Tayabas 500 kV Line,* ST-DC, 4-795 MCM, 0.15 km*;* ▪ *Alaminos Bus-in to Makban–Lumban 230 kV Line,* ST-DC, 4-795 MCM, 7 km*;*	
Nuvali 230 kV Substation	Laguna	Dec 2030
	Substation Components: ▪ *Nuvali 230 kV Substation,* 3x100 MVAR, 230 kV Shunt Capacitor and accessories, 13-230 kV PCBs and associated equipment. *Transmission Components:* ▪ *Nuvali 230 kV bus-in Transmission Line,* ST-DC, 2-795 MCM ACSR, 2 km	
Cabatuan 230 kV Substation	Isabela	Dec 2030
	Substation Components: ▪ *Cabatuan 230 kV Substation,* 2x300 MVA 230/69 kV Power Transformer and accessories, 3x50 MVAR, 230 kV Shunt Capacitor and accessories, 13-230 kV PCBs and associated equipment, 8-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Cabatuan Bus-in to Santiago–Gamu 230 kV Transmission Line*, ST-DC, 1-795 MCM ACSR, 2 km. ▪ *Cabatuan–Cabatuan Load-end Substation 69 kV Transmission Line,* SP/ST-SC, 1-795 MCM ACSR, 6.36 km ▪ *Cabatuan–Reina Mercedes Load-end Substation 69 kV Transmission Line,* SP/ST-SC, 1-795 MCM ACSR, 19.59 km ▪ *Cabatuan–Cauayan Load-end Substation 69 kV Transmission Line,* SP/ST-DC, 1-410 mm^2 TACSR, 14.49 km	
System Reliability		
Minuyan 115 kV Switching Station	Bulacan	Feb 2026
	Substation Components: ▪ *Minuyan Switching Station,* 11-115 kV PCBs and associated equipment. *Transmission Components:* ▪ *San Jose 115 kV Transmission Line Extension,* 2-795 MCM ACSR/AS, ST-DC, 0.5 km. ▪ *Angat 115 kV Transmission Line Extension,* 2-795 MCM ACSR/AS, ST-DC, 1 km. Bulk Cost Estimate: 551 Million Pesos	
Taguig–Silang 500 kV Transmission Line	Cavite, Metro Manila	Dec 2027
	Substation Components: ▪ *Silang 500 kV Substation,* 4-500 kV PCBs and associated equipment; *Transmission Components:* ▪ *Taguig–Silang 500 kV Transmission Line,* ST-DC, 4-410mm^2 TACSR, 72 km;	
Marilao–Mexico 230 kV Transmission Line	Pampanga, Bulacan	Aug 2027
	Substation Components: ▪ *Marilao 230 kV Substation,* 4-230 kV PCBs and associated equipment. ▪ *Mexico 230 kV Substation,* 230 kV series reactor, 4-230 kV PCBs and associated equipment. *Transmission Components:* ▪ *Marilao–Mexico 230 kV Transmission Line,* ST-DC, 4-795 MCM ACSR, 42 km. Bulk Cost Estimate: 2,542 Million Pesos	
San Jose–San Rafael 230 kV Transmission Line Upgrading	Bulacan	Oct 2027
	Substation Components: ▪ *San Jose 230 kV Substation,* 2-230 kV PCBs and associated equipment;	

Project Name/Driver(s)	Province(s) and Components	ETC
	▪ *San Rafael 230 kV Substation,* 2-230 kV PCBs and associated equipment. *Transmission Components:* *San Jose–San Rafael 230 kV Transmission Line,* ST-DC, 4-795 MCM ACSR, 31 km.	
Bauang–La Trinidad 230 kV Transmission Line Upgrading	La Union, Benguet	Dec 2027
	Substation Components: ▪ *La Trinidad 230 kV Substation, 9-230 kV PCBs and associated equipment; 3-69 kV PCBs and associated equipment.* *Transmission Components:* ▪ *Bauang–La Trinidad 230 kV Transmission Line,* 4-795 MCM ACSR ST-DC, 35.8 km. Bulk Cost Estimate: 2,393 Million Pesos	
Olongapo 230 kV Substation Upgrading	Zambales	Mar 2028
	Substation Components: ▪ *Olongapo 230 kV Substation*, 1x100 MVA, 230/69 kV Power Transformers and accessories; 8-230 kV PCB (GIS) and associated equipment, 9-69 kV PCB and associated equipment, Primary and Secondary Devices . Bulk Cost Estimate:2,957 Million Pesos	
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.	
Cabanatuan–San Rafael–Mexico 230 kV Transmission Line Upgrading	Nueva Ecija, Pampanga, Bulacan	Apr 2028
	Transmission Components: ▪ *Cabanatuan–San Rafael–Mexico 230 kV Transmission Line,* ST-DC, 4-795 MCM ACSR, 87 km.	
Bauang–Balaoan 230 kV Transmission Line Upgrading	La Union	Dec 2028
	Transmission Components: ▪ *Bauang–Balaoan 230 kV Transmission Line,* ST-DC, 4-795 MCM ACSR, 28 km.	
Hermosa–Mexico 230 kV Transmission Line Upgrading	Bataan, Pampanga	Dec 2028
	Transmission Components: ▪ *Hermosa–Mexico 230 kV Transmission Line,* ST-DC, 4-795 MCM ACSR, 37.65 km.	
Calaca–Salong 230 kV Transmission Line 2	Batangas	Dec 2028
	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, 4 km.	
Baras 500 kV Substation	Rizal	Feb 2029
	Substation Components: ▪ *Baras 500 kV Substation, 2x1,000 MVA, 500/230 kV, 14-500 kV PCBs and associated equipment, 20-230 kV PCBs* ▪ *Antipolo 230 kV Substation, 4-230 kV PCBs and associated equipment* *Transmission Components:* ▪ *Antipolo–Baras 230 kV Line, ST-DC, 4-795 MCM ACSR, 18 km.*	
Pasay–Taguig 230 kV Transmission Line	Metro Manila	Dec 2030
	Transmission Components: *Pasay–Taguig 230 kV Transmission Line,* 2-410 mm^2 TACSR SP-DC, 16 km.	
Navotas–Pasay 230 kV Transmission Line	Metro Manila	Dec 2030
	Transmission Components: ▪ *Navotas–Pasay (Submarine Cable Portion) 230 kV Transmission Line,* SC-DC, 2-200 mm^2 XLPE, 14 km.	

Project Name/Driver(s)	Province(s) and Components	ETC
	▪ *Navotas–Pasay (Overhead Line Portion) 230 kV Transmission Line,* SP-DC, 2-410 mm^2 TACSR/AS, 1.3 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).	
Baras–San Antonio 500 kV Transmission Line	Rizal,	Dec 2030
	Transmission Components: ▪ *Baras–San Antonio 500 kV Transmission Line*, ST-DC, 4-795 MCM, 152 km.	
Baras–Pinamucan 500 kV Transmission Line	Rizal,	Dec 2030
	Transmission Components: ▪ *Baras–Pinamucan 500 kV Transmission Line*, ST-DC, 4-795 MCM, 189 km.	
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.	
Power Quality		
Luzon Voltage Improvement Project 7	Metro Manila, Bulacan, Laguna, Pampanga, Cavite	Dec 2027
	Substation Components: *STATCOM:* ▪ *San Jose 230 kV Substation,* ±450 MVAR, 230 kV STATCOM; 1-230 kV PCB and associated equipment ▪ *Dasmariñas 230 kV Substation,* ±450 MVAR, 230 kV STATCOM; 1-230 kV PCB and associated equipment *Capacitor Banks:* ▪ *Taguig 230 kV Substation, 1x100 MVAR, 230 kV Capacitor Banks and accessories;* ▪ *Marilao 230 kV Substation, 2x100 MVAR, 230 kV Capacitor Banks and accessories;* ▪ *Calamba 230 kV Substation, 2x100 MVAR, 230 kV Capacitor Banks and accessories;* ▪ *Clark 230 kV Substation, 1x100 MVAR, 230 kV Capacitor Banks and accessories;* ▪ *Silang 230 kV Substation, 1x100 MVAR, 230 kV Capacitor Banks and accessories;* ▪ *Concepcion 230 kV Substation, 1x100 MVAR, 230 kV Capacitor Banks and accessories;* ▪ *Tanauan 230 kV Substation, 1x100 MVAR, 230 kV Capacitor Banks and accessories;* ▪ *Magapit 230 kV Substation, 1x25 MVAR, 230 kV Capacitor Banks and accessories;*	

9.3 Proposed Transmission Outlook for 2035

In the period 2031-2035, the development of new delivery substations is still necessary to meet the forecasted increase in demand in the area. These substations are the Sariaya 230 kV Substation in Quezon, Presentacion 230 kV Substation in Camarines Sur, Bustos 230 kV Substation in Bulacan, and San Mateo 230 kV Substation in Rizal.

The transmission corridor in Metro Manila will be further strengthened by upgrading the Taguig–Muntinlupa 230 kV Transmission Line from single circuit to double circuit.

To transmit 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.

Table 9.3: Proposed Luzon Transmission Outlook for 2035

Project Name/Driver(s)	Province(s) and Components
Generation Entry	
Santiago–Kabugao 500 kV Transmission Line	Apayao, Isabela
	Substation Components: ▪ *Kabugao 500 kV Substation, 2x750 MVA, 500/230-13.8 kV Power Transformers 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.* ▪ *Pudtol 230 kV Substation, 4-230 kV PCB and associated equipment.* *Transmission Components:* ▪ *Santiago–Kabugao 500 kV Transmission Line, ST-DC, 4-795 MCM ACSR, 171 km.* ▪ *Kabugao–Pudtol 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR, 23 km.*
Load Growth	
North Luzon Substation Upgrading 3	Ilocos Norte, Benguet, Pangasinan, Isabela, Cagayan, Bataan, Zambales, Tarlac, Pampanga, Nueva Ecija
	Substation Components: ▪ *Laoag 230 kV Substation*, 1x100 MVA 115/69-13.8 kV Power Transformer and associated equipment; ▪ *La Trinidad 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *San Manuel 230 kV Substation (Replacement)*, 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Dasol 230 kV Substation*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Santiago 230 kV Substation (Replacement)*, 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Tuguegarao 230 kV Substation (Replacement)*, 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Lal-lo 230 kV Substation*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Bangui 230 kV Substation*, 2x50 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Hermosa 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Limay 230 kV Substation (Replacement)*, 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Mariveles 230 kV Substation*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Olongapo 230 kV Substation (Replacement)*, 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Botolan 230 kV Substation (Replacement)*, 2x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Concepcion 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Capas 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Mexico 230 kV Substation (Replacement)*, 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Clark 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *San Simon 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment;

Project Name/Driver(s)	Province(s) and Components
	▪ *Porac 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Magalang 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Cabanatuan 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Sampaloc 230 kV Substation*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment;
South Luzon Substation Upgrading 3	Batangas, Albay
	Substation Components: ▪ *Tuy 230 kV Substation*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment ▪ *Tiwi 230 kV Substation (Replacement)*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Pinamucan 230 kV Substation*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment;
North Luzon 69 kV Transmission Line Upgrading 2	Ilocos Sur, Ilocos Norte, Bataan, Zambales, Tarlac
	Transmission Components: ▪ *San Esteban–Candon Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 24.12 km. ▪ *Laoag–San Nicolas Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 6.85 km. ▪ *Hermosa–Calaguiman Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 13.95 km. ▪ *Limay–Alas-asin Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 11.34 km. ▪ *Olongapo–Subic Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 5.06 km. ▪ *Botolan–Iba Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 5.04 km.
South Luzon 69 kV Transmission Line Upgrading 2	Batangas, Camarines Sur, Albay
	Transmission Components: ▪ *Tuy–Balayan Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 11 km. ▪ *Naga–Concepcion Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 4.88 km. ▪ *Daraga–Washington Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 3.66 km. ▪ *Daraga–Ligao Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 21.5 km. ▪ *Tiwi–Malinao Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 8.1 km. ▪ *Naga–Pamplona Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 21.15 km.
San Mateo 230 kV Substation	Metro Manila
	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.
Bustos 230 kV Substation	Bulacan
	Substation Components: ▪ *Bustos 230 kV Substation,* 10-230 kV PCBs and associated equipment *Transmission Components:* ▪ *Bustos Bus-in to San Rafael–San Jose 230 kV Transmission Line*, ST-DC, 4-795 MCM ACSR, 3 km.

Project Name/Driver(s)	Province(s) and Components
Sariaya 230 kV Substation	Quezon
	Substation Components: ▪ *Sariaya 230 kV Substation,* 2x100 MVA, 230/69 kV Power Transformers and accessories, 2x100 MVAR, 230 kV Shunt Capacitor and accessories, 12-230 kV PCBs and associated equipment, 6-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Malvar–Sariaya–Pagbilao 230 kV Transmission Line*, ST-DC, 2-410 mm^2 TACSR/AS, 70 km.
Presentacion 230 kV Substation	Camarines Sur
	Substation Components: ▪ *Naga 230 kV Substation,* 4-230 kV PCBs and associated equipment; ▪ *Presentacion 230 kV Substation,* 2x50 MVA 230/69 kV Power Transformers and accessories, 3x25 MVAR, 230 kV Shunt Capacitor and accessories, 9-230 kV PCBs and associated equipment, 3-69 kV PCBs and associated equipment.
Bacolor 500 kV Substation	Pampanga
	Substation Components: ▪ *Bacolor 500 kV Substation,* 2x1000 MVA 500/230 kV Power Transformers and accessories *Transmission Components:* ▪ *Bacolor Bus-in to Hermosa–Duhat 500 kV Transmission Line*, ST-DC, 4-795 MCM ACSR, 1 km. ▪ *Bacolor Bus-in to Mexico–Guagua 230 kV Transmission Line*, ST-DC, 4-795 MCM ACSR, 1 km.
Dasmariñas 500 kV Substation Upgrading	Cavite
	Substation Components: *Dasmariñas 500 kV Substation (Replacement)*, 4x1000 MVA 500/230 kV Power Transformer and associated equipment;
System Reliability	
Taguig–Muntinlupa 230 kV Transmission Line 2	Metro Manila
	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.

9.4 Proposed Transmission Outlook for 2040

From year 2035 to 2040, most of the projects will be focusing on the reliability of the transmission network. On the 500 kV network, the Bataan–Cavite 500 kV Transmission Line will be implemented. In the northern part of Luzon Grid, transmission backbone for the province of Aurora will be developed through the Baler–Dinadiawan–Santiago 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 Kalinga 500 kV Substation will be developed 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.

Table 9.4: Proposed Luzon Transmission Outlook for 2040

Project Name/Driver(s)	Province(s) and Components
Generation Entry	
Matnog 230 kV Substation	Sorsogon
	Substation Components: ▪ *Matnog 230 kV Substation,* 2x50 MVA, 230/69 kV Power Transformer and accessories, 3x25 MVAR, 230 kV Shunt Capacitor and accessories, 9-230 kV PCBs and associated equipment; ▪ Abuyog *230 kV Substation,* 4-230 kV PCB and associated equipment. *Transmission Components:* ▪ *Abuyog–Matnog 230 kV,* ST-DC, 2-795 MCM ACSR, 38 km.
Kalinga 500 kV Substation	Kalinga
	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 ▪ *Tuguegarao 230 kV Substation,* 4-230 kV PCBs and associated equipment *Transmission Components:* ▪ *Kalinga 500 kV bus-in Transmission Line,* ST-DC, 4-795 MCM ACSR, 2 km.
Load Growth	
North Luzon Substation Upgrading 4	Pangasinan, Cagayan, Zambales, Pampanga, Nueva Ecija
	Substation Components: ▪ *Labrador 230 kV Substation (Replacement)*, 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Balingueo 230 kV Substation (Replacement)*, 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Bayombong 230 kV Substation (Replacement)*, 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Tuguegarao 230 kV Substation (Replacement)*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Olongapo 230 kV Substation (Replacement)*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Porac 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Magalang 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *San Simon 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Cabanatuan 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Sampaloc 230 kV Substation*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment;
South Luzon Substation Upgrading 4	Batangas, Camarines Sur, Albay, Sorsogon
	Substation Components: ▪ *Malvar 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Naga 230 kV Substation*, 1x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Daraga 230 kV Substation (Replacement)*, 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; ▪ *Abuyog 230 kV Substation*, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment;
System Reliability	
Sagada–San Esteban 230 kV Transmission Line	Mountain Province, Ilocos Sur
	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:*

Project Name/Driver(s)	Province(s) and Components
	▪ *Sagada–San Esteban 230 kV Transmission Line,* ST-DC, 2-795 MCM ACSR, 60 km.
Dinadiawan–Santiago 230 kV Transmission Line	Isabela, Aurora
	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
	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
	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 500 kV Transmission Line	Bataan, Cavite
	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.
Upgrading of Bicol Transmission Facilities	Camarines Sur, Albay, Sorsogon
	Transmission Components: *Naga–Daraga–BacMan 500 kV Transmission Line,* ST-DC, 4-795 MCM ACSR/AS, 120 km. (initially energized at 230 kV)

Chapter 10 - Visayas Transmission Outlook

In addition to the projects presented in Chapter 8 which are on various stages of implementation, this section will provides 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.

With 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 8, 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 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. 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 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 that is for implementation is the Cebu–Bohol 230 kV Interconnection Project. Presently, Bohol Island has power deficiency issue due to limited power sources in the island. In 2019, the maximum demand in Bohol reached 91 MW. By 2021, even when all diesel power plants are utilized in Bohol Island, the Leyte–Bohol 138 kV submarine cable is expected to be overloaded. The implementation of Cebu–Bohol 230 kV 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 Cebu–Bohol 230 kV Interconnection Project.

10.1 Proposed Transmission Projects up to 2025

Shown in Table 10.1 is the list of transmission projects planned for Visayas in the period 2021-2025 in addition to the projects already approved by the ERC.

Table 10.1: Proposed Transmission Projects for Visayas

Project Name/Driver(s)	Province(s)	ETC
Generation Entry		
Cebu–Negros–Panay 230 kV Backbone Project – Stage 2	Cebu	Dec 2021
	Substation Components: ▪ *Cebu 230 kV Substation*, 3x300 MVA 230/138 kV Power Transformer and accessories, 8-230 kV PCBs (GIS) and 3-138 kV PCB and associated equipment. ▪ *Construction of Warehouse* *Transmission Components:* ▪ *Extension of Magdugo–Cebu 230 kV Lines*, ST/SP-DC, 2-610 mm^2 TACSR OHTL, 0.75 km; ▪ *Extension of Cebu–Lapulapu 230 kV Lines, Underground Cable System*, Double Circuit of 1200 MW Capacity, 0.425 km and 2-410 mm^2 STACIR, ST/SP-DC, 0.150 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: 3,329 million Pesos	
Panay–Guimaras 138 kV Interconnection Project	Panay	Oct 2022
	Substation Components: ▪ *Iloilo S/S,* 3x100 MVA, 138/69-13.8 kV Power Transformers and accessories, 2-138 kV PCBs, 10-69 kV PCBs (GIS) and associated equipment; ▪ *Buenavista S/S,* 1x100 MVA, 138/69-13.8 kV Power Transformers and accessories, 6-138 kV PCBs (GIS), 4-69 kV PCBs and associated equipment; ▪ *Transfer of existing 1x100 MVA* 138/69-13.8 kV Power Transformer from Iloilo S/S to Buenavista S/S *Transmission Components:* ▪ *Iloilo–Ingore 138 kV T/L*, ST-DC, 1-795 MCM ACSR, 2 km. ▪ *Sawang–Buenavista 138 kV T/L,* ST-DC, 1-795 MCM ACSR, 1 km. ▪ *Zaldivar bypass line,* 0.7 km, 69 kV, 1-336.4 MCM ACSR, ST-SC ▪ *PECO Baldoza 69 kV line Transfer*, 0.07 km, 1-336.4 MCM ACSR, SP-SC ▪ *PPC & PECO 69 kV line Transfer,* 0.09 km, 69 kV, 1-336.4 MCM ACSR, SP-SC ▪ *Banuyao 69 kV line Transfer*, 0.8 km, 69 kV, 1-336.4 MCM ACSR, SP-SC ▪ Extension of Sta. Barbara–Iloilo 138 kV Line, two circuits of 138 kV U/C of 400 MW-capacity, 0.15 km; ▪ *Iloilo 69 kV Underground Cables four circuits of 100 MW-capacity*, 0.25 km; ▪ *Extension of Iloilo–Ingore 138 kV Line*, two circuits of 138 kV U/C of 200 MW-capacity, 0.15 km; ▪ *Buenavista 138 kV U/C two circuits of 200 MW-capacity*, 0.15 km. Bulk Cost Estimate: 2,419 million Pesos	
Negros–Panay 230 kV Interconnection Line 2 Project	Negros and Panay	Mar 2023
	Substation Components: ▪ *Barotac Viejo Substation (Expansion)*, 1x70 MVAR, 230 kV Line reactor, 2-230 kV PCBs and associated equipment, associated submarine cable termination equipment; ▪ *E.B. Magalona Substation (Expansion),* 1x70 MVAR, 230 kV Line reactor, 3-230 kV PCB and associated equipment. *Submarine Cable Components:* ▪ *Barotac CTS–Barotac Viejo S/S*, 230 kV, Single Circuit, 1-1,600 mm^2 XLPE Underground Cable, 0.75 km; ▪ *Barotac Viejo–E. B. Magalona*, 230 kV, Single Circuit, 3-1,600 mm^2 XLPE Submarine Cable, 22 km. Bulk Cost Estimate: 8,293 million Pesos	

Project Name/Driver(s)	Province(s)	ETC
Load Growth		
Nabas–Caticlan–Boracay Transmission Line Project	Aklan	Jun 2022
	<u>*Substation Components:*</u> ▪ *Boracay 138 kV GIS S/S (New),* 2x100 MVA 138/69-13.8 kV Power Transformers and accessories, 5-138 kV PCBs (GIS), 6-69 kV PCBs (GIS) and associated equipment; ▪ *Nabas 138 kV Substation (Expansion)*, 4-138 kV PCB and associated equipment. <u>*Submarine Cable Components:*</u> ▪ *Caticlan–Boracay S/C*, Submarine Cable System, Double circuit of 100 MW capacity at 138 kV, 2.1 km; ▪ *Caticlan CTS (New)*, Cable Sealing End. <u>*Transmission Components:*</u> ▪ *Nabas–Unidos 230 kV Transmission Line* (Initially energized at 138 kV), 230 kV, ST/SP-DC, 4-795 MCM ACSR, 15.9 km. ▪ *Unidos–Caticlan 138 kV T/L, ST-DC, 138 kV, 1-795 MCM ACSR, 1.4 km;* ▪ *Caticlan 138 kV U/G, Double circuit, 138 kV Underground Cable System of 180 MW capacity per circuit, 4.5 km.* ▪ *Manocmanoc–Boracay Tie Line*, 69 kV, SP-SC, 1-336.4 MCM ACSR, 0.375 km; Bulk Cost Estimate: 5,484 million Pesos	
Cebu–Bohol 230 kV Interconnection Project	Cebu, Bohol	Sep 2022
	<u>*Substation Components:*</u> ▪ *Dumanjug 230 kV S/S,* 2x70 MVAR 230 kV line reactors, 4-230 kV PCBs and associated equipment; ▪ *Corella 230 kV S/S,* 2x300 MVA, 230/138-13.8 kV Power Transformers and accessories, 2x70 MVAR 230 kV line reactors, 8-230 kV PCBs, 5-138 kV PCBs and associated equipment. ▪ *Argao CTS (with provision to be SWS)* ▪ *Maribojoc CTS (with provision to be SWS)* <u>*Transmission Components:*</u> ▪ *Dumanjug–Argao T/L,* 230 kV, ST-DC, 4-795 MCM ACSR, 28 km; ▪ *Maribojoc–Corella T/L,* 230 kV, ST-DC, 4-795 MCM ACSR, 22 km. <u>*Submarine Cable Components:*</u> ▪ *Argao–Maribojoc 230 kV S/C*, Double circuit submarine cable system with transfer capacity of 600 MW at 230 kV, 30 km. (with provision for 3rd circuit) Bulk Cost Estimate: 19,762 million Pesos	
Banga 138 kV Substation Project	*Panay*	Dec 2024
	<u>*Substation Components:*</u> ▪ *Banga 138 kV S/S, 2*x100 MVA, 138/69-13.8 kV Power Transformer and accessories, 10-138 kV PCBs, 5-69 kV PCBs and associated equipment. <u>*Transmission Components:*</u> ▪ *Bus-in of Banga Substation to Panitan–Nabas T/L,* 138 kV Transmission Line, ST-DC, 1-795 MCM ACSR, 1 km. ▪ *Banga Cut-in 69 kV Cut-in Line,* SP-DC, 1-336.4 MCM ACSR, 1 km Bulk Cost Estimate: 982 million Pesos	
Amlan–Dumaguete 138 kV Transmission Project	Negros Oriental	Feb 2025
	<u>*Substation Components:*</u> ▪ *Amlan 138 kV S/S,* 3-138 kV PCBs and associated equipment; ▪ *Dumaguete 138 kV S/S (New),* 2x100 MVA, 138/69-13.8 kV Power Transformer and accessories, 6-138 kV PCBs, 4-69 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: 2,483 million Pesos	
Babatngon–Palo 230 kV Transmission Line	Southern Leyte	Oct 2025
	<u>*Substation Components:*</u> ▪ *Babatngon 138 kV S/S,* 3-138 kV PCBs and associated equipment;	

Project Name/Driver(s)	Province(s)	ETC
Project (Initially energized at 138 kV)	▪ *Palo 138 kV S/S (New), 3*x100 MVA, 138/69-13.8 kV Power Transformer and accessories, 8-230 kV PCBs, 9-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Babatngon–Palo 230 kV T/L (138 kV energized),* ST-DC, 4-795 MCM ACSR, 20 km. ▪ *Palo Cut-in Line,* 69 kV T/L, SP-DC, 1-336.4 MCM ACSR, 2 km. Bulk Cost Estimate: 3,044 million Pesos	
System Reliability		
Permanent Restoration of Panit-an–Nabas 138 kV Line affected by Typhoon Ursula	Panay	May 2021
	Transmission Components: Stage 1: Permanent Restoration of Toppled Towers *Panit-an-Nabas Transmission Line,* 1-795 MCM ACSR, 138 kV, ST-DC1, 14 toppled towers; Stage 2: Replacement/Upgrading of 4 Tower Adjacent to the Toppled Towers ▪ *Panit-an-Nabas Transmission Line,* 1-795 MCM ACSR, 138 kV, ST-DC1, 4 toppled towers; Bulk Cost Estimate: 317 million Pesos	
Permanent Restoration of Colon–Samboan 138 kV Lines 1 and 2 affected by Landslide	Colon, Cebu	Jun 2021
	Transmission Components: ▪ *Colon-Samboan Line 1,* 1-795 MCM ACSR, 138 kV, ST-DC1, 8km, 26 rerouted towers, 8 km; ▪ *Colon-Samboan Line 2,* 1-795 MCM ACSR, 138 kV, ST-DC1, 8km, 21 rerouted towers, 8 km; ▪ *Colon-Samboan Lines 1 and 2 (Common Tower),* 138 kV, ST-DC, 3 rerouted towers. Bulk Cost Estimate: 538 million Pesos	
Visayas Substation Upgrading Project 1	Cebu, Leyte, Samar	Nov 2021
	Substation Components: Cebu: ▪ *Daanbantayan S/S,* 150 MVA 230/69-13.8 kV Power Transformer and accessories, 1-230 kV PCB, 3-69 kV PCBs and associated equipment. Leyte: ▪ *Tabango S/S,* 50 MVA 230/69-13.8 kV Power Transformer and accessories, 1-230 kV PCB, 2-69 kV PCBs and associated equipment; ▪ *Maasin S/S,* 50 MVA 138/69-13.8 kV Power Transformer and accessories; Samar: ▪ *Calbayog S/S,* 50 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV PCB, 2-69 kV PCBs and associated equipment. Bulk Cost Estimate: 1,187 million Pesos	
Lapu-lapu 230 kV Substation Project	Lapu-lapu, Cebu	Dec 2022
	Substation Components: ▪ *Pusok 230 kV GIS S/S (New),* 2x300 MVA 230/69-13.8 kV Power Transformers and accessories, 8-230 kV PCB (GIS), 10-69 kV PCB (GIS) and associated equipment. *Submarine cable Components:* ▪ *Umapad–Pusok 230 kV S/C,* 600 MW per circuit, Double circuit, 2.1 km. Bulk Cost Estimate: 4,356 million Pesos	
Visayas Substation Upgrading Project 2	Cebu, Negros, Panay, Leyte	Mar 2023
	Substation Components: Leyte: ▪ *Isabel S/S,* 1x50 MVA 138/69-13.8 kV Power Transformer and accessories (1x50 MVA transformer transferred from Calong-calong Substation), 3-138 kV PCBs, 2-69 kV PCBs and associated equipment. (Additional), 10-138 kV PCBs, 2-69 kV PCBs and associated equipment. (Replacement), Centralized Control Building, Full upgrading of secondary devices;	

Project Name/Driver(s)	Province(s)	ETC
	▪ Tabango S/S, 1x50 MVA 230/69-13.8 kV Power Transformer and accessories, 6-230 kV PCBs, 4-69 kV PCBs and associated equipment, Centralized Control Building, Full upgrading of secondary devices; ▪ Maasin S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 5-138 kV PCBs, 9-69 kV PCBs and associated equipment, Expansion of Control Room; *Samar:* ▪ *Paranas S/S,* 2x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 30 MVA and 50 MVA transformers), 7-69 kV PCBs and associated equipment, Centralized Control Building, Full upgrading of secondary devices, and Transfer of 50 MVA Transformer to San Isidro S/S; ▪ *Calbayog S/S,* 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 5-138 kV PCB, 8-69 kV PCBs and associated equipment, Full upgrading of secondary devices, Centralized Control Building. Cebu: ▪ *Calong-calong S/S,* 3x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 2x50 MVA transformers), 3-138 kV PCBs,12-69 kV PCBs and associated equipment, Transfer of 2x50 MVA transformers to Isabel and San Isidro S/S, Full upgrading of secondary devices, Dismantling of existing 69 kV Switchyard, and Calong-calong 69 kV feeder line extensions; ▪ *Compostela S/S,* 2x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 2x50 MVA transformers), 2-230 kV PCBs, 3-69 kV PCBs and associated equipment, and Relocation of Warehouse; ▪ *Samboan S/S,* 4-138 kV PCB, *3*-69 kV PCBs and Associated equipment, Centralized Control Building, and Full upgrading of secondary devices; ▪ *Toledo S/S,* 3x100 MVA 138/34.5-13.8 kV Power Transformer and accessories (Replacement of 3x40 MVA transformers), 1-138 kV PCBs and associated equipment (Replacement), Transfer of termination of various transmission lines, and Centralized Control Building; ▪ *Daanbantayan S/S,* 1x150 MVA 230/69-13.8 kV Power Transformer and accessories, 3-69 kV PCB and associated equipment, Centralized Control Building; *Bohol:* ▪ *Ubay S/S,* 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 7-138 kV PCBs, 13-69 kV PCBs and associated equipment, Centralized Control Building, and transfer of Capacitor Bank from Trinidad 69 kV LES and 69 kV line extensions; ▪ *Corella S/S,* 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs, 9-69 kV PCBs and associated equipment and 69 kV line extensions. Negros: ▪ *Kabankalan S/S,* 2x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 30 and 50 MVA Transformers), 2-138 kV PCBs, 2-69 kV PCBs and associated equipment, Centralized Control Building and Telecom Shelter, Kabankalan–Overflow 69 kV Line Extension, and Full upgrading of secondary devices; ▪ *Mabinay S/S,* 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs, 4-69 kV PCBs and associated equipment, Centralized Control Building, and Full upgrading of secondary devices; Panay: ▪ *San Jose S/S,* 2x50 MVA 138/69-13.8 kV Power Transformer and accessories, 6-138 kV PCBs, 4-69 kV PCBs and associated equipment, Expansion of Control Building; ▪ *Panitan S/S,* 3x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 2x30 and 50 MVA transformers), 4-138 kV PCBs, 13-69 kV PCBs and associated equipment, Centralized Control Building and Container Van and Dismantling of existing 69 kV Switchyard; ▪ *Dingle S/S,* 2x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 2x50 MVA Transformers), 3-138 kV PCBs, 3-69 kV PCBs and	

Project Name/Driver(s)	Province(s)	ETC
	associated equipment, Centralized Control Building and Telecom Shelter, and Full upgrading of secondary devices; ▪ *Concepcion S/S,* 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Barotac Viejo S/S,* 50 MVA 138/69-13.8 kV Power Transformer and accessories (50 MVA Transformer transferred from Iloilo Substation), 2-138 kV PCBs, 1-69 kV PCBs and associated equipment; ▪ *Sta. Barbara S/S,* 1x75 MVA 138/69-13.8 kV Power Transformer and accessories. (Spare), 2-138 kV PCBs, 1-69 kV PCBs and associated equipment. Bulk Cost Estimate: 18,706 million Pesos	
Barotac Viejo–Natividad 69 kV Transmission Line Project	Iloilo	Oct 2023
	Substation Components: ▪ *Natividad LES,* 3-69 kV Air-break Switches. *Transmission Components:* ▪ *Barotac Viejo–Natividad 69 kV T/L,* SP-SC, 1-336.4 MCM ACSR, 7km. Bulk Cost Estimate: 58 million Pesos	
Upgrading of acquired Transmission Assets	Cebu and Panay	Dec 2023
	Substation Components: ▪ *CEDC 138kV S/S*, new separate control building, upgrading of various disconnect switches, telecom requirements, automation system and other accessories; ▪ *TPC CARCON 34.5 kV S/S*, new separate control building, upgrading of various protective devices and other accessories; ▪ *TPC 2nd Lift 34.5 kV S/S*, new separate control building, upgrading of various protective devices, telecom requirements and other accessories; ▪ *TPC SANGI 34.5 kV Switchyard*, new separate control building, upgrading of various protective devices, telecom requirements and other accessories.	
Calbayog–Allen 138 kV Transmission Line Project	Samar, Northern Samar	Nov 2025
	Substation Components: ▪ *Calbayog S/S,* 2-69 kV PCBs and associated equipment. ▪ *Allen and Bobon LES,* 1-138 kV and 2-69 kV Air-break Switches. ▪ *San Isidro S/S,* 2x50 MVA 138/69 kV Power Transformer and accessories (2x50 MVA transformer from Paranas S/S and Calong-calong S/S), 11-138 kV PCBs, 5-69 kV PCBs and associated equipment; *Transmission Components:* ▪ *Calbayog–San Isidro 138 kV T/L,* ST-DC, 1-795 MCM ACSR, 58 km; ▪ *San Isidro–Allen 69 kV T/L,* SP-SC, 1-336.4 MCM ACSR, 20 km. Bulk Cost Estimate: 944 million Pesos	

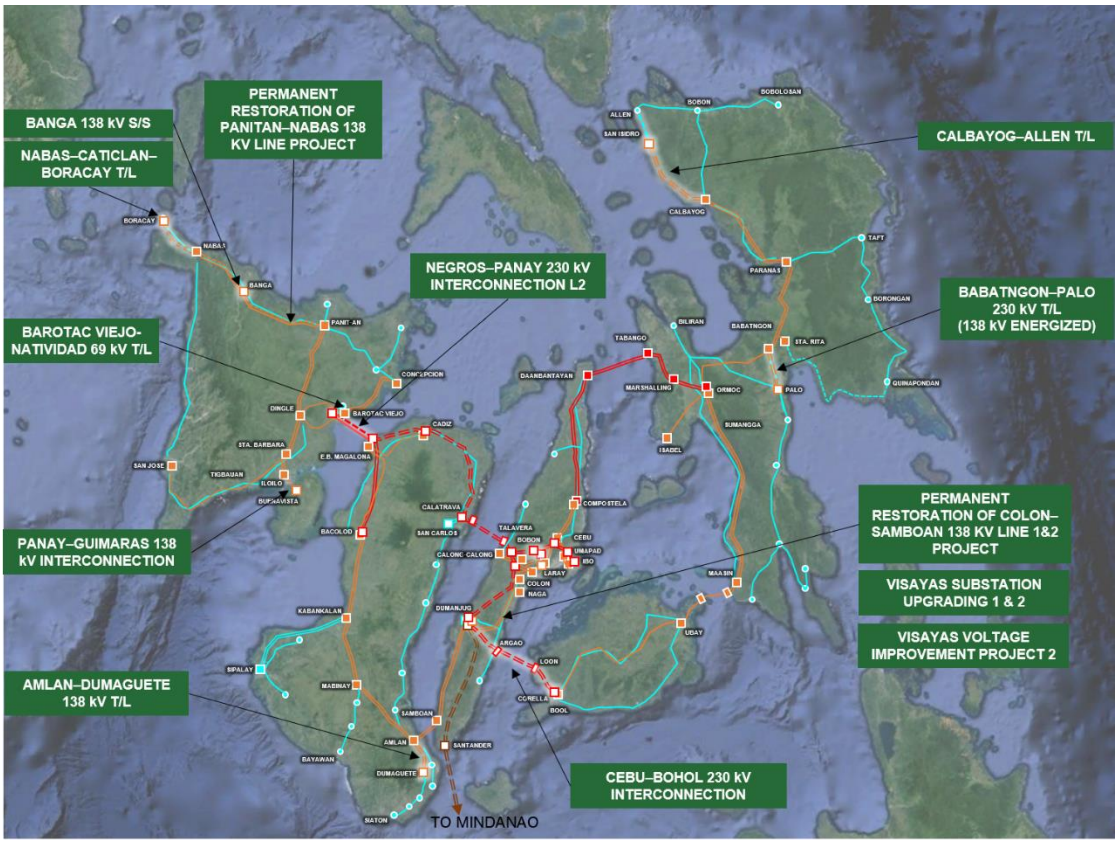
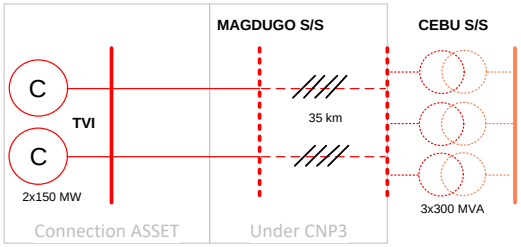


Figure 10.1: Proposed Visayas Transmission Outlook for 2025



Figure 10.2: Proposed Metro Cebu Transmission Outlook for 2025

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

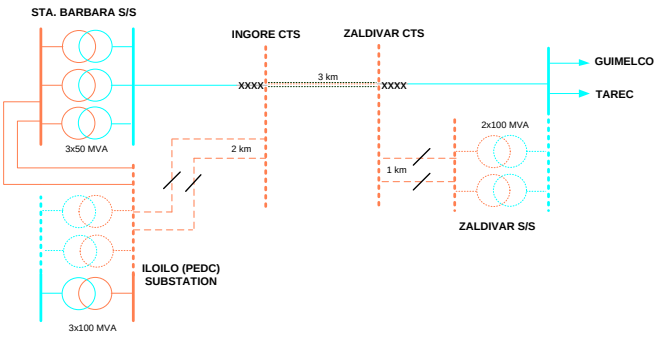


Therma Visayas, Inc. is developing a 300 MW coal-fired power plant in Toledo City, Cebu and is intended to supply additional power to the load centers in Metro Cebu. However, the existing transmission system between the area of Toledo and the major drawdown substations in Metro Cebu has limited capacity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

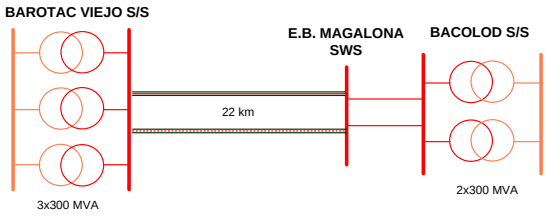
10.1.2 Panay–Guimaras 138 kV Interconnection Project



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.

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 transmission line from the cable terminal station in Ingore towards Iloilo Substation, as well as the expansion and upgrading works at Zaldivar Substation and Iloilo Substation.

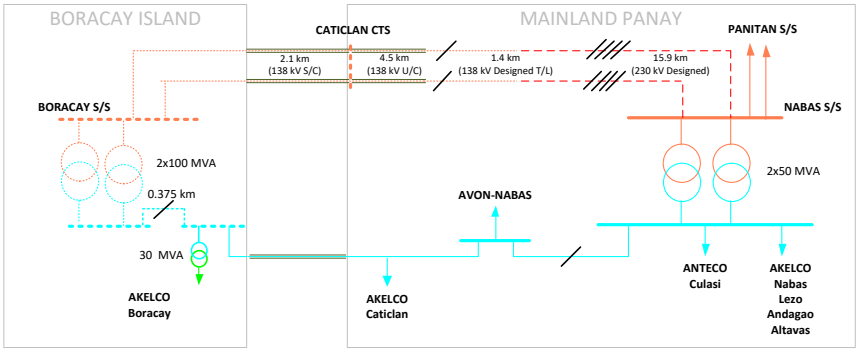
10.1.3 Negros–Panay 230 kV Interconnection Line 2 Project



The project aims to address the need to increase the interconnection capacity between Negros and Panay to cater the incoming large generators in Panay, particularly the 300 MW Aklan Pump Storage Hydro Power Plant. 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.

10.1.4 Nabas–Caticlan–Boracay Transmission Line Project

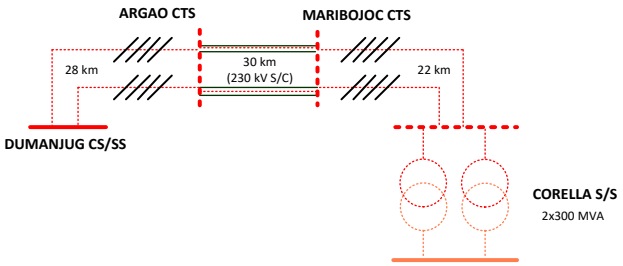


In line with the developments in the tourism industry in Boracay Island, the power requirement is expected to increase. The power requirement of Caticlan and Boracay Island is currently supplied by Nabas Substation via a single circuit 69 kV overhead transmission line and submarine cable. These 69 kV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

The project will 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 Substation, 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 230 kV OHTL which will be initially energized at 138 kV, 138 kV underground cable in Caticlan and installation of 2x100 MVA 138/69 kV power transformer in Boracay Substation.

The submarine cable from Boracay to Caticlan was changed from single to double circuit submarine cable for outright compliance with the N-1 provision. The 69/13.8 kV Transformers are removed from the project components since it will now be implemented by AKELCO.

10.1.5 Cebu–Bohol 230 kV Interconnection Project

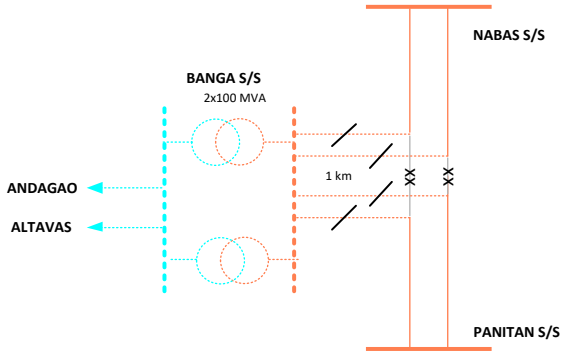


Currently, Cebu, Leyte and Bohol are connected radially which are prone to isolations. By 2021, even when all the diesel power plants in Bohol are dispatched at full capacity, the Leyte–Bohol 138 kV submarine cable will be overloaded which could result in load curtailment in the said island. With the 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 backbone towards Bohol.

The project involves laying of outright double circuit 230 kV submarine cable with 600 MW capacity per circuit with provision for a 3rd circuit between Cebu and Bohol, construction of 230 kV double circuit overhead transmission line, development of a 230 kV switchyard in the existing Corella Substation and the expansion of the proposed Dumanjug 230 kV Substation under the Mindanao–Visayas Interconnection Project (MVIP).

10.1.6 Banga 138 kV Substation Project

Power consumers in Northern Panay draw power from Nabas and some from Panit-an 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.

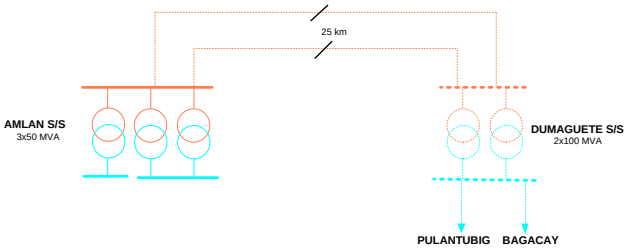


The project provides alternative connection point to power consumers particularly for Northern Panay, thus, will accommodate the projected increase in the power demand.

The new substation will bus-in to the Panit-an–Nabas 138 kV Transmission Line and will be located in Banga, Panay.

10.1.7 Amlan–Dumaguete 138 kV Transmission Project

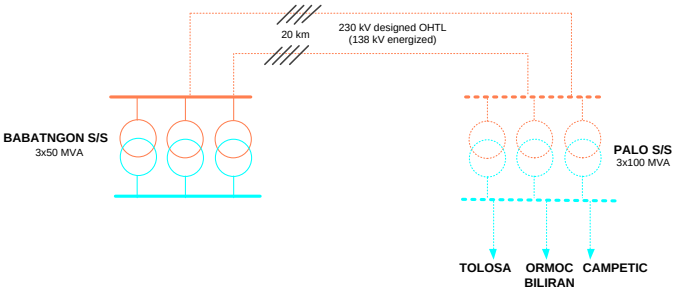
The power requirement in the southern part of Negros Oriental is being served by 69 kV line which draws power from Amlan Substation. However, the 69 kV line will not be sufficient to cater the projected increase in the power demand in the area.



To accommodate the future power requirement in the southern part of Negros Oriental, a new drawdown substation is proposed near 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 Substation via 138 kV transmission line.

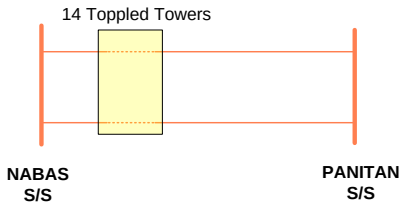
10.1.8 Babatngon–Palo 230 kV Transmission Line Project (Initially energized at 138 kV)

Large part of the power customers in the eastern Leyte area is being served through 69 kV lines which draw power from Babatngon Substation and Ormoc Substation in the north and Maasin Substation 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.



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 Substation 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 Kananga–Babatngon and Palo–Javier 230 kV Transmission Lines.



10.1.9 Permanent Restoration of Panit-an–Nabas 138 kV Line Affected by Typhoon Ursula Project

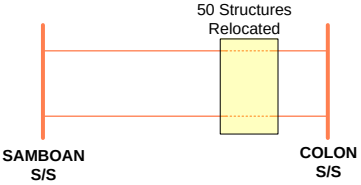
In year 2019, Typhoon Ursula devastated many areas in the Visayas and Mindoro Island. The typhoon made a landfall in Panay Island on 25 December 2019 which damaged the portion of the Panitan-Nabas 138 kV Transmission Line. A total of 14 steel tower structures were toppled along the Panitan-Nabas 138 kV Transmission Line –2 in Nabas and 12 in Ibajay both in Aklan province. All the toppled towers are original towers energized in 2011 with wind velocity design of 240 kph.

The Permanent Restoration of Panitan-Nabas 138 kV Line Affected by Typhoon Ursula is a system reliability project that aims to permanently restore the portion of the 138 kV transmission line that were toppled during the occurrence of Typhoon Ursula last 25 December 2019. The said transmission line serves Aklan Electric Cooperative, Inc. (AKELCO), Antique Electric Cooperative, Inc (ANTECO), Avon-Nabas Diesel Power Plant of Global Business Power Corporation and Nabas Wind of PetroWind Energy Inc. This project will ensure the reliability and integrity of the Panitan-Nabas 138 kV Line to avoid load and generation curtailment.

The project involves the construction of 18 steel tower structures along the Panitan-Nabas 138 kV Line. The 14 steel towers immediately toppled during the aftermath of Typhoon Ursula, and four adjacent towers also need replacement to further strengthen the line. These 18 towers will be designed to withstand 270 kph wind velocity. The project consists of two stages: (1) The replacement of the 14 steel tower structures that were toppled by the typhoon. (2) The replacement of four towers adjacent to the toppled towers. The ERS will be dismantled and retrieved for future emergencies.

10.1.10 Permanent Restoration of Colon–Samboan 138 kV Lines 1 and 2 Affected by Landslide Project

The fatal landslide that struck Brgy. Tina-an, City of Naga, Cebu on 20 September 2018 was a result of a natural phenomenon and man-made actions.



The portion of mountainous areas of the Tina-an, City of Naga, Cebu, where located the Colon-Samboan 138 kV Lines 1 and 2 are within the declared danger zone of MGB of the Department of Environmental and Natural Resources (DENR) hindering maintenance

and construction activities in the affected transmission line. Moreover, in the event of recurrence of landslide and ground movements, toppling of the structures will affect the stability of the grid.

The project includes the rerouting of the portion of Colon-Samboan 138 kV Line 1 and 2 affected by the landslide. This will avoid the 1 km danger zone declared by Mines and Geosciences Bureau (MGB).

10.1.11 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 1x50 MVA. This will provide N-1 provision on the said substation.

To accommodate the proposed 100 MW CEKO Solar Power Plant and the increase in demand in the area, there is a need to upgrade the substation capacity in Daanbantayan Substation to 1x150 MVA.

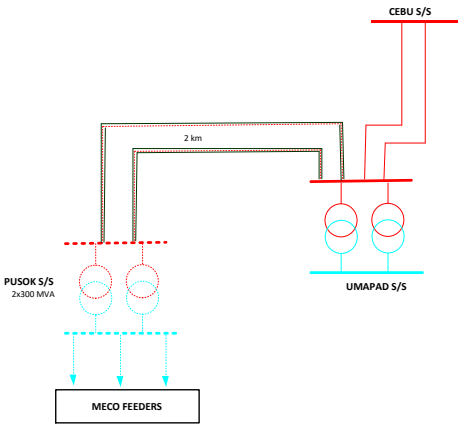
To comply with the N-1 contingency criterion of the PGC, an additional 1x50 MVA transformer needs to be installed at Maasin and Calbayog Substations.

10.1.12 Lapu-lapu 230 kV Substation Project

Power consumers in Mactan Island currently draws power from Lapu-lapu 138 kV 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 provides an alternative connection point to power consumers particularly for Mactan Island, thus, will accommodate the projected increase in the power demand.

The new substation will be connected to Umapad 230 kV Substation and will be located in Lapu-lapu, Cebu.

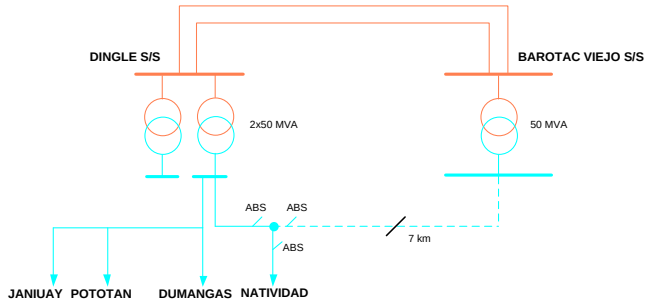


10.1.13 Visayas Substation Upgrading Project 2

The project involves the upgrading of 20 substations in the Visayas by installing an additional 850 MVA transformer capacity and replacing the existing transformers with a total of 1,600 MVA higher capacity transformers to cater the load growth in the area and to provide N-1 contingency to the substations. Replaced transformers will be either redeployed to other substations or refurbished.

10.1.14 Barotac Viejo–Natividad 69 kV Transmission Line Project

This project extends 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.

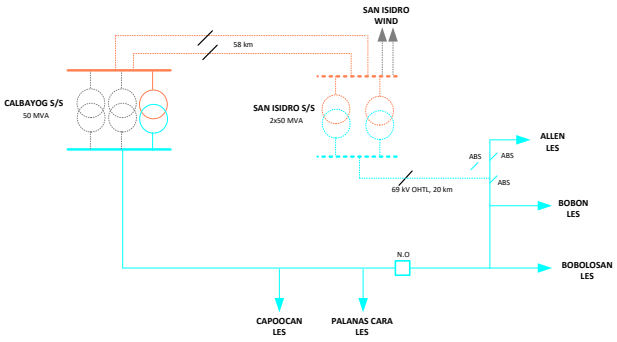


10.1.15 Upgrading of Acquired Transmission Assets

Assets of generating companies that are classified by the ERC as transmission assets shall be maintained and operated by the TNP. The project involves replacement and upgrading of acquired primary and secondary equipment, which are already old, obsolete and not compliant with the TNP standards. A new separate control building will be constructed to ensure safety and improved operational efficiency.

10.1.16 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 and accommodate the load growth and power plant in the northern part of Samar, a 138 kV transmission line traversing northern Samar up to the new substation which is located in San Isidro which will cater the loads in Northern Samar. The project aims to form a loop, thus, will provide single outage contingency to the transmission lines serving Northern Samar.

10.2 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 Daanbantayan–Bobon 230 kV Transmission Line under Cebu–Leyte 230 kV Interconnection Line 3 Project. More generations are expected to come in Panay that will need major

reinforcements of the 230 kV lines. While extension of the 138 kV line from Calbayog to Catarman will provide reliability as the demand in the Northern Samar increases.

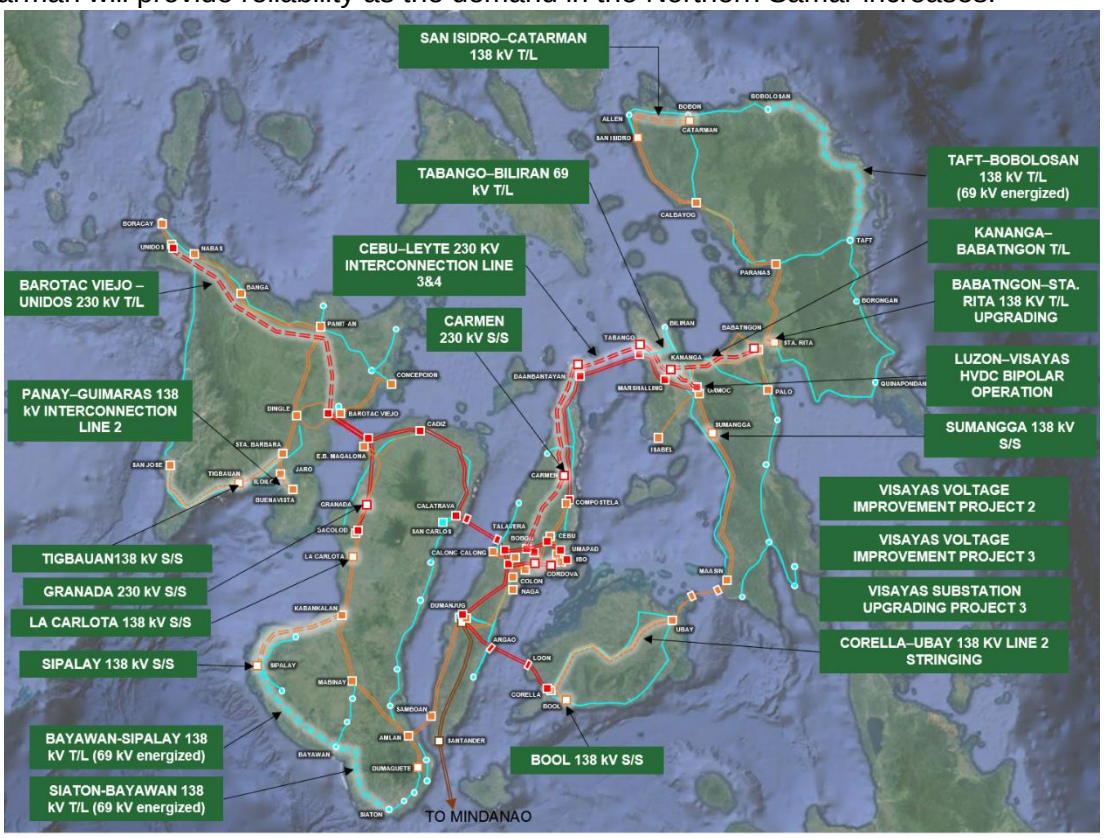


Figure 10.3: Proposed Visayas Transmission Outlook for 2030



Figure 10.4: Proposed Metro Cebu Transmission Outlook for 2030

Shown in Table 10.2 is the list of proposed transmission projects for Visayas by 2030.

Table 10.2: Proposed Transmission Outlook for 2030

Project Name/Driver(s)	Province(s) and Components	ETC
Load Growth		
Laray 230 kV Substation Project (Initially energized at 138 kV)	Cebu	Nov 2026
	<u>Substation Components:</u> ▪ *Laray 230 kV S/S (New)*, 3x100 MVA 138/69-13.8 kV Power Transformer and accessories, 10-230 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: 5,173 million Pesos	
Sumangga 138 kV Substation Project	*Leyte*	May 2027
	<u>Substation Components:</u> ▪ *Sumangga S/S,* 2x100 MVA, 138/69-13.8 kV Power Transformer and accessories, 10-138 kV PCBs, 5-69 kV PCBs and associated equipment; ▪ *Ormoc S/S,* 6-69 kV PCBs and associated equipment. <u>Transmission Components:</u> ▪ *Sumangga 138 kV Bus-in Line,* ST-DC, 1-795 MCM ACSR, 2x1.50 km; ▪ *Sumangga 69 kV Cut-in Line,* SP-DC, 1-336.4 MCM ACSR, 2 km; ▪ *Sumangga–Talisayan T/L,* 69 kV, SP-SC, 1-336.4 MCM ACSR, 4 km. Bulk Cost Estimate: 1,372 million Pesos	
Granada 230 kV Substation Project	Granada, Negros Occidental	Sep 2027
	<u>Substation Components:</u> ▪ *Granada 230 kV S/S*, 3x300 MVA, 230/69-13.8 kV Power Transformers and accessories, 12-230 kV PCBs and associated equipment, 10-69 kV PCBs and associated equipment. <u>Transmission Components:</u> ▪ *Granada 230 kV Bus-in Line,* ST-DC, 2-795 MCM ACSR, 2x0.50 km. Bulk Cost Estimate: 1,959 million Pesos	
Tigbauan 138 kV Substation Project	Iloilo	Sep 2027
	<u>Substation Components:</u> ▪ *Tigbauan 138 kV S/S,* 2x100 MVA 138/69-13.8 kV Power Transformer and accessories, 10-138 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ *Sta. Barbara S/S,* 1-138 kV PCB, 2-69 kV PCBs and associated equipment; ▪ *San Jose S/S,* 2-138 kV PCBs and associated equipment. <u>Transmission Components:</u> ▪ *Stringing of Sta. Barbara–San Jose 138 kV Line 2,* ST-DC2, 1-795 MCM ACSR, 93 km; ▪ *Reconductoring of portion of Sta. Barbara–San Jose 69 kV Line,* 1-160 mm^2 STACIR, 30 km; ▪ *Tigbauan 138 kV Bus-in Line,* ST-DC, 1-795 MCM ACSR, 2x0.50 km; ▪ *Tigbauan 69 kV Cut-in Line,* SP-DC, 1-160 mm^2 STACIR/1-336.4 MCM ACSR, 0.5 km; Bulk Cost Estimate: 1,537 million Pesos	
Carmen 230 kV Substation Project	Carmen, Cebu	Sep 2028
	<u>Substation Components:</u> ▪ *Carmen 230 kV S/S, 3*x300 MVA, 230/69-13.8 kV Power Transformer and accessories, 11-230 kV PCBs, 4-69 kV PCBs and associated equipment. <u>Transmission Components:</u> ▪ *Carmen 230 kV Bus-in Line,* ST-DC, 4-795 MCM ACSR, 2x0.50 km; ▪ *Carmen 69 kV Cut-in Line,* SP-DC, 1-336.4 MCM ACSR, 2 km. Bulk Cost Estimate: 1,553 million Pesos	
La Carlota 138 kV Substation Project	Negros	Oct 2028
	<u>Substation Components:</u>	

Project Name/Driver(s)	Province(s) and Components	ETC
	▪ *La Carlota S/S,* 2x100 MVA, 138/69-13.8 kV Power Transformers and accessories, 10-138 kV PCBs, 4-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *La Carlota 138 kV Bus-in Line,* ST-DC, 1-795 MCM ACSR, 2x0.50 km; ▪ *La Carlota 69 kV Cut-in Line,* ST-DC, 1-160 mm^2 STACIR/336.4 MCM ACSR, 1.5 km; ▪ *Reconductoring of Bacolod–San Enrique–La Carlota Line,* 69 kV, 1-160 mm2 STACIR, 42 km. Bulk Cost Estimate: 1,138 million Pesos	
San Isidro–Catarman 138 kV Transmission Line Project	Samar	Dec 2028
	Substation Components: ▪ *Catarman S/S,* 2x100 MVA 138/69 kV Power Transformer and accessories (2x100 MVA transferred from Mandaue and Lapu-lapu S/S), 10-138 kV PCBs, 6-69 kV PCBs and associated equipment. *Transmission Components:* *Calbayog–San Isidro–Catarman T/L Extension,* ST/DC, 1-795 MCM ACSR, 40 km.	
Bool 138 kV Substation Project	Bohol	Jun 2029
	Stage 1 (Nov 2019–Dec 2024) *Substation Components:* ▪ *Bool SWS, 4*-69 kV PCB and associated equipment; ▪ *Corella S/S (Expansion):* 100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV PCB, 4-69 kV PCBs and associated equipment; *Transmission Components:* ▪ *Corella–Bool 138 kV T/L (69 kV energized),* ST-DC, 1-795 MCM ACSR, 6 km; Stage 2 (Aug 2027–Dec 2029) *Substation Components:* ▪ *Bool S/S,* 2x100 MVA 138/69-13.8 kV Power Transformer and accessories, 8-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ Transfer of 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 3-69 kV PCBs to Bool Substation; *Transmission Components:* ▪ *Bool 69 kV Cut-in Line,* SP-DC, 1-336.4 MCM ACSR, 1 km. Bulk Cost Estimate: 1,775 million Pesos	
Laray–Cordova 230 kV Interconnection Project	Cebu	Jun 2029
	Substation Components: ▪ *Cordova S/S,* 2x300 MVA, 230/69-13.8 kV Power Transformer and accessories, 8-230 kV PCBs, 9-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Laray Underground cable,* 230 kV, 600 MW capacity per circuit, Double Circuit, 1 km. *Submarine cable Components:* ▪ *Laray–Cordova S/C,* 230 kV submarine Cable, 600 MW capacity per circuit, Double Circuit, 12 km.	
Sipalay 138 kV Substation Project	Negros	Dec 2029
	Substation Components: ▪ *Sipalay S/S,* 2x50 MVA 138/69 kV Power Transformer and accessories, 1-138 kV PCB, 1-69 kV PCB and associated equipment. (50 MVA transformer will be transferred from Kabankalan Substation)	
Laray–Alpaco 230 kV Energization Project	Cebu	Dec 2030
	Substation Components: ▪ *Alpaco 230 kV SWS*, 10-230 kV PCBs and associated equipment; ▪ *Energization of Laray to 230 kV, 3*x300 MVA, 230/69-13.8 kV Power Transformer and accessories. *Transmission Components:* ▪ *Extension of Laray–Alpaco SWS 230 kV T/L,* ST-DC, 4-795 MCM ACSR, 10 km.	

Project Name/Driver(s)	Province(s) and Components	ETC
Generation Entry		
Luzon–Visayas HVDC Bipolar Operation Project	Camarines Sur and Leyte	Apr 2028
	Substation Components: ▪ *Naga Converter/Inverter Station Upgrading;* ▪ *Naga 500/230 kV Substation,* 2x750 MVA, 500/230 kV Power Transformers 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.* Bulk Cost Estimate: 25,886 million Pesos	
Corella–Ubay 138 kV Line 2 Stringing Project	*Bohol*	Sep 2028
	Substation Components: ▪ *Ubay S/S,* 3-138 kV PCBs and associated equipment; ▪ *Corella S/S,* 1-138 kV PCBs and associated equipment; *Transmission Components:* ▪ *Corella–Ubay 138 kV T/L,* ST/SC2, 1-795 MCM ACSR, 93 km.	
Barotac Viejo–Unidos 230 kV Transmission Line Project	Iloilo, Aklan	Nov 2028
	Substation Components: ▪ *Unidos GIS S/S,* 2x300 MVA, 230/138-13.8 kV Power Transformer and accessories, 12-230 kV PCBs, 9-138 kV PCBs and associated equipment. ▪ *Barotac Viejo 230 kV Substation (Expansion),* 2-230 kV PCBs and associated equipment. *Transmission Components:* ▪ *Barotac Viejo–Unidos Transmission Line (Extension up to Barotac Viejo),* ST-DC, 4-795 MCM ACSR, 140 km. ▪ *Bus-in of Unidos S/S to Nabas–Caticlan T/L (Going to Caticlan),* 138 kV T/L, ST-DC, 1-795 MCM ACSR, 1 km. ▪ *Bus-in of Unidos S/S to Nabas–Caticlan T/L (Going to Barotac Viejo),* 230 kV T/L, ST-DC, 4-795 MCM ACSR, 1 km. Bulk Cost Estimate: 7,480.083 million Pesos	
System Reliability		
Panay–Guimaras 138 kV Interconnection Line 2 Project	*Guimaras, Panay*	Sep 2026
	Submarine Cable Components: ▪ *Ingore–Sawang 138 kV S/C,* 3-400 mm^2 XLPE Submarine Cable, 2.56 km ▪ *Sawang CTS–Zaldivar 138 kV U/C,* XLPE Undeground Cable, 0.8 km	
Nivel Hills 230 kV Substation Project	Nivel Hills, Cebu	Apr 2027
	Substation Components: ▪ *Nivel Hills GIS S/S,* 3x300 MVA 230/69-13.8 kV Power Transformer and accessories, 6-230 kV PCBs, 10-69 kV PCBs and associated equipment; ▪ *Bobon SWS,* 10-230 kV PCB and associated equipment. *Transmission Components:* ▪ *Nivel Hills-Bobon T/L*, ST-DC, 4-795 MCM ACSR, 230 kV, 5 km; ▪ *Bus-in of Bobon SWS to Cebu-Magdugo OHTL,* ST-DC, 4-795 MCM ACSR, 230 kV, 2x0.5 km. Bulk Cost Estimate: 3,570 million Pesos	
Tabango–Biliran 69 kV Transmission Line Project	Leyte	Jun 2027
	Substation Components: ▪ *Tabango S/S,* 1-69 kV PCB and associated equipment; ▪ *Biliran LES,* 3-69 kV Air-break Switches. *Transmission Components:* ▪ *Tabango–Biliran 69 kV T/L,* SP-DC, 1-795 MCM ACSR, 35 km. Bulk Cost Estimate: 849 million Pesos	
Siaton–Bayawan 138 kV Transmission Line (Initially energized at 69 kV)	*Negros Occidental and Negros Oriental*	Dec 2027
	Substation Components: ▪ *Siaton LES*, 1-138 kV and 2-69 kV Air-break Switches; ▪ *Bayawan LES,* 1-138 kV Air-break Switch. *Transmission Components:* ▪ *Siaton–Bayawan 138 kV T/L (69 kV energized),* ST-DC, 1-795 MCM ACSR, 52 km.	

Project Name/Driver(s)	Province(s) and Components	ETC
Visayas Substation Upgrading Project 3	*Cebu, Panay, and Negros*	Dec 2027
	Substation Components: ▪ *Boracay GIS S/S (Expansion),* 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV PCB (GIS), 1-69 kV PCB and associated equipment (GIS); ▪ *Umapad GIS S/S (Expansion),* 1x300 MVA 230/69-13.8 kV Power Transformer and accessories. ▪ *Cadiz S/S,* 2x100 MVA 138/69-13.8 kV Power Transformer and accessories. (Replacement of existing 2x50 MVA transformer).	
Taft–Bobolosan 138 kV Transmission Line Project (Initially energized at 69 kV)	*Northern and Eastern Samar*	Dec 2028
	Substation Components: ▪ *Bobolosan LES,* 1-138 kV and 2-69 kV Air-break Switches. ▪ *Taft LES,* 1-138 kV and 2-69 kV Air-break Switches. *Transmission Components:* ▪ *Bobolosan–Taft 138 kV T/L (69 kV energized),* ST/DC, 1-795 MCM ACSR, 123 km.	
Cebu–Leyte 230 kV Interconnection Lines 3 and 4 Project	Cebu and Leyte	May 2029
	Substation Components: ▪ *Daanbantayan SWS*, 4x70 MVAR, 230 kV Line Reactors, 11-230 kV PCBs and associated equipment; ▪ *Tabango SWS*, 4x70 MVAR, 230 kV Line Reactors, 11-230 kV PCBs and associated equipment; ▪ *Bobon SWS (Expansion),* 2-230 kV PCBs and associated equipment; ▪ *Kananga SWS,* 6-230 kV PCBs and associated equipment; ▪ *Marshalling SWS (Expansion),* 2-230 kV PCBs and associated equipment; ▪ *Tabango S/S*, 2x0.25 MVAR series line reactor along Tabango–Marshalling 230 kV T/L *Transmission Components:* ▪ *Daanbantayan–Tabango S/C,* Submarine Cable, 600 MW capacity per ckt, Double Circuit, 33 km; ▪ *Bobon SWS–Daanbantayan SWS T/L*, 4-795 MCM ACSR, 120 km; ▪ *Tabango SWS–Kananga SWS T/L,* 4-795 MCM ACSR, 33 km; ▪ *Kananga SWS–Marshalling SWS T/L,* 4-795 MCM ACSR, 10 km. Bulk Cost Estimate: 31,295 million Pesos	
Babatngon–Sta. Rita 138 kV Transmission Line Upgrading	Leyte, Samar	Jun 2029
	Substation Components: ▪ *Sta. Rita S/S,* 1x50 MVA 138/69-13.8 kV Power Transformer and accessories (50 MVA transformer will be transferred from Cadiz Substation), 10-138 kV PCBs, 4-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Babatngon–Paranas 138 kV T/L (segment along San Juanico Strait),* ST-DC, 1-795 MCM ACSR, 1.8 km; ▪ *Sta. Rita Bus-in Line,* 138 kV T/L, ST-DC, 1-795 MCM ACSR, 2x0.8 km.	
Kananga–Babatngon 230 kV Transmission Line Project	Kananga, Ormoc	Nov 2029
	Substation Components: ▪ *Babatngon S/S,* 2x300 MVA 230/138 kV Power Transformer and accessories, 10-230 kV PCBs, 3-138 kV PCBs and associated equipment; ▪ *Kananga SWS (Expansion),* 4-230 kV PCBs and associated equipment. *Transmission Components:* ▪ *Kananga–Babatngon T/L,* ST-DC, 4-795 MCM ACSR, 65 km. Bulk Cost Estimate: 4,482 million Pesos	
Bayawan–Sipalay 138 kV Transmission Line (Initially energized at 69 kV)	*Negros Occidental and Negros Oriental*	Dec 2030
	Substation Components: ▪ *Bayawan LES*, 2-138 kV and 2-69 kV Air-break Switches. *Transmission Components:* ▪ *Bayawan–Sipalay 138 kV T/L (69 kV energized),* ST-DC, 1-795 MCM ACSR, 74 km.	
Power Quality		

Project Name/Driver(s)	Province(s) and Components	ETC
Visayas Voltage Improvement Project 2	Samar, Leyte, Cebu, Negros, Panay	Jun 2027
	Substation Components: *STATCOM:* ▪ *Calbayog 138 kV S/S,* ±20 MVAR 138 kV STATCOM, 1-138 kV PCB and associated equipment ▪ *Naga 138 kV S/S,* ±40 MVAR 138 kV STATCOM, 2x20 MVAR Capacitor Bank, 4-138 kV PCBs and associated equipment ▪ *Panitan 138 kV S/S,* ±20 MVAR 138 kV STATCOM, 1-138 kV PCB and associated equipment *Capacitor Banks:* ▪ *Quinapondan 69 kV LES,* 5 MVAR 69 kV Capacitor Bank, 1-69 kV PCB and associated equipment ▪ *Baybay 69 kV LES,* 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment ▪ *Asturias 69 kV LES,* 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment ▪ *Garcia Hernandez 69 kV LES,* 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment ▪ *Carmen 69 kV LES, 2x*5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment ▪ *Sipalay 69 kV LES, 2x*5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment ▪ *Valladolid 69 kV LES, 5x*5 MVAR 69 kV Capacitor Bank, 5-69 kV PCBs and associated equipment ▪ *Bayawan 69 kV LES,* 5 MVAR 69 kV Capacitor Bank, 1-69 kV PCBs and associated equipment ▪ *Roxas 69 kV LES,* 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCB and associated equipment ▪ *San Jose 69 kV LES,* 3x5 MVAR 69 kV Capacitor Bank, 3-69 kV PCBs and associated equipment ▪ *Estancia 69 kV LES,* 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment Bulk Cost Estimate: 2,149 million Pesos	
Visayas Voltage Improvement Project 3	Samar, Leyte, Cebu, Negros, Panay	Dec 2027
	Substation Components: ▪ *Tigbauan 69 kV LES,* 3x5 MVAR Capacitor Bank, 3-69 kV PCBs and associated equipment; ▪ *Dingle 138 kV S/S,* 20 MVAR Capacitor Bank, 1-138 kV PCB and associated equipment; ▪ *Granada 69 kV S/S,* 3x5 MVAR Capacitor Bank, 3-69 kV PCBs and associated equipment; ▪ *Umapad 69 kV S/S,* 4x5 MVAR Capacitor Bank, 4-69 kV PCBs and associated equipment; ▪ *Maasin 138 kV S/S, 4x*20 MVAR Capacitor Bank, 4-138 kV PCB and associated equipment; ▪ *Himayangan 69 kV LES,* 5 MVAR Capacitor Bank, 1-69 kV PCBs and associated equipment; ▪ *Calbayog 69 kV S/S, 3x*5 MVAR Capacitor Bank, 3-69 kV PCBs and associated equipment.	

10.3 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 Transmission Line Project aims to loop the 138 kV

system in Panay, on the other hand the Bohol–Leyte 230 kV Interconnection Project and the Palo–Javier 138 kV Transmission Line Project aims to form a 230 kV loop among Cebu, Bohol and Leyte sub-grids.

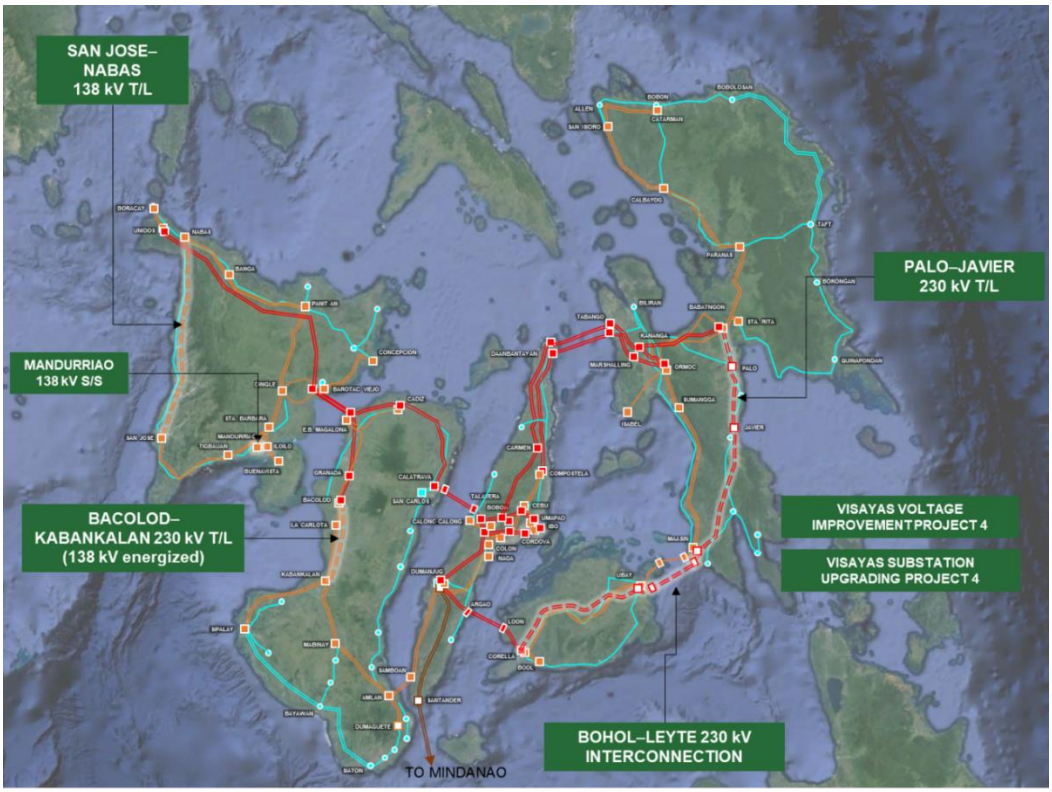


Figure 10.5: Proposed Visayas Transmission Outlook for 2035



Figure 10.6: Proposed Metro Cebu Transmission Outlook for 2035

Table 10.3: Proposed Transmission Outlook for 2035

Project Name/Driver(s)	Province(s) and Components
Load Growth	
Mandurriao 138 kV Substation Project	Panay
	Substation Components: ▪ *Mandurriao S/S,* 2x100 MVA 138/69 kV Power Transformer and accessories, 6-138 kV PCBs, 4-69 kV PCBs and associated equipment. *Transmission Components:* *Sta. Barbara–Mandurriao T/L ,* ST/DC, 1-795 MCM ACSR, 15 km.
Generation Entry	
Bacolod–Kabankalan 230 kV Transmission Line Project (Initially energized at 138 kV)	Negros Occidental
	Substation Components: ▪ *Bacolod S/S,* 2-138 kV PCBs and associated equipment; ▪ *Kabankalan S/S,* 2-138 kV PCBs and associated equipment. *Transmission Components:* ▪ *Bacolod–Kabankalan T/L (138 kV energized),* ST-DC, 2-795 MCM ACSR, 62 km.
Reliability	
Visayas Substation Upgrading Project 4	*Cebu, Panay, Leyte, Negros and Bohol*
	Substation Components: ▪ *Dingle S/S (Expansion),* 1x100 MVA 138/69-13.8 kV Power Transformer and accessories (Transferred from Palo 138 kV Substation), 2-138 kV PCBs, 1-69 kV PCBs and associated equipment. ▪ *Amlan S/S (Expansion),* 3x100 MVA 138/69-13.8 kV Power Transformer and accessories (Transformers transferred from Laray 138 kV Substation); ▪ *Corella S/S (Expansion),* 100 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCB, 2-69 kV PCB and associated equipment; ▪ *Banga S/S (Expansion),* 100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV PCB, 2-69 kV PCB and associated equipment; ▪ *Concepcion (Replacement),* 100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of existing 50 MVA Transformer); ▪ *Sumangga S/S (Expansion),* 100 MVA 138/69-13.8 kV Power Transformer and accessories (Transferred from Palo 138 kV Substation), 1-138 kV PCB, 2-69 kV PCB and associated equipment; ▪ *Kabankalan S/S (Expansion),* 100 MVA 138/69-13.8 kV Power Transformer and accessories, 2-69 kV PCBs and associated equipment; ▪ *Panit-an S/S (Expansion),* 100 MVA 138/69-*13.8* kV Power Transformer and accessories (Transferred from Palo 138 kV Substation), 2-138 kV PCBs, 1-69 kV PCBs and associated equipment; ▪ *Nabas S/S (Expansion),* 2x50 MVA 138/69-13.8 kV Power Transformer and accessories (Transferred from Amlan Substation), 2-138 kV PCBs, 7-69 kV PCBs and associated equipment; ▪ *Dingle S/S (Expansion),* 100 MVA 138/69-13.8 kV Power Transformer and accessories (Transferred from Palo 138 kV Substation), 2-69 kV PCBs and associated equipment.
Bohol–Leyte 230 kV Interconnection Project	Bohol, Leyte
	Substation Components: ▪ *Corella S/S (Expansion),* 4-230 kV PCBs and associated equipment; ▪ *Maasin S/S (Expansion),* 2x300 MVA 230/138-13.8 kV Transformers, 2x70 MVAR Line Reactors and accessories, 8-230 kV PCBs, 2-138 kV PCBs and associated equipment; ▪ *Ubay S/S (Expansion),* 2x300 MVA 230/138-13.8 kV Transformers, 2x70 MVAR Line Reactors and accessories, 8-230 kV PCBs and associated equipment; ▪ *C.P. Garcia 230 kV CTS;* ▪ *Guadalupe 230 kV CTS.* *Transmission Components:* ▪ *Ubay–C.P. Garcia 230 kV T/L,* 4-795 MCM ACSR, ST-DC, 19 km; ▪ *Maasin–Javier 230 kV T/L,* ST-DC, 4-795 MCM ACSR, 120 km; ▪ *Corella–Ubay 230 kV T/L,* 4-795 MCM ACSR, ST-DC, 95 km; ▪ *Guadalupe–Maasin 230 kV T/L,* ST-DC, 4-795 MCM ACSR, 4.5 km. *Submarine Cable Components:* ▪ *C.P. Garcia–Guadalupe 230 kV S/C,* Double Circuit Submarine Cable, 600 MW per circuit, 17.6 km.
	Panay

Project Name/Driver(s)	Province(s) and Components
San Jose–Nabas 138 kV Transmission Line Project	*Substation Components:* ▪ *San Jose S/S*, 2-138 kV PCBs and associated equipment; *Transmission Components:* ▪ *San Jose–Nabas T/L,* ST-DC, 1-795 MCM ACSR, 125 km.
Palo–Javier 230 kV Transmission Line Project	Leyte
	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, 4-230 kV PCBs and associated equipment; ▪ *Energization of Babatngon–Palo to 230 kV level (Transferring of termination)*
Power Quality	
Visayas Voltage Improvement Project 4	Negros
	Substation Components: ▪ *Granada 230 kV S/S,* 5x20 MVAR Capacitor Bank, 5-230 kV PCBs and associated equipment. ▪ *La Carlota 138 kV S/S,* 20 MVAR Capacitor Bank, 1-138 kV PCB and associated equipment. ▪ *Cordova 69 kV S/S,* 4x5 MVAR Capacitor Bank, 4-69 kV PCBs and associated equipment;

10.4 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.

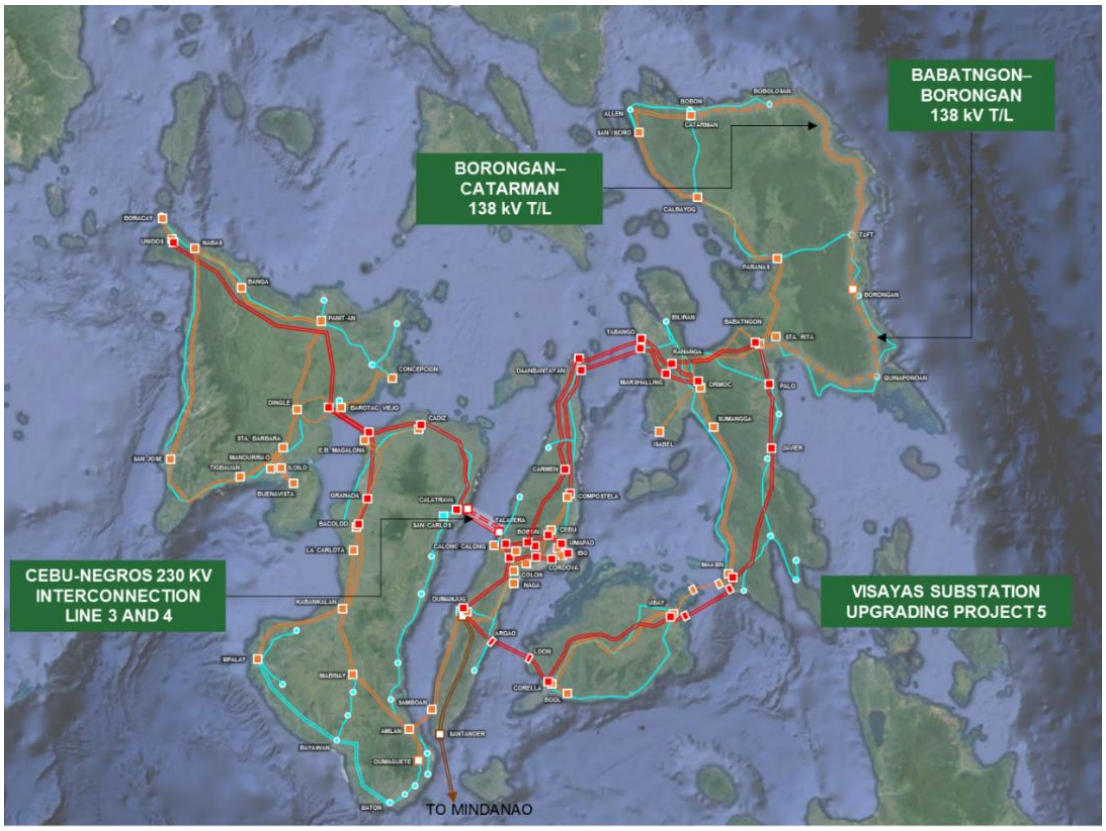


Figure 10.7: Proposed Visayas Transmission Outlook for 2040



Figure 10.8: Proposed Metro Cebu Transmission Outlook for 2040

Shown in Table 10.4 is the list of proposed transmission projects for Visayas by the 2040.

Table 10.4: Proposed Transmission Outlook for 2040

Project Name/Driver(s)	Province(s) and Components
Generation Entry	
Cebu–Negros 230 kV Interconnection Line 3 and 4 Project	Cebu and Negros *Substation Components:* ▪ *Talavera SWS (Expansion)*, 12-230 kV PCBs and associated equipment, 2x70 MVAR 230 kV Line Reactor; ▪ *Calatrava SWS (Expansion)*, 12-230 kV PCBs and associated equipment, 2x70 MVAR 230 kV Line Reactor; *Transmission Components:* ▪ *Calatrava–Talavera 230 kV S/C, 2* ckts XLPE submarine cable of 400 MW per ckt capacity, 29 km.
Load Growth	
Babatngon–Borongan 138 kV Transmission Line Project	Samar *Substation Components:* ▪ *Babatngon S/S,* 4-138 kV PCBs and associated equipment; ▪ *Borongan S/S,* 2x100 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 6-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Babatngon–Borongan T/L,* ST-DC, 1-795 MCM ACSR, 185 km.
Reliability	
Visayas Substation Upgrading Project 5	*Cebu, Panay, Leyte and Negros* *Substation Components:* ▪ *Nivel Hills S/S (Expansion),* 1x300 MVA 230/69-13.8 kV Power Transformer and accessories, 1-230 kV PCB, 1-69 kV PCB and associated equipment; ▪ *Dumanjug S/S (Expansion),* 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCB, 2-69 kV PCB and associated equipment. ▪ *Pusok S/S (Expansion),* 300 MVA 230/69-13.8 kV Power Transformer and accessories; ▪ *Cadiz S/S (Expansion),* 100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV PCB, 2-69 kV PCB and associated equipment; ▪ *Daanbantayan S/S (Expansion),* 150 MVA 138/69-13.8 kV Power Transformer and accessories, 1-230 kV PCB, 1-69 kV PCB and associated equipment; ▪ *Calatrava S/S (Expansion),* 100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV PCB, 2-69 kV PCB and associated equipment; ▪ *La Carlota S/S (Expansion),* 100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV PCB, 2-69 kV PCB and associated equipment.
Lapu-lapu–Cordova 230 kV Interconnection Project	Cebu *Transmission Components:* ▪ *Pusok–Cordova S/C S/C,* 2 ckts XLPE submarine cable of 600 MW per ckt capacity, 6 km; *Substation Components:* ▪ *Cordova S/S (Expansion),* 4-230 kV PCBs and associated equipment.
Borongan–Catarman 138 kV Transmission Line Project	Samar *Substation Components:* ▪ *Catarman S/S,* 4-138 kV PCBs, associated equipment; ▪ *Borongan S/S,* 2-138 kV PCBs and associated equipment. *Transmission Components:* ▪ *Borongan–Catarman T/L,* ST-DC, 1-795 MCM ACSR, 118 km.

Chapter 11 - Mindanao Transmission Outlook

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 several 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 this Chapter.

Meanwhile, to cater the other requirements of the Mindanao Grid, reinforcements of the existing 138 kV substations, extension of some of the existing 230 kV and 138 kV transmission lines, and looping of some of 69 kV transmission systems as well as power quality projects 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 and nearby areas. 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.

11.1 Proposed Transmission Projects up to 2025

Shown in Table 11.1 is the list of transmission projects planned for Mindanao Grid for the period 2020-2025 in addition to the projects already approved by the ERC.

Table 11.1: Proposed Transmission Projects for Mindanao

Project Name/Driver(s)	Province(s) and Components	ETC
Load Growth		
Laguindingan 230 kV Substation Project	Misamis Oriental	Jun 2023
	Substation Components: ▪ *Laguindingan 230 kV Substation (New):* 2x300 MVA, 230/138-13.8 kV Power Transformers and accessories, 1x100 MVA, 138/69-13.8 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 6-138 kV PCBs and associated equipment, 3-69 kV PCBs and associated equipment; ▪ *Tagoloan 138 kV Substation:* 5-138 kV PCBs and associated equipment. *Transmission Components:* ▪ *Balo-i – Villanueva 230 kV line bus-in to Laguindingan 230 kV SS*: 230 kV, ST-DC, 2x795 MCM ACSR/AS, 2 x 5.75 km Bulk Cost Estimate: 2,353.912 Million Pesos	
Mindanao Substation Expansion 4 Project (MSE4P)	Zamboanga Sibugay, Zamboanga del Norte, Lanao del Norte, Bukidnon, Davao de Oro, Davao Occidental, Maguindanao, Agusan del Norte	Jun 2023
	Substation Components:	

	▪ *Naga Min 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Polanco 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Agus 6 138 kV Switchyard:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Maramag 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Maco 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Culaman 230 kV Substation:* 1x50 MVA 239/69 kV Power Transformer and accessories, 2-230 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Sultan Kudarat 138 kV Substation*: 2x100 MVA 138/69 kV Power Transformers and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ *Nasipit 138 kV Substation*: 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment. Bulk Cost Estimate: 3,524.761 Million Pesos	
Mindanao Substation Expansion 3 Project (MSE3P)	Zamboanga City, Surigao del Norte, Agusan del Sur, Davao del Sur	Jul 2025
	<u>*Substation Components:*</u> ▪ *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 ▪ *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: 1,464.64 Million Pesos	
System Reliability		
Zamboanga Peninsula Voltage Improvement Project (ZPVIP)	Zamboanga del Sur, Zamboanga Sibugay, Sultan Kudarat, South Cotabato	Capacitors – 2021 STATCOM - 2022
	<u>*Substation Components:*</u> ▪ *Zamboanga 138 kV Substation:* 200 MVAR STATCOM, 2-138 kV PCBs and associated equipment, 1-69 kV PCB and associated equipment; ▪ *Naga Min 138 kV Substation:* 4x10 MVAR 138 kV Shunt Capacitors, 4-138 kV PCBs and associated equipment; ▪ *Pitogo 138 kV Substation:* 2x10 MVAR 138 kV Shunt Capacitors, 6-138 kV PCBs and associated equipment; ▪ *Tacurong 138 kV Substation:* 2x30 MVAR 138 kV Shunt Capacitors, 2-138 kV PCBs and associated equipment; ▪ *General Santos 138 kV Substation:* 4x30 MVAR 138 kV Shunt Capacitors, 4-138 kV PCBs and associated equipment; Bulk Cost Estimate: 1,877.631 Million Pesos	
Nasipit Substation Bus-In Project	Agusan Del Norte	Jun 2023
	<u>*Substation Components:*</u> ▪ *Nasipit 138 kV Substation:* 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 7-138 kV PCBs and associated equipment, 1-69 kV PCBs and associated equipment <u>*Transmission Components:*</u> ▪ *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: 1,171.71 Million Pesos	
Kabacan 138 kV Substation Project	North Cotabato, South Cotabato, Sultan Kudarat, Maguindanao	S/S - Jun 2023; T/L to Kidapawan – Sep 2025
	<u>*Substation Components:*</u> ▪ *Kabacan 138 kV Substation (New):* 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 11-138 kV PCBs, 1-69 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, 50.6 km; ▪ *Kabacan – Villarica 69 kV Transmission Line,* SP-SC, 1-336.4 MCM ACSR, 37.2 km; ▪ *Kibawe 138 kV Line Extension: ST-DC, 1-795 MCM ACSR/AS, 0.5 km;* ▪ *Tacurong 138 kV Line Extension: ST-SC, 1-795 MCM ACSR/AS, 1.86 km;* ▪ *Sultan Kudarat 138 kV Line Extension: ST-SC, 1-795 MCM ACSR/AS, 1.88 km.* Bulk Cost Estimate: 4,167.87 Million Pesos	
Mindanao Substation Upgrading 2 Project (MSU2P)	Lanao del Norte, Misamis Oriental, Bukidnon, Agusan del Norte, Davao del Sur, North Cotabato, South Cotabato	Jun 2023
	Substation Components: ▪ *Balo-i 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 3-138 kV PCBs, 6-69 kV PCBs and associated equipment; ▪ *Tagoloan 138 kV Substation:* 2x100 MVA 138/69 kV Power Transformers and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ *Jasaan 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Kibawe 138 kV Substation:* 1x50 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Butuan 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 1-138 kV PCB, 1-69 kV PCB and associated equipment; ▪ *Davao 138 kV Substation:* 2x150 MVA 138/69 kV Power Transformers and accessories, 3-138 kV PCBs, 7-69 kV PCBs and associated equipment; ▪ *Toril 138 kV Substation:* 2x100 MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 1-69 kV PCBs and associated equipment; ▪ *Bunawan 138 kV Substation:* 2x100 MVA 138/69 kV Power Transformers and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ *Kidapawan 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *General Santos 138 kV Substation:* 2x100 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment Bulk Cost Estimate: 5,556.906 Million Pesos	
Sultan Kudarat – Pinaring 69 kV Line Upgrading Project	Maguindanao	Dec 2023
	Substation Components: ▪ *Sultan Kudarat 138 kV Substation*: 2-69 kV PCBs and associated equipment *Transmission Components:* ▪ *Sultan Kudarat – Pinaring 69 kV Transmission Line (Upgrading):* SP-DC, 1-795 MCM ACSR/AS, 6.67 km Bulk Cost Estimate: 110.945 Million Pesos	
San Francisco – Tago 138 kV Transmission Line Project	Agusan del Sur, Surigao del Sur	Dec 2023
	Substation Components: ▪ *San Francisco 138 kV Substation:* 4-138 kV PCBs and associated equipment; ▪ *Tago 138 kV Substation (New):* 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 5-138 kV PCBs, 3-69 kV PCBs and associated equipment; ▪ *Madrid 69 kV Substation:* 2-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *San Francisco–Tago 138 kV Transmission Line:* ST-DC, 1-795 MCM ACSR/AS, 81.6 km; ▪ *Madrid–Tandag 69 kV Transmission Line*: SP-SC**,** 1-795 MCM ACSR/AS, 54 km. Bulk Cost Estimate: 4,198.64 Million Pesos	
Polanco – Oroquieta 138 kV Transmission Line Project (Initially energized at 69 kV)	Zamboanga del Sur, Zamboanga del Norte, Misamis Occidental	Capacitors – Sep 2024 T/L – Apr 2028
	Substation Components: ▪ *Oroquieta 69 kV Switching Station (New)*: 8-69 kV PCBs and associated equipment, 2x7.5 MVAR 69 kV Shunt Capacitors;	

	▪ *Polanco 138 kV Substation:* 4x10 MVAR 138 kV Shunt Capacitors, 4-138 kV PCBs and associated equipment; ▪ *Aurora 69 kV Substation:* 2-69 kV PCBs and associated equipment; ▪ *Bañadero 69 kV Substation:* 2x7.5 MVAR 69 kV Shunt Capacitors, 2-69 kV PCBs and associated equipment; ▪ *Villaflor 69 kV Substation:* 1x7.5 MVAR 69 kV Shunt Capacitor, 1-69 kV PCB and associated equipment; <u>*Transmission Components:*</u> ▪ *Polanco – Oroquieta 138 kV Transmission Line:* ST-DC, 1-795 MCM ACSR/AS, 48 km; ▪ *Oroquieta – Villaflor 69 kV Transmission Line:* ST-DC, 1-795 MCM ACSR, 1 km; ▪ *Aurora – Villaflor 69 kV Transmission Line (Upgrading):* SP-SC, 1-795 MCM ACSR, 84 km. Bulk Cost Estimate: 4,039.200 Million Pesos	
Maco – Mati 138 kV Transmission Line Project	Davao de Oro, Davao Oriental	Aug 2025
	<u>*Substation Components:*</u> ▪ *Maco 138 kV Substation:* 4-138 kV PCB and associated equipment; ▪ *Mati 138 kV Substation:* 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 5-138 kV PCBs, 3-69 kV PCBs and associated equipment. <u>*Transmission Components:*</u> ▪ *Maco – Mati 138 kV Transmission Line:* ST-DC, 1-795 MCM ACSR/AS, 72.3 km. Bulk Cost Estimate: 2,344.51 Million Pesos	
Eastern Mindanao Voltage Improvement Project (EMVIP)	Agusan del Norte, Agusan del Sur, Davao de Oro	Dec 2025
	<u>*Substation Components:*</u> ▪ *Butuan 138 kV Substation:* 3x10 MVAR, 138 kV Shunt Capacitors and accessories, 3-138 kV PCBs and associated equipment ▪ *San Francisco 138 kV Substation:* 3x10 MVAR, 138 kV Shunt Capacitors and accessories, 3-138 kV PCBs and associated equipment ▪ *Nabunturan 138 kV Substation:* 3x10 MVAR, 138 kV Shunt Capacitors and accessories, , 3-138 kV PCBs and associated equipment ▪ *Maco 138 kV Substation:* 3x10 MVAR, 138 kV Shunt Capacitors and accessories, , 3-138 kV PCBs and associated equipment Bulk Cost Estimate: 868.435 Million Pesos	

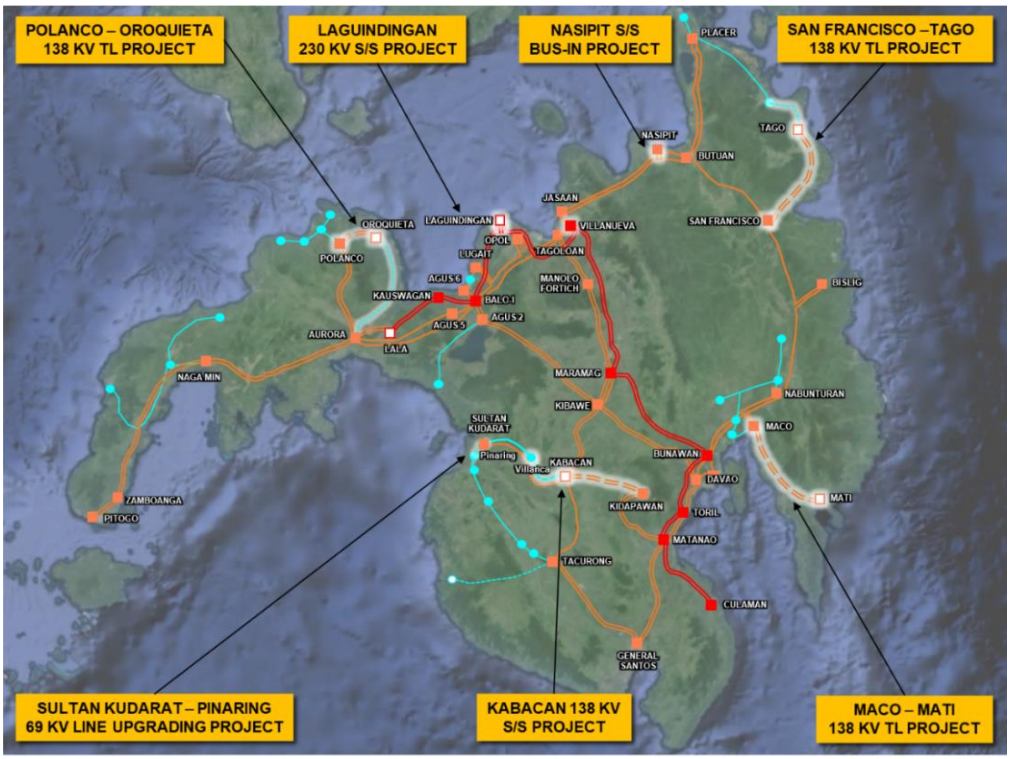


Figure 11.1: Proposed Mindanao Transmission Outlook for 2025

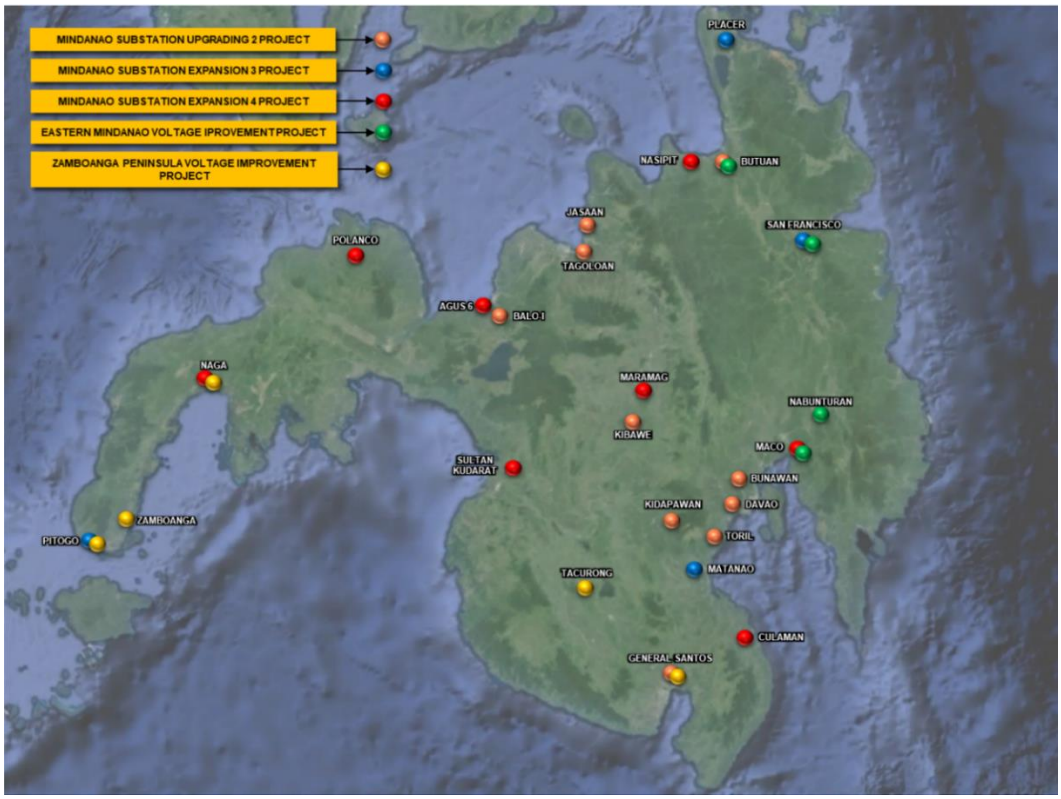
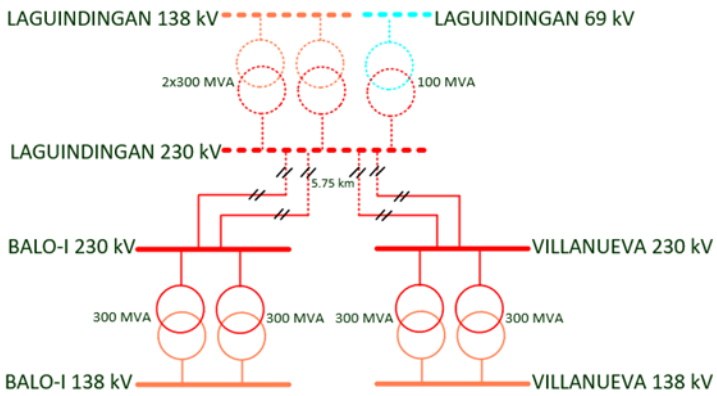


Figure 11.2: Mindanao Substation Upgrading and Voltage Improvement for 2025

11.1.1 **Laguindingan 230 kV Substation Project**



The abrupt industrial and commercial developments in the area of Laguindingan requires substantial power supply requirement, which exceeds the existing capacity of the nearby transmission facility.

The project involves the implementation of a new 230 kV substation within Laguindingan that will bus-in to the existing Balo-i – Villanueva 230 kV line. This provides stable supply and efficient delivery of bulk power to the loads in the vicinity through the 230 kV backbone of the Mindanao Grid. The continuous power supply is essential for the operation of the Laguindingan Economic Zone.

11.1.2 **Mindanao Substation Expansion 4 Project (MSE4P)**

Several substations in Mindanao are expected to become overloaded based on the demand forecast. Thus, transmission facilities should be developed in which substation capacity must be upgraded.

The Mindanao Substation Expansion 4 Project caters to the looming demand load and fulfills the N-1 contingency criterion of the PGC. Starting year 2024, the existing transformers in Naga Min, Polanco, Agus 6, Maramag, Maco, Culaman, Sultan Kudarat, and Nasipit Substations have their capacities exceeded during N-1 condition. Hence, the installation of additional transformers in the affected substations are necessary to maintain continuous operation even during an outage of one of the transformers.

11.1.3 **Mindanao Substation Expansion 3 Project (MSE3P)**

Starting 2023, the existing transformers in Pitogo, Placer, San Francisco and Matanao Substations will exceed their thermal capacity during N-1 condition. The installation of additional transformer in each of these substations maintains the continuous operation even during outage of one of the transformers. This development also complies with the N-1 contingency criterion of the Philippine Grid Code.

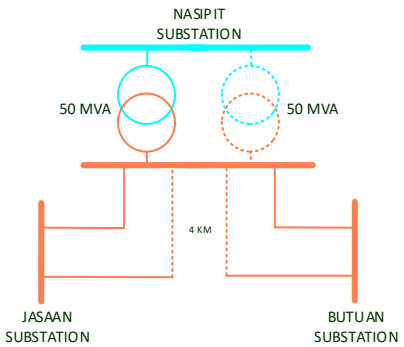
11.1.4 **Zamboanga Peninsula Voltage Improvement Project (ZPVIP)**

The main problem in the Zamboanga Peninsula is the absence of a local base load generator, which triggers voltage difficulties in the northwestern Mindanao area. Under the circumstance, voltage levels should be managed to maintain the normal operation of the grid.

While waiting for the needed power plant in the area, ZPVIP provides voltage support in the peninsula by installing 200 MVAR Static VAR Compensator (STATCOM) in Zamboanga Substation, 4x10 MVAR 138 kV capacitor bank in Naga Min Substation, and 2x10 MVAR capacitor bank in Pitogo Substation. STATCOM offers fast response in the control of reactive power flow, thereby increasing stability of the network.

11.1.5 **Nasipit Substation Bus-In Project**

The outage of the existing Nasipit – Butuan 138 kV line results in a low voltage in the following substations: Butuan, Placer, and San Francisco.

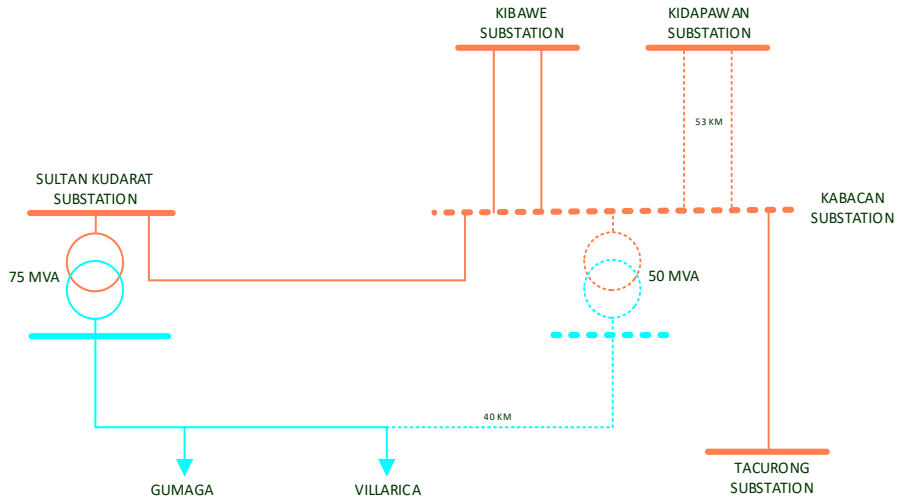


The project improves the reliability and power quality of the transmission system in the northeastern Mindanao area. It is comprised of the 4 km bus-in of the existing Jasaan – Butuan

138 kV line to Nasipit Substation, installation of a new 50 MVA power transformer, and replacement of defective PCBs.

11.1.6 **Kabacan 138 kV Substation Project**

The Kibawe – Sultan Kudarat and Kabacan – Tacurong 138 kV lines traverse areas with prevalent presence of militant groups and lawless elements. Thus, transmission facilities are exposed to a high risk of sabotage. An outage of any of these line will result in large scale power interruptions in Sultan Kudarat, Maguindanao, North Cotabato, and South Cotabato provinces.

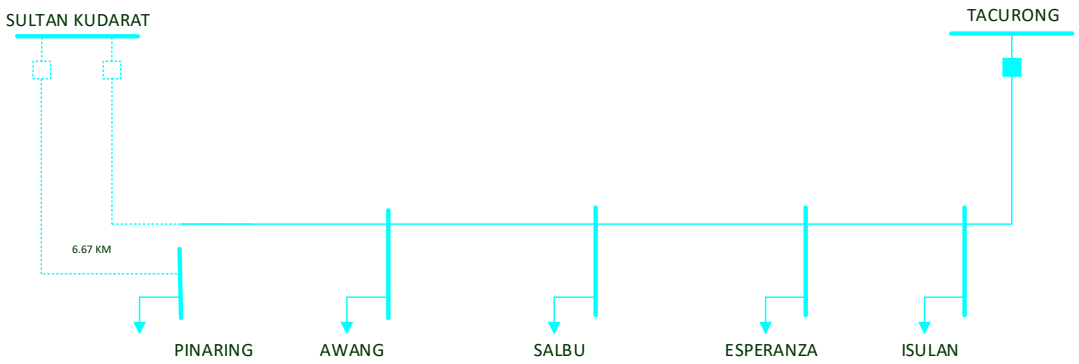


The project involves the bus-in connection of the mentioned lines to the proposed Kabacan Substation, installation of a new 50 MVA power transformer, construction of a new 53 km Kabacan – Kidapawan 138 kV line, and construction of a new 40 km Kabacan – Villarica 69 kV line. These new developments provide flexibility and additional reliability to the transmission system and ensure the continuity of power supply in the concerned areas. Additionally, the project includes the installation of four new PCBs in General Santos Substation, allowing the entry of the 105 MW Coal-Fired Power Plant Phase 2 of Sarangani Energy Corporation (SEC).

11.1.7 **Mindanao Substation Upgrading 2 Project (MSU2P)**

MSU2P accommodates the growing demand of the following substations by providing addtional power transformers: Balo-i, Tagoloan, Jasaan, Kibawe, Butuan, Davao, Toril, Bunawan, Kidapawan, and General Santos. With the new power transformers in place, the substations operate continuously and without interruption even during outage of one of the power transformers.

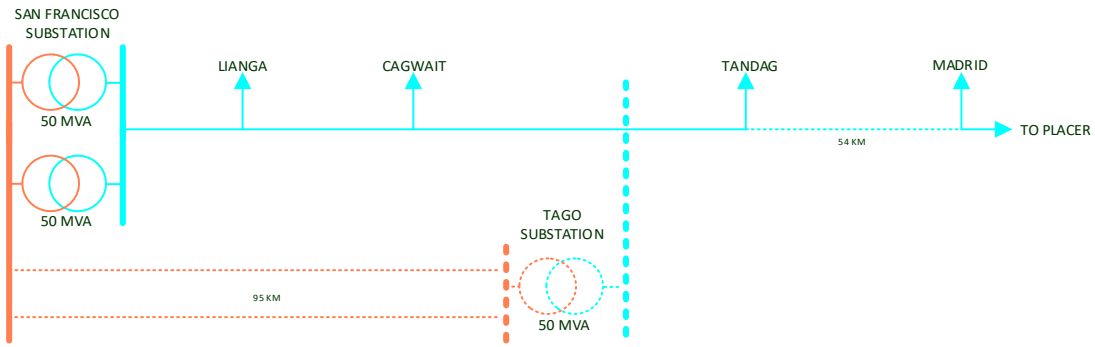
11.1.8 **Sultan Kudarat – Pinaring 69 kV Line Upgrading Project**



The Sultan Kudarat – Datu Saudi Ampatuan – Tacurong 69 kV line is experiencing frequent load shifting, which entails low voltage and rotational power interruptions in the area. This impedes the economic development of the Maguindanao province especially Cotabato City. To prevent these issues on the said feeder, the almost 7 km Sultan Kudarat – Pinaring line section is upgraded from Single Circuit 1-336.4 MCM ACSR to Double Circuit 1-795 MCM ACSR. The line upgrading increases the capacity of the mentioned line section and also effectively separates the load serving Cotabato City for a more reliable and uninterrupted supply.

11.1.9 **San Francisco – Tago 138 kV Transmission Line Project**

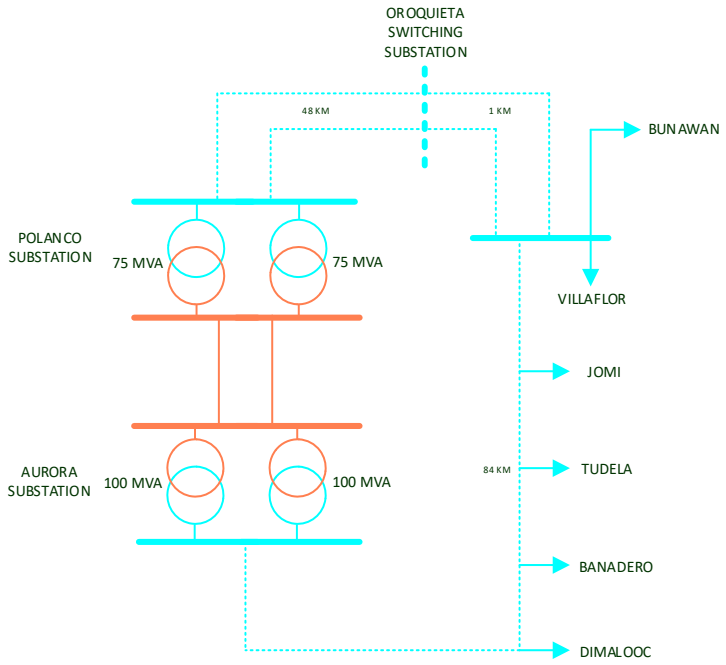
An outage of either San Francisco – Tandag 69 kV Line or Placer – Madrid 69 kV Line shuts down the connected loads in Surigao provinces due to absence of an alternative transmission facility.



The project is comprised of the 138 kV line extension from San Francisco Substation to the new Tago Substation and the looping of the 69 kV lines in Surigao del Sur area. This project allows the switching of loads during line outage, and solves the power quality and reliability problems being experienced in the area.

11.1.10 **Polanco - Oroquieta 138 kV Transmission Line Project (Initially energized at 69 kV)**

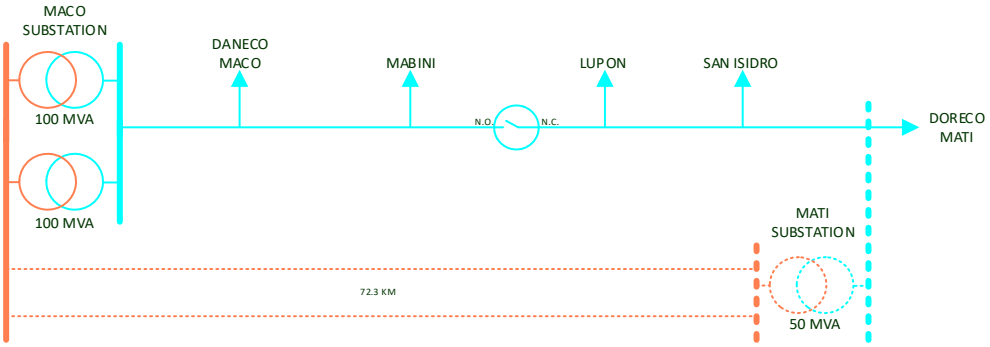
The thermal capacity of the existing Aurora – Calamba 69 kV line is already exceeded by the year 2022 onwards. The system will require load curtailment to maintain the continuous operation of the feeder. Moreover, a low voltage problem is being experienced by LES connected at the far end of the line due to its length. The limited line capacity and low voltage problem suppress the progress of the municipalities in Misamis Occidental.



The project involves the construction of a new 48 km double circuit transmission line from Polanco Substation to new Oroquieta Switching Station. The mentioned line is designed at 138 kV but will be energized initially at 69 kV. From the new switching station, a 1 km double circuit feeder will traverse towards the MOELCI I Villaflor. This loops the 69 kV feeder serving Misamis Occidental for operational flexibility especially during outage of any segment from either Aurora or Polanco Substation. Included in the project is the upgrading of the Aurora – Villaflor 69 kV line to increase the power transfer capacity of the existing feeder. Lastly, capacitor bank installations in Polanco, Oroquieta, Villaflor, and Bañadero are considered to relieve the foreseen low voltage problem.

11.1.11 **Maco – Mati 138 kV Transmission Line Project**

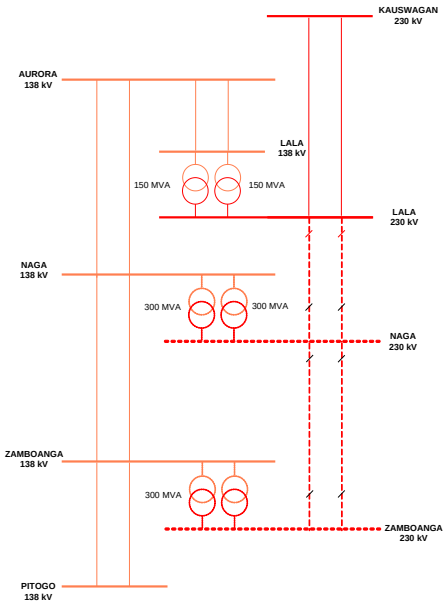
Presently, the existing Maco – Mati 69 kV Transmission Line is in a radial configuration. It has no alternate line to deliver power to the customer when it is shut down during outage or maintenance. Low voltage problem is anticipated due to rapid development and increasing power requirement of Mati City.



The project consists of the extension of the 138 kV transmission system from the existing Maco Substation to the new Mati Substation and the installation of a 50 MVA power transformer in the new substation. These developments address the anticipated low voltage in the area and offer continuous and reliable power delivery during normal and N-1 condition.

11.1.12 **Eastern Mindanao Voltage Improvement Project (EMVIP)**

The substations in eastern Mindanao experience undervoltage due to increasing demand. The installation of capacitor banks in the substations ensures the voltage level within the prescribed limits of PGC even during contingent scenarios. It also maintains the nominal voltage level in the area until the completion of the Eastern Mindanao 230 kV Transmission Line Project.



11.1.13 **Lala – Naga Min – Zamboanga 230 kV Transmission Line Project**

The main problem in the Zamboanga Peninsula is the absence of a local base load generator, which triggers voltage difficulties in the northwestern Mindanao area. Under the circumstance, voltage levels should be managed to maintain the normal operation of the grid. Further, Zamboanga Peninsula is prone to operation stability issues due to a long and radial transmission line.

The extension of the Mindanao 230 kV transmission backbone towards Zamboanga Peninsula offers operational stability by having another transmission corridor with higher power transfer capacity. The 230 kV transmission facility alleviates the power supply delivery and voltage stability issues in Zamboanga Peninsula.

11.2 Proposed Transmission Outlook for 2030

The Lala– Malabang–Sultan Kudarat 230 kV Transmission Line Project, which creates a looped system through a high voltage power line emanating from Lanao del Norte, further improves the reliability of transmitted power towards southwestern Mindanao. Likewise, the various 69 kV transmission line projects such as the Siom – Sindangan – Salug 69 kV line in Zamboanga Del Norte and upgrading of Placer – Madrid 69 kV line in CARAGA Region provide flexibility in supplying power to the customers in that part of Mindanao. Two new

substations namely the Salug and Midsayap Substation are to be constructed for the growing demand load in the provinces of Zamboanga del Norte and Cotabato, respectively. Moreover, as indicated in Figure 11.3, the upgrading of the existing substations is programmed to address the growing demand requirements of different electric cooperatives.

In the long term, the installation of transformers in the Matanao 230 kV facility ensures adequate substation and improve voltage profile for the customers in Davao del Sur.

Finally, the implementation of Zamboanga – Basilan and Davao – Samal interconnection projects significantly boost the supply reliability supporting the load requirements of Basilan and Samal islands.

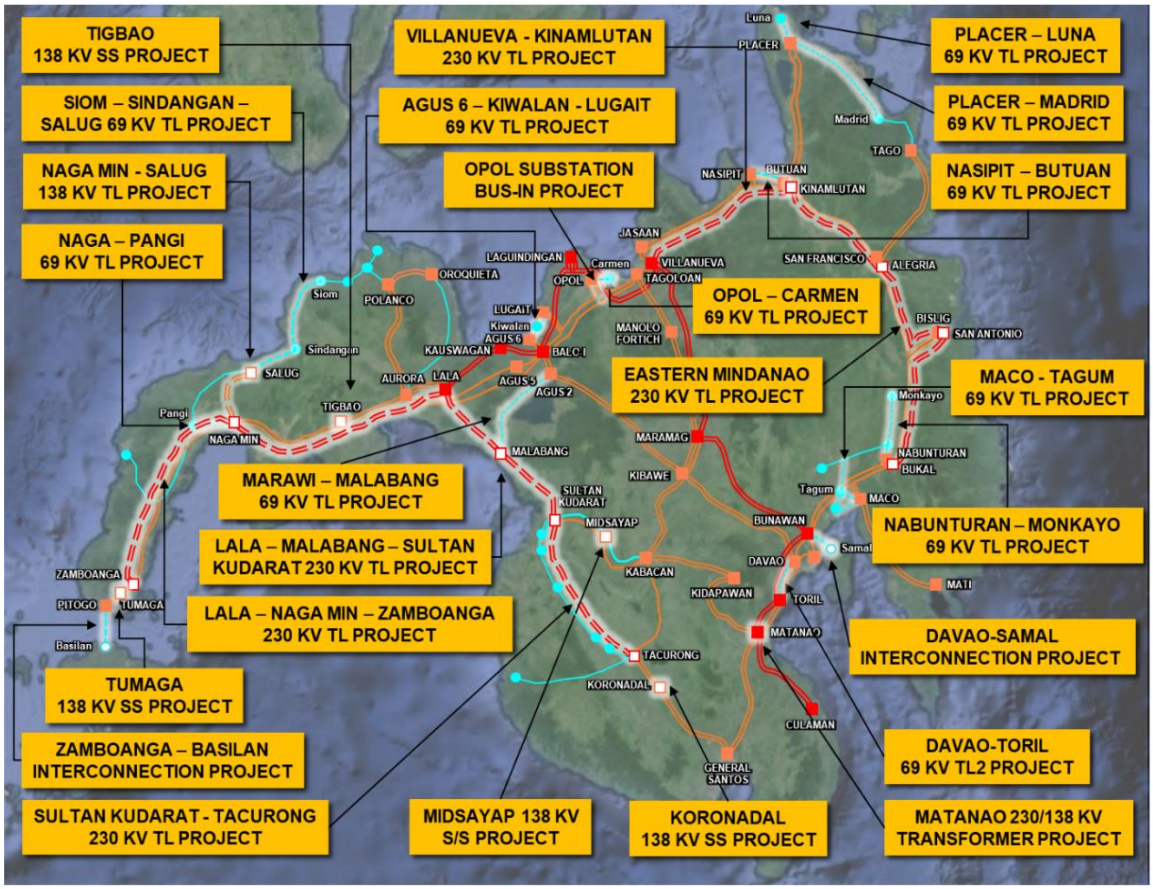


Figure 11.3: Proposed Mindanao Transmission Outlook for 2030

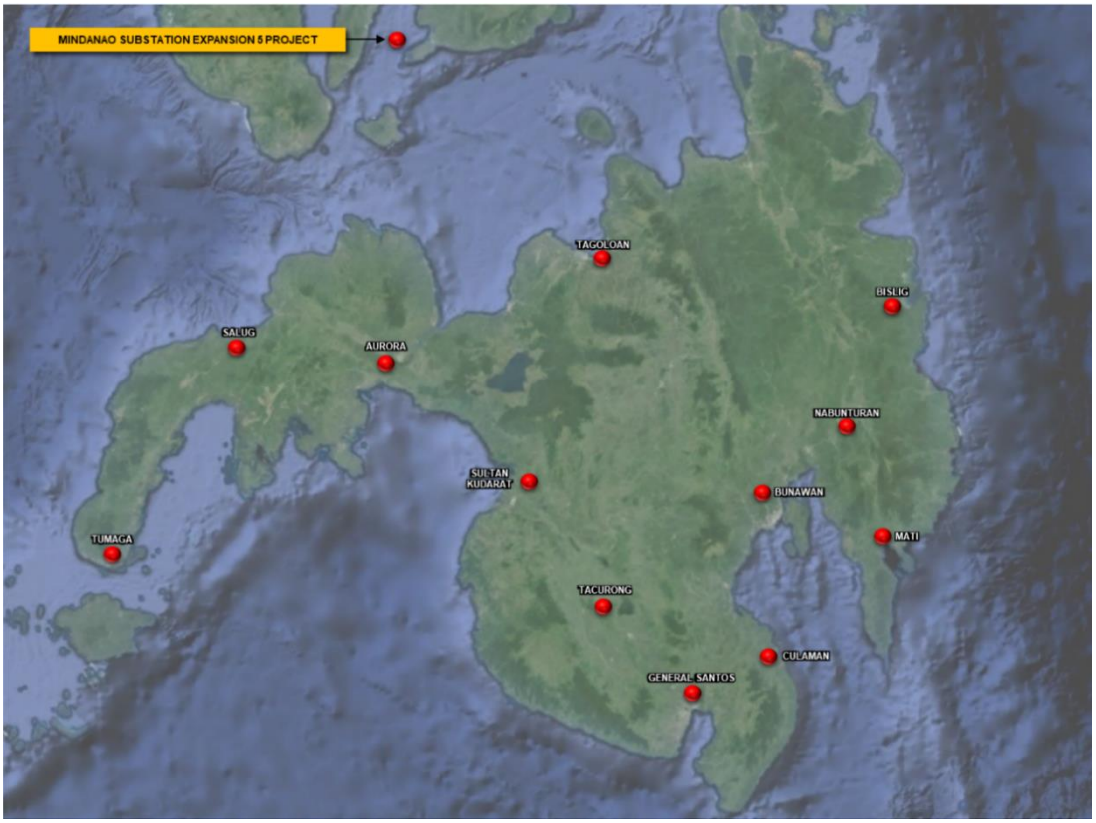


Figure 11.4: Proposed Mindanao Substation Expansion 5 Project

Table 11.2: Proposed Mindanao Transmission Outlook for 2030

Project Name/Driver(s)	Province(s) and Components	ETC
Load Growth		
Nasipit–Butuan 69 kV Transmission Line Project	Agusan del Norte	Jan 2026
	<u>*Substation Components:*</u> ▪ *Nasipit 69 kV Substation:* 1-69 kV PCB and associated equipment; ▪ *Butuan 69 kV Substation:* 1-69 kV PCB and associated equipment. <u>*Transmission Components:*</u> ▪ *Nasipit – Butuan 69 kV Transmission Line (Upgrading):* SP-SC, 1-795 MCM ACSR, 25 km.	
Placer – Luna 69 kV Transmission Line Project	Surigao del Norte	Dec 2026
	<u>*Substation Components:*</u> ▪ *Placer 69 kV Substation:* 1-69 kV PCB and associated equipment; ▪ *Luna 69 kV Substation (SURNECO):* 1-69 kV PCB and associated equipment. <u>*Transmission Components:*</u> ▪ *Placer – Luna 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 18 km.	
Opol – Carmen 69 kV Transmission Line Project	Misamis Oriental	Dec 2026
	<u>*Substation Components:*</u> ▪ *Opol 69 kV Substation:* 1-69 kV PCB and associated equipment; ▪ *Carmen 69 kV Substation:* 1-69 kV PCB and associated equipment. <u>*Transmission Components:*</u> ▪ *Opol-Carmen 69 kV Transmission Line (Upgrading):* SP-SC, 1-795 MCM ACSR, 12 km.	
Davao – Toril 69 kV Transmission Line 2 Project	Davao City	Dec 2026
	<u>*Substation Components:*</u> ▪ *Davao 69 kV Substation:* 1-69 kV PCB and associated equipment;	

	▪ *Toril 69 kV Substation:* 1-69 kV PCB and associated equipment. *Transmission Components:* ▪ *Davao – Toril 69 kV Transmission Line 2:* SP-SC, 1-795 MCM ACSR, 8 km.	
Villanueva – Kinamlutan 230 kV Transmission Line Project	Misamis Oriental, Agusan del Norte	Jan 2027
	Substation Components: ▪ *Kinamlutan 230 kV Substation (New):* 2x300 MVA, 230/138-13.8 kV Power Transformers and accessories, 8-230 kV PCBs and associated equipment, 7-138 kV PCBs and associated equipment; ▪ *Butuan 138 kV Substation:* 2-138 kV PCBs and associated equipment; ▪ *Villanueva 230 kV Substation:* 4-230 kV PCBs and associated equipment, 2x100 ohm, 138 kV Series Line Reactors. *Transmission Components:* ▪ *Villanueva – Kinamlutan 230 kV Transmission Line:* ST-DC, 2-795 MCM ACSR/AS, 157.5 km. ▪ *Butuan – Kinamlutan 138 kV Transmission Line:* ST-DC, 2-795 MCM ACSR/AS, 0.85 km Bulk Cost Estimate: 7,873.393 Million Pesos	
Koronadal 138 kV Substation Project	South Cotabato	Aug 2027
	Substation Components: ▪ *Koronadal 138 kV Substation (New): 2*x150 MVA 138/69-13.8 kV Power Transformers and accessories, 1x7.5 MVAR 69 kV Shunt Capacitor, 10-138 kV PCBs, 7-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Tacurong – General Santos 138 kV Transmission Line Bus-in: ST-DC, 1-795 MCM ACSR, 0.5 km* Bulk Cost Estimate: 1,893.649 Million Pesos	
Agus 6 – Kiwalan – Lugait 69 kV Transmission Line Project	Iligan City, Lanao del Norte	Oct 2027
	Transmission Components: ▪ *Agus 6 – Kiwalan – Lugait, 69 kV Transmission Line (Upgrading):* SP-SC, 1-795 MCM ASCR/AS, 27 km. Bulk Cost Estimate: 610.872 Million Pesos	
Tigbao 138 kV Substation Project	Zamboanga del Sur	Dec 2027
	Substation Components: ▪ *Tigbao 138 kV Substation (New):* 2x100 MVA 138/69-13.8 kV Power Transformers and accessories, 10-138 kV PCBs, 5-69 kV PCB and associated equipment. *Transmission Components:* ▪ *Tigbao – Dumalinao 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 15 km; Bulk Cost Estimate: 1,361.995 Million Pesos	
Maco – Tagum 69 kV Transmission Line Project	Davao de Oro, Davao del Norte	Dec 2027
	Substation Components: ▪ *Maco 69 kV Substation*: 1-69 kV PCB and associated equipment; ▪ *Tagum 69 kV Substation (DANECO)*: 1-69 kV PCB and associated equipment. *Transmission Components:* ▪ *Maco – Tagum – Magdum 69 kV Transmission Line (Upgrading):* SP-SC, 1-795 MCM ACSR/AS, 31 km; ▪ *Maco – Tagum 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR/AS, 12 km. Bulk Cost Estimate: 1,028.688 Million	
Naga Min – Pangi 69 kV Transmission Line Project	Zamboanga Sibugay	Dec 2027
	Substation Components: ▪ *Naga Min 69 kV Substation:* 1-69 kV PCB and associated equipment; ▪ *Pangi 69 kV Substation:* 1-69 kV PCB and associated equipment.	

	Transmission Components: *Naga Min – Pangi 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 12 km.	
Marawi – Malabang 69 kV Transmission Line Project	Lanao del Sur	Dec 2027
	Substation Components: ▪ *Marawi 69 kV Substation:* 1-69 kV PCB and associated equipment; ▪ *Malabang 69 kV Substation:* 1-69 kV PCB and associated equipment. *Transmission Components:* *Marawi – Malabang 69 kV Transmission Line (Upgrading):* SP-SC, 1-795 MCM ACSR, 62 km.	
Tumaga 138 kV Substation Project	Zamboanga City	May 2028
	Substation Components: ▪ *Tumaga 138 kV Substation (New):* 2x100 MVA, 138/69-13.8 kV Power Transformers and accessories, 10-138 kV PCBs, 6-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Tumaga 138 kV Bus-in Line to Zamboanga:* ST-DC, 1-795 MCM ACSR, 0.5 km; ▪ *Tumaga 138 kV Bus-in Line to Pitogo:* ST-DC, 1-795 MCM ACSR, 0.5 km; ▪ *Tumaga 69 kV Cut-in Line to Putik-Tumaga LES:* SP-DC, 1-795 MCM ACSR, 5 km. ▪ Bulk Cost Estimate: 1,502.157 Million Pesos	
Naga Min – Salug 138 kV Transmission Line Project (Initially energized at 69 kV)	Zamboanga Sibugay, Zamboanga del Norte	Jul 2028
	Substation Components: ▪ *Naga Min 138 kV Substation: 2-138 kV PCBs and associated equipment.* ▪ *Salug 69 kV Switching Substation (New): 4-138 kV PCBs and associated equipment.* *Transmission Components:* ▪ *Naga Min – Salug 138 kV Transmission Line: ST-DC, 1-795 MCM ACSR, 60 km.* Bulk Cost Estimate: 3,129.437 Million Pesos	
Midsayap 138 kV Substation Project	North Cotabato	Dec 2028
	Substation Components: ▪ *Midsayap 138 kV Substation (New):* 2x100 MVA, 138/69-13.8 kV Power Transformers and accessories, 10-138 kV PCBs and associated equipment, 4-69 kV PCB and associated equipment.	
Nabunturan – Monkayo 69 kV Transmission Line Project	Davao de Oro	Dec 2029
	Substation Components: ▪ *Nabunturan 69 kV Substation:* 1-69 kV PCB and associated equipment; ▪ *Monkayo 69 kV Substation (DANECO):* 1-69 kV PCB and associated equipment. *Transmission Components:* ▪ *Nabunturan – Monkayo 69 kV Transmission Line (Upgrading):* SP-SC, 1-795 MCM ACSR, 42 km.	
Matanao 230/138 kV Transformer Project	Davao del Sur	Dec 2030
	Substation Components: ▪ *Matanao 230 kV Substation:* 2x300 MVA 230/138-13.8 kV Power Transformers and accessories, 4-230 kV PCBs, 4-138 kV PCBs and associated equipment.	
Placer – Madrid 69 kV Transmission Line Project	Surigao del Norte	Dec 2030
	Substation Components: ▪ *Placer 69 kV Substation:* 1-69 kV PCB and associated equipment; ▪ *Marid 69 kV Substation (SURSECO II):* 1-69 kV PCB and associated equipment. *Transmission Components:* ▪ *Placer – Madrid 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 84 km.	
Mindanao Substation Expansion 5 Project (MSE5P)	Mindanao	Dec 2030
	Substation Components: ▪ *Tumaga 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Salug 138 kV Substation: 2*x50 MVA 138/69 kV Power Transformers and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment;	

	▪ *Aurora 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Bislig 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Nabunturan 138 kV Substation:* 2x100 MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Bunawan 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Mati 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Culaman 230 kV Substation:* 1x50 MVA 230/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *General Santos 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Tacurong 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Sultan Kudarat 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment	
System Reliability		
Sultan Kudarat – Tacurong 230 kV Transmission Line Project (Initially energized at 138 kV)	Maguindanao, Sultan Kudarat	Oct 2026
	<u>*Substation Components:*</u> ▪ *Tacurong 230 kV Substation (Expansion):* 5-230 kV PCBs and associated equipment, *2*-138 kV PCBs and associated equipment; ▪ *Sultan Kudarat 230 kV Substation (New):* 5-230 kV PCBs and associated equipment; ▪ *Sultan Kudarat 138 kV Substation:* 2-138 kV PCBs and associated equipment. ▪ <u>*Transmission Components:*</u> • *Sultan Kudarat – Tacurong 230 kV Transmission Line:* ST-DC, 2-795 MCM ACSR, 101 km; • *Sultan Kudarat 138 kV S/S – Sultan Kudarat 230 kV S/S (New) 138 kV Tie Line:* SP-SC, 1-795 MCM ACSR, 1 km. Bulk Cost Estimate: 5,887.700 Million Pesos	
Eastern Mindanao 230 kV Transmission Line Project (Initially energized at 138 kV)	Agusan del Norte, Surigao del Sur, Davao de Oro	Aug 2027
	<u>*Substation Components:*</u> ▪ *Kinamlutan 230 kV Substation (Butuan 230 kV Substation):* 4-230 kV PCBs and associated equipment; ▪ *Alegria 230 kV Substation (San Francisco 230 kV Substation):* 10-230 kV PCBs and associated equipment; ▪ *San Francisco 138 kV Substation:* 2-138 kV PCBs and associated equipment; ▪ *San Antonio 230 kV Substation (Bislig 230 kV Substation):* 10-230 kV PCBs and associated equipment; ▪ *Bukal 230 kV Substation (Nabunturan 230 kV Substation):* 6-230 kV PCBs and associated equipment: ▪ *Nabunturan 138 kV Substation:* 3-138 kV PCBs and associated equipment; ▪ *Bislig 138 kV Substation:* 4-138 kV PCBs and associated equipment. <u>*Transmission Components:*</u> ▪ *Kinamlutan-Alegria 230 kV Transmission Line:* SP/ST-DC, 2-795 MCM ACSR/AS, 92.9 km; ▪ *Alegria-San Antonio 230 kV Transmission Line:* SP/ST-DC, 2-795 MCM ACSR/AS, 92.9 km; ▪ *San Antonio-Bukal 230 kV Transmission Line:* ST-DC: 2-795 MCM ACSR/AS, 96.8 km; ▪ *San Francisco-Alegria 138 kV Tie Line:* ST-DC, 2-795 MCM ACSR/AS, 0.75 km; ▪ *Bislig-San Antonio 138 kV Tie Line:* ST-DC: 2-795 MCM ACSR/AS, 0.75 km. ▪ *Nabunturan-Bukal 138 kV Tie Line,* ST-DC: 2-795 MCM ACSR/AS, 0.5 km. Bulk Cost Estimate: 14,180.781 Million Pesos	

Opol Substation Bus-in Project	Misamis Oriental	Sep 2027
	Substation Components: ▪ *Opol 138 kV Substation:* 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 5-138 kV PCBs, 1-69 kV PCB 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. ▪ *Opol – Carmen 69 kV Transmission Line (Re-routing)*: SP-SC, 1-336.4 MCM, ACSR/AS, 0.5 km Bulk Cost Estimate: 885.396 Million Pesos	
Lala – Naga Min – Zamboanga 230 kV Transmission Line Project	Lanao del Norte, Zamboanga Sibugay, Zamboanga City	Jul 2029
	Substation Components: ▪ *Lala 230 kV Substation:* 4-230 kV PCBs and associated equipment; ▪ *Naga Min 230 kV Substation (Expansion): 2*x300 MVA 230/138-13.8 kV Power Transformers and accessories, 6-230 kV PCBs, 6-138 kV PCBs and associated equipment; ▪ *Zamboanga 230 kV Substation (Expansion): 2*x300 MVA 230/138-13.8 kV Power Transformers and accessories, 6-230 kV PCBs, 6-138 kV PCBs and associated equipment. *Transmission Components:* ▪ *Lala – Naga Min 230 kV Transmission Line:* ST-DC, 2-795 MCM ACSR/AS, 150 km; ▪ *Naga Min – Zamboanga 230 kV Transmission Line:* ST-DC, 2-795 MCM ACSR/AS, 110 km; Bulk Cost Estimate: 15,061.800 Million Pesos	
Lala–Malabang–Sultan Kudarat 230 kV Transmission Line Project	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): 2*x50 MVA 230/69-13.8 kV Power Transformer and accessories, 8-230 kV PCBs, 3-69 kV PCBs and associated equipment; ▪ *Sultan Kudarat 230 kV Substation: 4-*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 Project	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. *Transmission Components:* ▪ *Siom – Sindangan – Salug 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 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.	

11.3 Proposed Transmission Outlook for 2035

The development in eastern Mindanao is expected to escalate within this period which requires a new 138 kV transmission corridor to support such progress. Further, the upgrading of the existing 69 kV transmission lines is needed to prevent thermal overloading of the existing lines through a looped network that provides adequate line capacity to sustain the growing mining operations in CARAGA Region.

Within this period, the expansion of various facilities through the installation of additional transformers in each of the affected substations support the expected load growth in Mindanao.

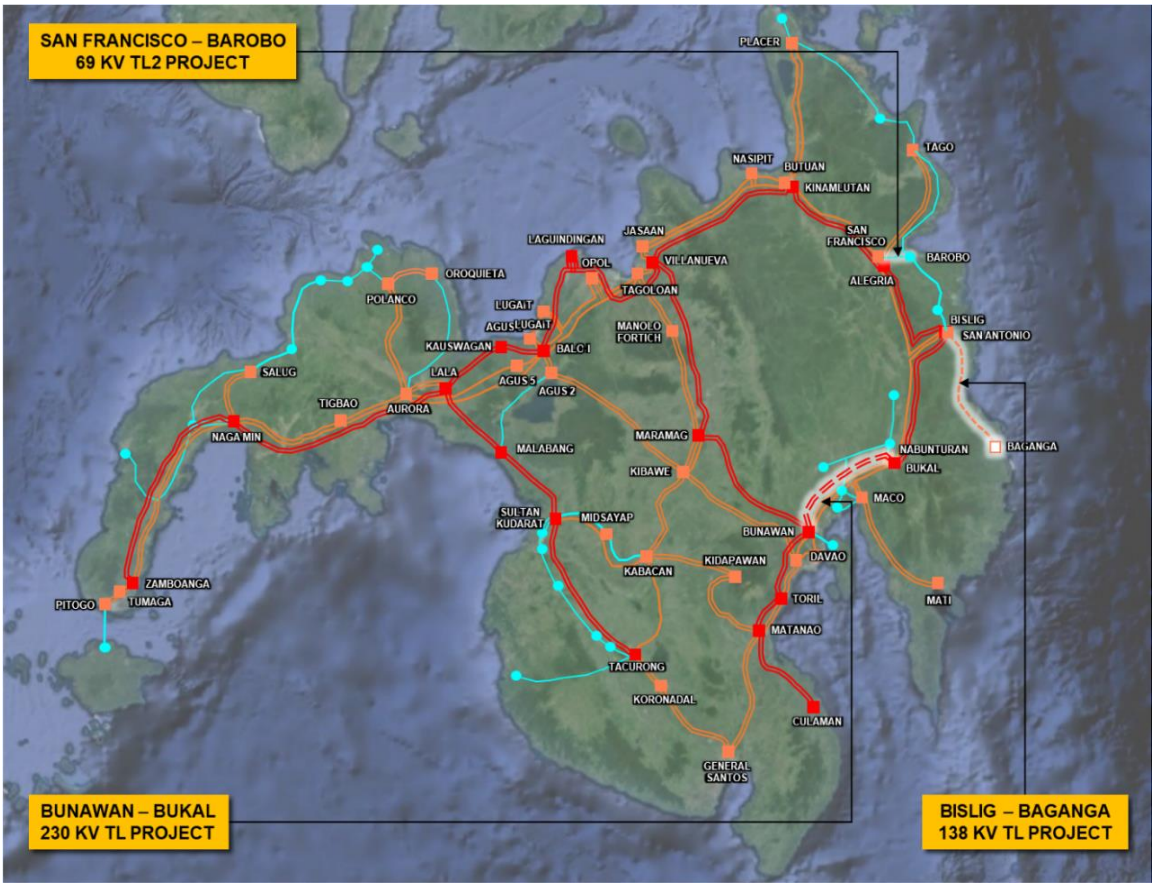


Figure 11.5: Proposed Mindanao Transmission Outlook for 2035

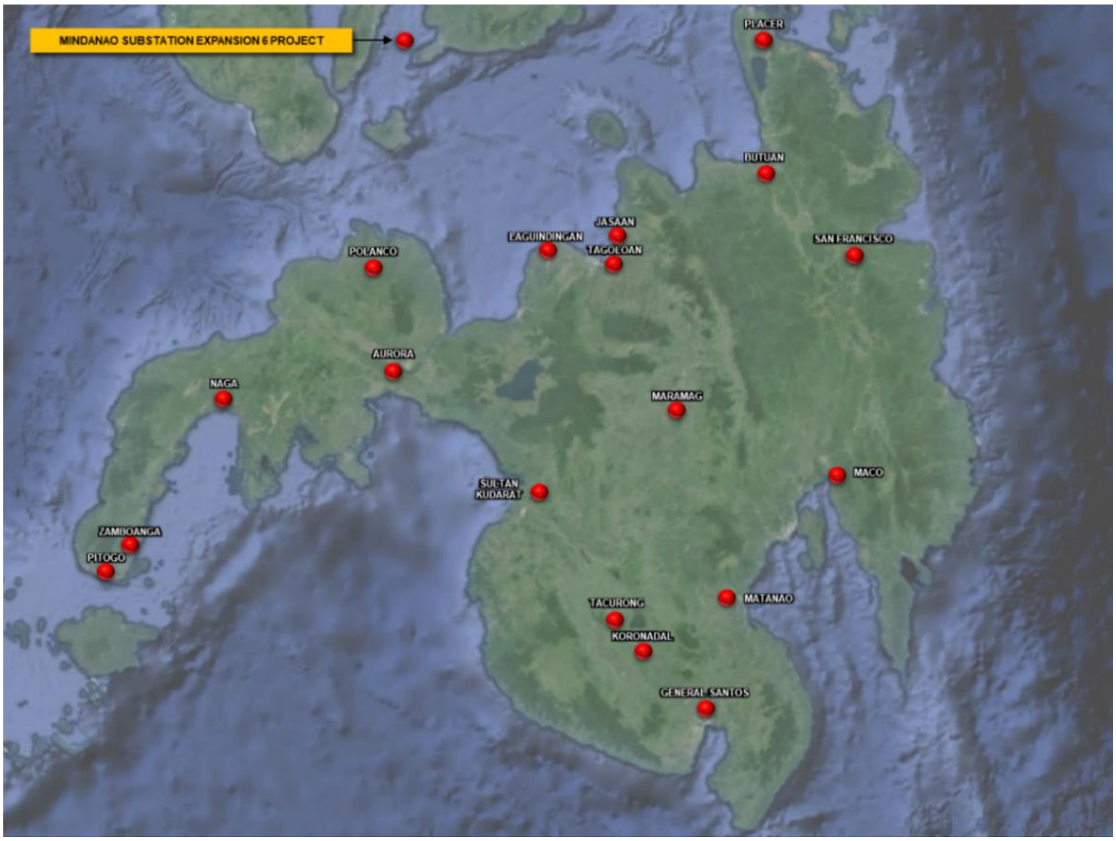


Figure 11.6: Proposed Mindanao Substation Expansion 6 Project

Table 11.3: Proposed Mindanao Transmission Outlook for 2035

Project Name/Driver(s)	Province(s) and Components
System Reliability	
San Francisco – Barobo 69 kV Transmission Line 2 Project	Agusan del Sur, Surigao del Sur *Substation Components:* ▪ *San Francisco 69 kV Substation: 1*-69 kV PCB and associated equipment; ▪ *Barobo 69 kV Substation (SURSECO I): 1*-69 kV PCB and associated equipment. *Transmission Components:* ▪ *San Francisco – Barobo 69 kV Transmission Line: ST-SC, 1-795 MCM ACSR, 16.6 km*
Bislig – Baganga 138 kV Transmission Line Project	Surigao del Sur, Davao Oriental *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. *Transmission Components:* ▪ *Bislig – Baganga 138 kV Transmission Line, ST-SC, 1-795 MCM ACSR, 85 km*
Bunawan – Bukal 230 kV Transmission Line	Davao City, Davao de Oro *Substation Components:* ▪ *Bukal 230 kV Substation: 4*-230 kV PCBs and associated equipment; ▪ *Bunawan 230 kV Substation:* 4-230 kV PCBs and associated equipment. *Transmission Components:* ▪ *Bunawan – Bukal 230 kV Transmission Line:* ST-DC, 2-795 MCM ACSR/AS, 70 km

Project Name/Driver(s)	Province(s) and Components
Load Growth	
Mindanao Substation Expansion 6 Project (MSE6P)	Mindanao <u>*Substation Components:*</u> ▪ *Pitogo 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Zamboanga 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Naga Min 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Aurora 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Polanco 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Laguindingan 230 kV Substation:* 1x300 MVA 230/138 kV Power Transformer and accessories, 2-230 kV PCBs, 2-139 kV PCBs and associated equipment; ▪ *Jasaan 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Tagoloan 138 kV Substation: 1*x150 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Maramag 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Butuan 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Placer 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ *San Francsico 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Maco 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Matanao 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ *General Santos 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Tacurong 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Koronadal 138 kV Substation: 1*x150 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Sultan Kudarat 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment.

11.4 Proposed Transmission Outlook for 2040

The identified grid expansion projects in Mindanao by 2040 mainly consider the anticipated demand load. The Mindanao Grid 230 kV transmission backbone network is extended towards Zamboanga Sibugay, Davao de Oro, and Southwestern areas to improve power reliability. The high-voltage network expansion projects are the Matanao – Tacurong 230 kV Transmission Line, Culaman-Gen. Santos 230 kV Transmission Line, and Nabunturan – Bunawan 230 kV Transmission Line. These transmission corridors complete the envisioned 230 kV loop system of the Mindanao Grid.

Expected development in new areas in Mindanao requires additional reinforcement of existing 69 kV transmission lines that provide more sustainable and reliable power supply delivery to their service areas. The reinforcement consists of upgrading the existing transmission facilities to a higher capacity which can be energized to a higher voltage level in the future.

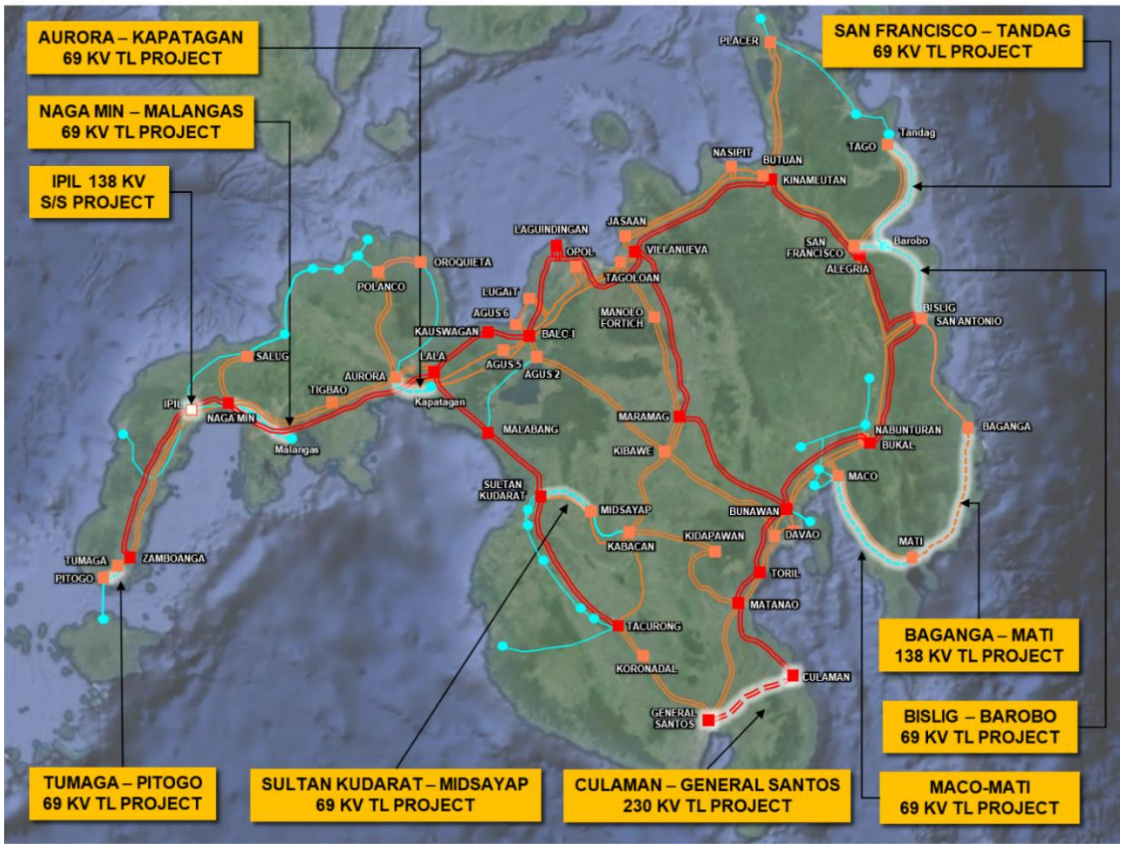


Figure 11.7: Proposed Mindanao Transmission Outlook for 2040

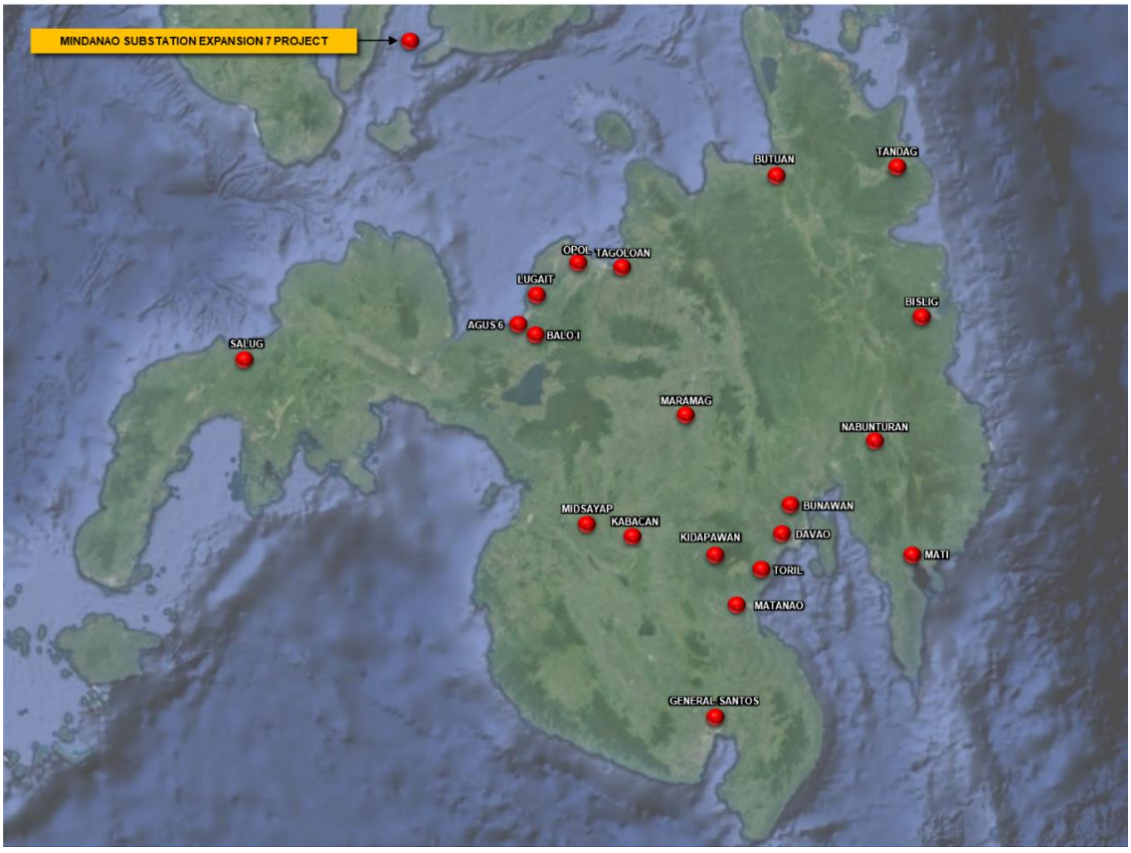


Figure 11.8: Proposed Mindanao Substation Expansion 7 Project

Table 11.4: Proposed Mindanao Transmission Outlook for 2040

Project Name/Driver(s)	Province(s) and Components
System Reliability	
Maco – Mati 69 kV Transmission Line Project	Davao de Oro, Davao Oriental *Substation Components:* ▪ *Maco 69 kV Substation:* 1-69 kV PCB and associated equipment; ▪ *Mati 69 kV Substation:* 1-69 kV PCB and associated equipment. *Transmission Components:* ▪ *Maco – Mati 69 kV Transmission Line:* ST-SC, 1-795 MCM ACSR, 48 km
San Francisco – Tandag 69 kV Transmission Line Project	Agusan del Sur, Surigao del Sur *Substation Components:* ▪ *Tandag 69 kV Substation:* 1-69 kV PCB and associated equipment; ▪ *San Francisco 69 kV Substation*: 1-69 kV PCB and associated equipment. *Transmission Components:* ▪ *San Francisco – Tandag 69 kV Transmission Line:* ST-SC, 1-795 MCM ACSR, 95.1 km
Naga Min – Malangas 69 kV Transmission Line Project	Zamboanga Sibugay *Substation Components:* ▪ *Naga Min 69 kV Substation:* 1-69 kV PCB and associated equipment; ▪ *Malangas 69 kV Substation:* 1-69 kV PCB and associated equipment. *Transmission Components:* ▪ *Naga Min – Malangas 69 kV Transmission Line:* ST-SC, 1-795 MCM ACSR, 40.94 km
Aurora – Kapatagan 69 kV Transmission Line Project	Zamboanga del Sur, Lanao del Norte *Substation Components:* ▪ *Aurora 69 kV Substation:* 1-69 kV PCB and associated equipment; ▪ *Kapatagan 69 kV Substation:* 1-69 kV PCB and associated equipment. *Transmission Components:* ▪ *Aurora – Kapatagan 69 kV Transmission Line:* ST-SC, 1-795 MCM ACSR, 25 km
Sultan Kudarat – Midsayap 69 kV Transmission Line Project	Maguindanao *Substation Components:* ▪ *Sultan Kudarat 69 kV Substation:* 1-69 kV PCB and associated equipment; ▪ *Midsayap 69 kV Substation:* 1-69 kV PCB and associated equipment. *Transmission Components:* ▪ *Sultan Kudarat – Midsayap 69 kV Transmission Line:* ST-SC, 1-795 MCM ACSR, 29.2 km
Baganga – Mati 138 kV Transmission Line Project	Davao Oriental *Substation Components:* ▪ *Baganga 138 kV Substation:* 2-138 kV PCBs and associated equipment; ▪ *Mati 138 kV Substation:* 2-138 kV PCBs and associated equipment. *Transmission Components:* ▪ *Baganga – Mati: 138 kV Transmission Line:* ST-SC, 1-795 MCM ACSR, 105 km
Bislig – Barobo 69 kV Transmission Line Project	Surigao del Sur *Substation Components:* ▪ *Barobo 69 kV Substation:* 1-69 kV PCBs and associated equipment; ▪ *Bislig 69 kV Substation:* 1-69 kV PCBs and associated equipment. *Transmission Components:* ▪ *Bislig – Barobo 69 kV Transmission Line:* ST-SC, 1-795 MCM ACSR, 56.6 km

Project Name/Driver(s)	Province(s) and Components
Tumaga – Pitogo 69 kV Transmission Line Project	Zamboanga del Sur
	<u>*Substation Components:*</u> ▪ *Pitogo 69 kV Substation:* 1-69 kV PCBs and associated equipment; ▪ *Tumaga 69 kV Substation:* 1-69 kV PCBs and associated equipment. <u>*Transmission Components:*</u> ▪ *Tumaga – Pitogo 69 kV Transmission Line:* ST-SC, 1-795 MCM ACSR, 38.8 km
Culaman – Gen. Santos 230 kV Transmission Line	Davao Occidental, South Cotabato
	<u>*Substation Components:*</u> ▪ *Culaman 230 kV Substation:* 4-230 kV PCBs and associated equipment; ▪ *General Santos 230 kV Substation (Expansion):* 4-230 kV PCBs and associated equipment. <u>*Transmission Components:*</u> ▪ *Culaman – General Santos* 230 kV Transmission Line: ST-DC, 2-795 MCM ACSR/AS, 60 km
Load Growth	
Ipil 138 kV Substation Project	Zamboanga Sibugay
	<u>*Substation Components:*</u> ▪ *Ipil 138 kV Substation (New):* 10-138 kV PCBs, 4-69 kV PCB and associated equipment.
Mindanao Substation Expansion 7 Project (MSE7P)	Mindanao
	<u>*Substation Components:*</u> ▪ *Salug 138 kV Substation: 1*x50 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Agus 6 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Balo-i 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Lugait 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Opol 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Tagoloan 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Butuan 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Tago 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Maramag 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Bislig 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Nabuturan 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment ▪ *Mati 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Bunawan 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Davao 138 kV Substation: 1*x150 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment ▪ *Toril 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Matanao 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Kidapawan 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *General Santos 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment

Project Name/Driver(s)	Province(s) and Components
	▪ *Kabacan 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Midsayap 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment

Chapter 12 – Major Island Interconnection

12.1 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 using 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.

12.1.1 Existing Island Interconnections

As of December 2020, 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 and 230 kV cables, 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 2016, 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 was 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.

12.1.2 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.

12.1.3 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

12.2 Transmission Backbone and Major Island Interconnection Projects for 2016-2025

Figure 12.1 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 6, 7, and 8, 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 12.2 shows the Existing and Future Philippine Network Topology of an interconnected grid.

The formulation of the Transmission Backbone and Major Island Interconnections 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 12.1: Transmission Backbone and Major Island Interconnections

Project Name	ETC	Project Status (as of Dec 2019)
1. Bolo to Laoag 500 kV Backbone Composed of Bolo–Balaoan and Balaoan–Laoag 500 kV Transmission Lines that will traverse the provinces of Pangasinan, La Union, Ilocos Sur, and Ilocos Norte. This 500 kV Backbone is	Apr 2028	• For ERC Application

Project Name	ETC	Project Status (as of Dec 2019)
intended to support the entry of large generation capacities in La Union, Mountain Province, and Ilocos area. It also aims to address the anticipated overloading of the San Esteban–Laoag and San Esteban–Bakun/Bacnotan–Bauang 230 kV Transmission Lines during N-1 contingency event.		
2. Nagsaag to Kabugao 500 kV Backbone Composed of Nagsaag–Santiago and Santiago–Kabugao 500 kV Transmission Lines that will traverse the provinces of Pangasinan, Isabela, Kalinga, and Apayao. This is to support the generation developments in Cagayan Valley and the Cordilleras. Furthermore, it also intends to augment and relieve the overloading of the Santiago–Bayombong and Bayombong–Ambuklao 230 kV Transmission Lines.	2031-2035	Transmission Components: • Nagsaag–Santiago 500 kV Transmission Line: For ERC Application • Santiago–Kabugao 500 kV Transmission Line: Under Project Development
3. Western Luzon 500 kV Backbone Subdivided in two stages: (a) Stage 1 is the construction of Castillejos–Hermosa 500 kV Transmission Line (initially energized at 230 kV), which provides a transmission facility to connect the 2x300 MW RP Energy CFPP to the Luzon Grid through Hermosa Substation; and (b) Stage 2 is 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 500/230 kV Substation, which will serve as the permanent connection point for RP Energy CFPP. The Western Luzon 500 kV Backbone will traverse the provinces of Pangasinan and Zambales.	Dec 2025	Transmission Components: • Stage 1, Castillejos–Hermosa 500 kV Transmission Line, 64.79% Complete • Stage 2; Bolo-Castillejos 500 kV Transmission Line and Castillejos 500/230 kV Substation, For ERC Application
4. Metro Manila 500 kV Backbone Loop The development of Metro Manila 500 kV Backbone Loop involves the implementation of the Silang 500 kV Substation, which will bus-in to the existing Dasmariñas–Tayabas 500 kV Transmission Line; the implementation of Taguig 500 kV Substation, which will initially cut-in to the existing San Jose–Tayabas 500 kV Transmission Line; the construction of the Silang–Taguig 500 kV Transmission Line; and the development of the Baras 500 kV Substation, which will bus-in to the existing San Jose–Taguig–Tayabas 500 kV Transmission Line. This forms the Silang–Taguig–Baras–Tayabas 500 kV Backbone Loop for Metro Manila. Another 500 kV Backbone Loop within Metro Manila will be developed through the Bataan–Cavite 500 kV Transmission Line Project.	Feb 2029	Transmission Components: • Taguig–Baras T/L (Land Portion) 28.48% Complete • Taguig Bus-in to Muntinlupa–Paco 230 kV T/L 24.13% Complete Substation Component: • Site Development 88.09% Complete Taguig 500 kV S/S 26.17% Complete
5. Batangas–Mindoro Interconnection The proposed interconnection of Mindoro Island with the Luzon Grid was envisioned to provide 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 nearest connection point in the Luzon Grid for the planned island interconnection project is the proposed Pinamucan 500 kV Substation, while Calapan would serve as the interconnection point in Mindoro Island.	Feb 2026	• Waiting for ERC Decision

Project Name	ETC	Project Status (as of Dec 2019)
6. Luzon–Visayas HVDC Bipolar Operation The Luzon–Visayas High Voltage Direct Current (HVDC) Bipolar Operation will accommodate additional generation, import and export to the Visayas Grid. This includes the development of the Naga 500/230 kV Substation, as well as upgrading of the Naga and Ormoc Converter/Inverter Stations.	Apr 2028	• Under Project Development
7. Palawan–Mindoro Interconnection Subdivided in 2 stages: (a) Stage 1 will include the Desktop, System and Feasibility Studies, and Hydrographic Survey of the submarine cable route of the Palawan–Mindoro Interconnection Project (PMIP). It will also include the preparation of the Mindoro Backbone through the development of Calapan–San Jose 230 kV Transmission Line Backbone and San Jose 230 kV Substation in Occidental Mindoro; and (b) Stage 2 will involve the implementation of the PMIP. It will utilize HVDC transmission system from San Jose Converter Station in Occidental Mindoro to Roxas Converter Station in Palawan. The power supply from the Luzon Grid will then be delivered to the proposed drawdown substations in Roxas, El Nido, and Irawan through the 230 kV High Voltage Alternating Current (HVAC) system. This interconnection project aims to provide the Mainland Palawan with a more reliable supply of power and to address the power quality issues, which result to frequent power interruptions.	Feb 2028	• Stage 1, Waiting for ERC Decision • Stage 2, Under Project Development
8. Cebu–Negros–Panay 230 kV Backbone The Cebu–Negros–Panay 230 kV Backbone involves the construction of a 230 kV transmission backbone between the Cebu, Negros and Panay Islands. It will augment the transfer capacity of the existing corridor which will support the transmission of excess power generation in Negros and Panay Islands toward the rest of the Philippine Grid. The project is subdivided into three (3) stages: (a) Stage 1 involves the development of transmission corridor composed of submarine cable system and overhead transmission lines from Barotac Viejo Substation in Panay to Bacolod Substation in Negros; (b) Stage 2 involves the construction of 230 kV facilities in the existing Cebu 138 kV Substation and harmonize its capacity with the 230 kV transmission backbone; and (c) Stage 3 involves the construction of 230 kV facilities from Barotac Viejo Substation to Cebu Substation.	Dec 2022	Stage 1 Transmission Components: Bacolod-E. B. Magalona T/L: 86.39%; Bacolod S/S: 100% Substation Components: • Bacolod S/S and Barotac Viejo S/S 100% Complete Stage 2 Transmission Components: • Cebu GIS–Magdugo T/L & Cebu–Lapu-lapu T/L 100% Complete Substation Components: • Cebu S/S 230 kV Upgrading 5.45% Complete • Underground Cable Turnkey (Underground Cable): 14.01% Complete Turnkey (Multi-Storey Facility): 27.22% Stage 3 Status of Phase 1:

Project Name	ETC	Project Status (as of Dec 2019)
		Submarine Cable: 96.65%, Reconductoring/Bundling of 138 kV T/L: 100%; E. B. Magalona–Cadiz–Calatrava 230 kV Erection T/L: 0.60%, Cadiz–Calatrava 230 kV Supply T/L: 100% Magdugo–Cebu (TVI) 230 kV T/L: 53.62%, Barotac Viejo S/S: 84.34%; Bacolod S/S: 36.72% Status of Phase 2: Cadiz S/S: For issuance to proceed, Calatrava S/S: 6.54%, E.B Magalona S/S: 1.50%, Magdugo S/S 0.53% Status of Phase 3: Cebu S/S (6-138kV PCB) and Quiot S/S (4-138kV PCB): 0.09% Status of Phase 4: Calatrava–San Carlos 69 kV T/L: For issuance to Notice to Proceed, S/S: For issuance of Notice to Proceed
9. Metro Cebu 230 kV Backbone Loop The Metro Cebu 230 kV Backbone Loop aims to pool the excess power resources from Negros, Panay and Mindanao and transmit it to the main load center in Metro Cebu. It involves the construction of several 230 kV transmission corridors and 230 kV drawdown substations with adequate capacities to facilitate the power absorption by the load-end customers. This long-term plan is the basis of the transmission projects in Metro Cebu spread within the 2040 planning horizon namely: 1. Cebu–Lapu-lapu Transmission Project 2. Cebu–Negros–Panay 230 kV Backbone Project Stages 2 and 3 3. Mindanao–Visayas Interconnection Project (MVIP) 4. Lapu-lapu 230 kV Substation Project 5. Laray–Alpaco 230 kV Energization Project 6. Laray–Cordova 230 kV Interconnection Project 7. Lapu-lapu–Cordova 230 kV Interconnection Project	2036-2040	1. Cebu–Lapu-Lapu 230 kV T/L Project Transmission Components: • Submarine Cable Notice of Award • Overhead T/L Preparation of Bidding Documents (rebidding) Substation Components: • Lapu-Lapu S/S 97.40% Complete 2. Cebu–Negros–Panay 230 kV Backbone Project Stages 2 and 3 Stage 2 Transmission Components: • Cebu GIS–Magdugo T/L & Cebu–Lapu-lapu T/L 100% Complete Substation Components: • Cebu S/S 230 kV Upgrading 5.45% Complete • Underground Cable

Project Name	ETC	Project Status (as of Dec 2019)
		Turnkey (Underground Cable): 14.01% Complete Turnkey (Multi-Storey Facility): 27.22% Stage 3 Status of Phase 1: Submarine Cable: 96.65%, Reconductoring/Bundling of 138 kV T/L: 100%; E. B. Magalona–Cadiz–Calatrava 230 kV Erection T/L: 0.60%, Cadiz–Calatrava 230 kV Supply T/L: 100% Magdugo–Cebu (TVI) 230 kV T/L: 53.62%, Barotac Viejo S/S: 84.34%; Bacolod S/S: 36.72% Status of Phase 2: Cadiz S/S: For issuance to proceed, Calatrava S/S: 6.54%, E.B Magalona S/S: 1.50%, Magdugo S/S 0.53% Status of Phase 3: Cebu S/S (6-138kV PCB) and Quiot S/S (4-138kV PCB): 0.09% Status of Phase 4: Calatrava–San Carlos 69 kV T/L: For issuance to Notice to Proceed, S/S: For issuance of Notice to Proceed 3. Mindanao–Visayas Interconnection Project (MVIP) Transmission Line Components: • Submarine Cable (Turnkey) Santander CTS-Dapitan CTS HVDC 59.89% Complete • Package A: Dumanjug-Magdugo 230kV T/L 73.43 % Complete • Package B: Kauswagan-Lala 230kV T/L & Aurora- Lala 138kV T/L 77.82% Complete • Package C:

Project Name	ETC	Project Status (as of Dec 2019)
		Dumanjug-Santander HVDC OHTL 69.75% Complete • Package D: Alegria-Dumanjug Electrode Line & Kolambugan-Lala Electrode Line 56.27% Complete Substation Components: • Dumanjug Converter Station & S/S Lala Converter Station & S/S Aurora S/S Magdugo S/S 64.16% Complete 4. Lapu-lapu 230 kV Substation Project Awaiting ERC Decision 5. Laray–Alpaco 230 kV Energization Project Under Project Development 6. Laray–Cordova 230 kV Interconnection Project Under Project Development 7. Lapu-Lapu–Cordova 230 kV Interconnection Project Under Project Development
10. Cebu–Bohol–Leyte 230 kV Backbone The Cebu–Bohol–Leyte 230 kV Backbone involves the construction of a 230 kV transmission backbone between the Cebu, Bohol and Leyte Islands. It increases the reliability the current transmission system by constructing several 230 kV facilities and to distribute the excess power generation from Negros, Panay and Mindanao toward power customers in Bohol, Leyte and Samar. This long-term plan is the basis of the transmission projects in Cebu, Bohol and Leyte spread within the 2040 planning horizon namely: 1. Cebu–Bohol 230 kV Interconnection Project 2. Babatngon–Palo 230 kV Transmission Line Project 3. Kananga–Babatngon 230 kV Transmission Line Project 4. Cebu–Leyte 230 kV Interconnection Lines 3 and 4 Project 5. Palo–Javier 230 kV Transmission Line Project 6. Bohol-Leyte 230 kV Interconnection Project	2031-2035	1. Cebu–Bohol 230 kV Interconnection Project • Corella S/S Checking of Manufacturer's drawings 2. Babatngon–Palo 230 kV Transmission Line Project Filed For PA 3. Kananga–Babatngon 230 kV Transmission Line Project Under Project Development

Project Name	ETC	Project Status (as of Dec 2019)
		4. Cebu–Leyte 230 kV Interconnection Lines 3 and 4 Project Under Project Development 5. Palo–Javier 230 kV Transmission Line Project Under Project Development 6. Bohol–Leyte 230 kV Interconnection Project Under Project Development
11. Mindoro–Panay 230 kV Interconnection Project The Mindoro–Panay 230 kV Interconnection Project creates a new interconnection between Luzon and Visayas Grids via Mindoro Island in the western region of the Philippines. It increases the power transfer capability of the system as this new transmission corridor accommodates the power generation in Luzon and Visayas especially power plants that are located within Competitive Renewable Energy Zones.	2036-2040	• Under Project Development
12. Luzon–Visayas 230 kV AC Interconnection Project The Samar–Sorsogon AC Interconnection Project will provide Samar Island an alternate power source. The creates a new interconnection between Luzon and Visayas Grids via extension of 230 kV backbone in Sorsogon towards Northern Samar.	2036-2040	• Under Project Development
13. Mindanao–Visayas Interconnection As part of the government's vision to interconnect the major grids into a single national grid, this interconnection project is intended to help improve the overall power supply security in the country by optimizing the use of available energy resources and additional generation capacities of the major grids through sharing of reserves from one grid to another. For more detailed information, please refer to sub-section 13.2.4.	Dec 2021	Transmission Line Components: • Submarine Cable (Turnkey) Santander CTS-Dapitan CTS HVDC 59.89% Complete • Package A: Dumanjug-Magdugo 230kV T/L 73.43 % Complete • Package B: Kauswagan-Lala 230kV T/L & Aurora- Lala 138kV T/L 77.82% Complete • Package C: Dumanjug-Santander HVDC OHTL 69.75% Complete • Package D: Alegria-Dumanjug Electrode Line & Kolambugan-Lala Electrode Line

Project Name	ETC	Project Status (as of Dec 2019)
		56.27% Complete Substation Components: • Dumanjug Converter Station & S/S Lala Converter Station & S/S Aurora S/S Magdugo S/S 64.16% Complete
14. Southwestern Mindanao 230 kV Transmission Backbone The Southwestern Mindanao 230 kV Transmission Backbone Project completes the envisioned 230 kV transmission looping at the southwestern side of the island. It provides transmission of reliable power supply in the far-flung areas of the island. Currently, there is a 69 kV and 138 kV single-circuit transmission facilities in existence in this part of Mindanao. With the completion of the projects under this umbrella project, the alternate transmission corridor becomes available for the reliable delivery of the required power supply in this region.	Dec 2030	1. Lala–Naga-Min–Zamboanga 230 kV T/L Project Transmission Components: • Lala–Naga-Min 230 kV T/L • Naga-Min–Zamboanga 230 kV T/L Substation Components: • Lala S/S • Naga-Min S/S • Zamboanga S/S For Filing to the ERC 2. Sultan Kudarat – Tacurong 230 kV T/L Project Transmission Components: • Sultan Kudarat – Tacurong 230 kV T/L • Sultan Kudarat 230 kV S/S – Sultan Kudarat 138 kV S/S Tie Line Substation Components: • Sultan Kudarat S/S • Tacurong S/S For Filing to the ERC 3. Lala–Malabang–Sultan Kudarat 230 kV T/L Project Transmission Components: • Lala–Malabang 230 kV T/L • Malabang–Sultan Kudarat 230 kV T/L Substation Components: • Lala S/S • Malabang S/S • Sultan Kudarat S/S

Project Name	ETC	Project Status (as of Dec 2019)
		Under Project Development
15. Eastern Mindanao 230 kV Transmission Backbone The Eastern Mindanao 230 kV Transmission Backbone Project loops the 230 kV transmission line backbone in the eastern region of Mindanao. It increases the power transfer capability of the system as this new transmission line accommodates the anticipated entry of loads from the mining industry and the expected load demand in the area. The project improves the system reliability providing a robust transmission network that offers N-1 contingency to the existing Butuan-San Francisco-Bislig-Nabunturan 138 kV single circuit line.	Aug 2027	Transmission Components: • Kinamlutan–Alegria 230 kV T/L • Alegria–San Antonio 230 kV T/L • San Antonio–Bukal 230 kV T/L • San Francisco–Alegria 138 kV Tie Line • Bislig–San Antonio 138 kV Tie Line • Nabunturan–Bukal 138 kV Tie Line Substation Components: • Kinamlutan S/S • Alegria S/S • San Francisco S/S • San Antonio S/S • Bukal S/S • Nabunturan S/S • Bislig S/S For Filing to the ERC

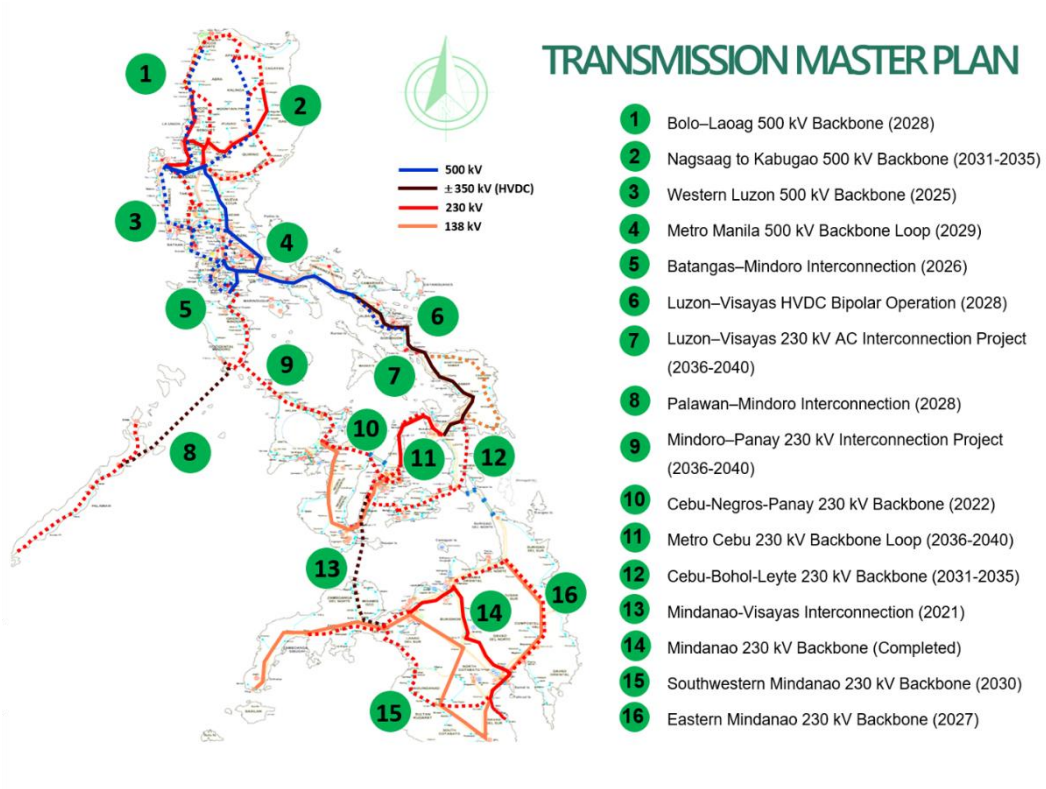


Figure 12.1: Transmission Backbones and Island Interconnections

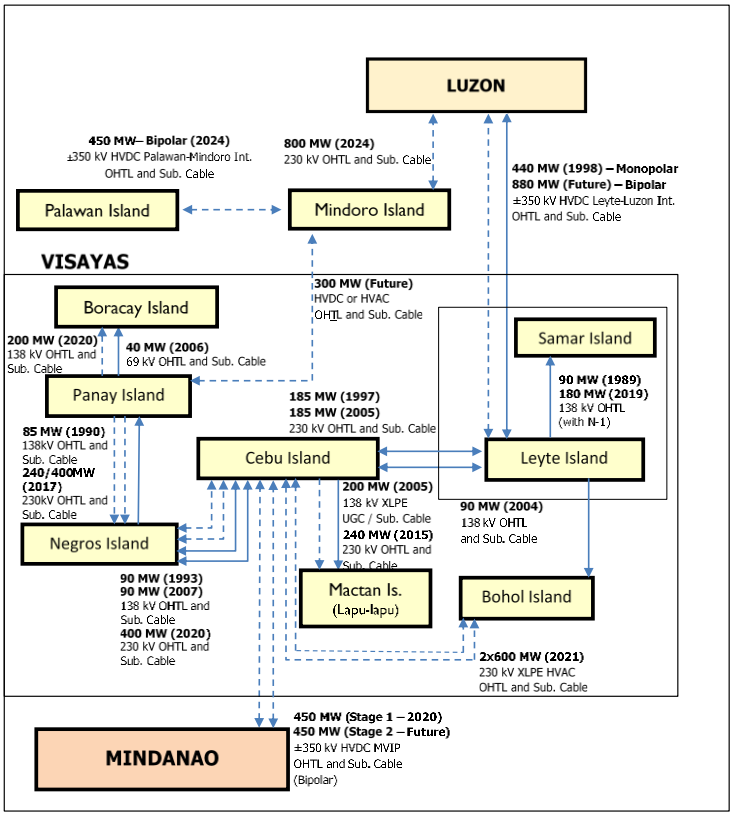


Figure 12.2: Existing and Future Philippine Network Topology

12.2.1 **Batangas–Mindoro Interconnection Project (BMIP)**

The power system of Mindoro Island, which is composed of 69 kV lines connected to several power plants and various load-end substations, is presently being operated by Small Power Utilities Group (SPUG) of the National Power Corporation (NPC). Power distribution to the consumers is handled by Oriental Mindoro Electric Cooperative (ORMECO) and Occidental Mindoro Electric Cooperative (OMECO). The major load center is in Calapan City in Oriental Mindoro and the total peak demand of the island in 2018 was more than 77 MW already, based on the combined total load of ORMECO and OMECO.



Figure 12.3: Batangas–Mindoro Interconnection Project

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:

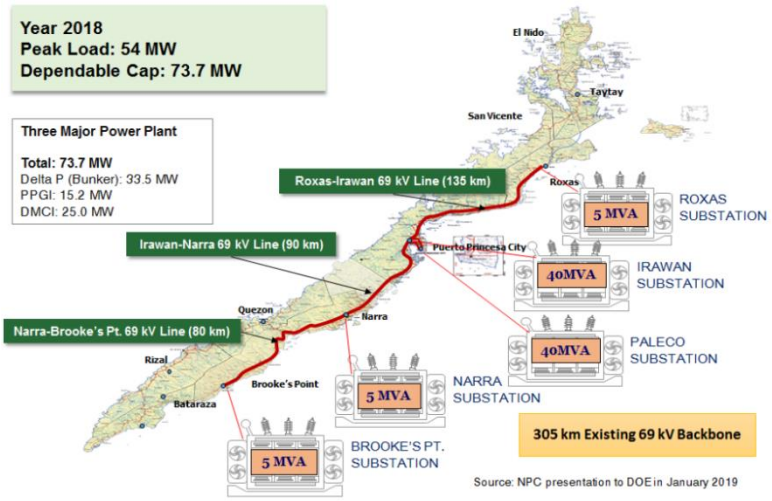
- Pinamukan–Lobo CTS 230 kV Transmission Line, ST-DC 2-795 MCM ACSR, 37 km;
- Lobo CTS-Mahal na Pangalan CTS 230 kV Submarine Cable, DC, 2-1,600 mm^2 XLPE, 25 km;
- Mahal na Pangalan CTS–Calapan 230 kV Transmission Line, ST-DC 2-795 MCM ACSR, 6 km;
- Pinamukan 230 kV Substation: 4-230 kV PCB and associated 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 Substation: 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.

12.2.2 **Palawan–Mindoro Interconnection Project (PMIP)**

With the envisioned interconnection of Mindoro Island to the Luzon Grid, the province of Palawan will be the next big island to be interconnected in terms of land area and energy demand. Presently, the power system of Palawan Island is composed of a 69 kV transmission corridor which stretches from Roxas in the north and extending down to Brooke's Point in the south with an estimated length of about 305 circuit-km. Based from 2018 record of the National Power Corporation (NAPOCOR), the main power grid of Palawan registered a peak load of 54 MW and being served by combination of bunker and diesel power plants with a dependable capacity of 73.7 MW.

Figure 12.4: Palawan-Mindoro Interconnection Project

The Palawan-Mindoro Interconnection Project (PMIP) will provide the Mainland Palawan a more reliable supply of power and to address the power quality issues which result to frequent blackouts experienced by customers. The project is also in support to the government's direction of interconnecting off-grid areas into the main grid.



By interconnecting the existing Palawan grid into the Luzon grid via Mindoro island, the current energy mix of the province, which is mainly oil-based, is seen to deviate from conventional sources in the forthcoming years. This is due to the projected entry of renewable energy power plants in which Palawan has high potential. A reliable transmission backbone and an opportunity to export power to the main grid will encourage the development of more renewable power plants in the province.

To interconnect Palawan to the Luzon Grid, NGCP will be implementing a stage-by-stage project development. Stage 1 will include the Desktop, System and Feasibility Studies and Hydrographic Survey of the submarine cable route of the Palawan–Mindoro Interconnection. Furthermore, Stage 1 will include the preparation of the Mindoro Backbone through the development of Calapan–San Jose 230 kV Transmission Line Backbone and San Jose 230 kV Substation in Occidental Mindoro. On the other hand, Stage 2 of the project will involve the physical implementation of the PMIP. Due to the significant distance from Palawan to Mindoro, it will utilize High Voltage Direct Current (HVDC) transmission system from San Jose Converter Station in Occidental Mindoro to Roxas Converter Station in Palawan. The power supply from the Luzon Grid will then be delivered to the proposed drawdown substations in Roxas, El Nido, and Irawan through the 230 kV High Voltage Alternating Current (HVAC) system.

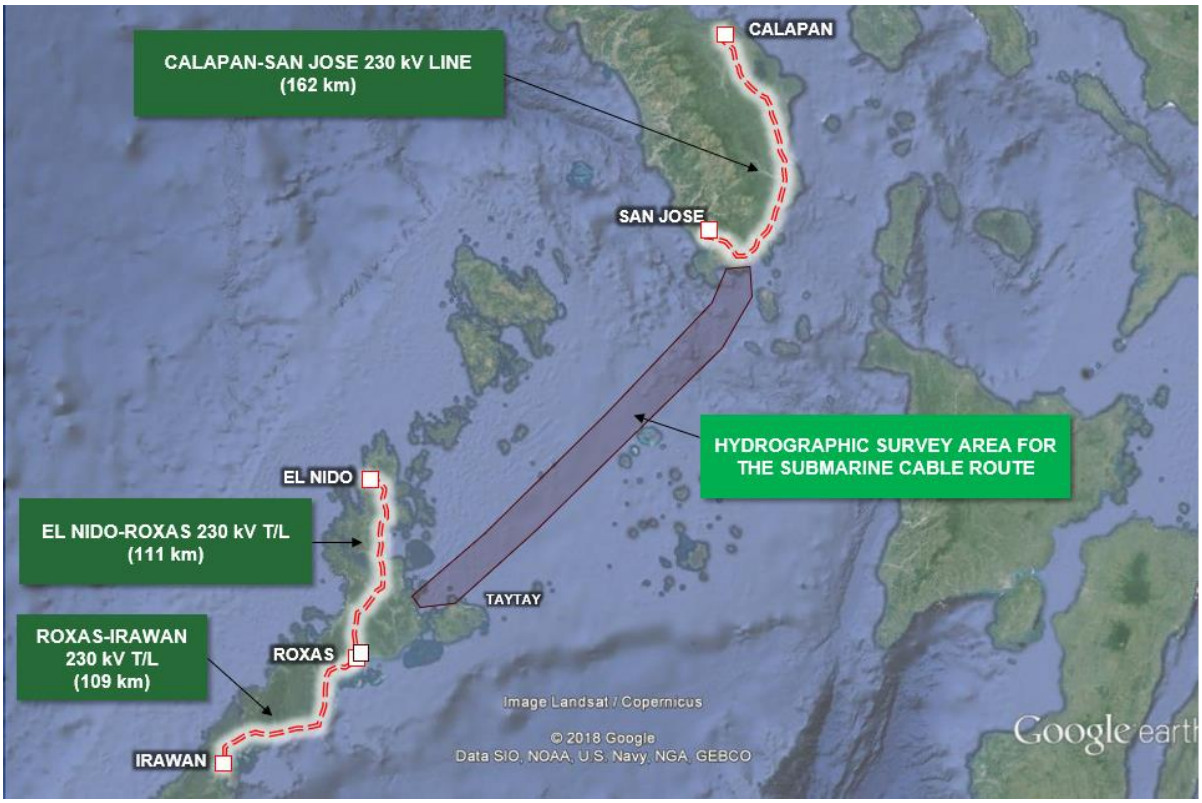


Figure 12.5: Hydrographic Survey Area for the Submarine Cable Route (PMIP)

Major Project Components:

- Desktop, System and Feasibility Studies and Hydrographic Survey of the Palawan–Mindoro Interconnection;
- Calapan–San Jose 230 kV Transmission Line, ST-DC 2-795 MCM ACSR, 154 km;
- Calapan 230 kV Substation: 4-230 kV PCBs and associated equipment;
- San Jose 230 kV Substation: 2x100 MVA 230/69 kV Power Transformer, 6-230 kV PCBs and associated equipment, 6-69 kV PCBs and associated equipment, 2x25 MVAR 230 kV Shunt Reactor and associated equipment;

This Palawan-Mindoro Interconnection Project will also prepare the country for interconnection with other ASEAN member states as envisaged in the ASEAN Power Grid under the Heads of ASEAN Power Utilities/Authorities or the regional initiatives for power grid interconnection being done by the Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area.

12.2.3 **Mindanao-Visayas Interconnection Project (MVIP)**

The Mindanao-Visayas Interconnection Project was previously known as Visayas-Mindanao Interconnection Project (VMIP). The change to MVIP indicates 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 benefits 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): 75 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 Substation: 53 km, 230 kV, ST-DC, 4-795 MCM ACSR;
- Umapad Substation Line Extension: 230 kV, ST-DC, 2-410 mm^2 STACIR, 2x0.1 km;
- Bus-in of Dumanjug to Colon–Samboan 138 kV OHTL, 138 kV, ST-DC, 1-795 MCM ACSR, 2x8 km;

c) Electrode Lines/Stations:
- Lala CS–Kolambugan ES: 20 kV OHTL (2 lines), 34 km, 2-795 MCM ACSR Condor; and
- Dumanjug CS–Alegria ES: 20 kV OHTL (2 lines), 31 km, 2-795 MCM ACSR Condor.

d) Converter Stations (Conventional Bipolar):

Dumanjug Converter Station:
- Thyristor Valves: 2x225 MW, 350 kV, 750 A, water cooled, air insulated, suspended, indoor 12-pulse single phase quadruple;
- Converter Transformers: 2x225 MW, 230 kV AC/350 kV DC, single phase and three - winding;
- Power Transformer: 2x150 MVA, 230/138-13.8 kV Power Transformers, 2x100 MVA 230/138-13.8 kV Power Transformers and accessories, 2x100 MVA, 138/69-13.8 kV Power Transformers and accessories;
- Power Circuit Breakers: 14-230 kV PCB and associated equipment, 12-138 kV PCB and associated equipment, 5-69 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: 2x225 MW, 350 kV, 750 A, water cooled, air insulated, suspended, indoor 12-pulse single phase quadruple;
- Converter Transformers: 2x225 MW, 230 kV AC/350 kV DC, single phase and three-winding;
- Power Transformer: 3x150 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 GIS Substation (New): 2x300 MVA, 230/69-13.8 kV Power Transformers and accessories, 8-230 kV PCBs (GIS), 10-69 kV PCBs (GIS) and associated equipment;
- Magdugo Substation (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, 92 km, ±350 kV HVDC, Bipolar, 1,500 mm^2 HVDC Mass Impregnated (MI) submarine cable.

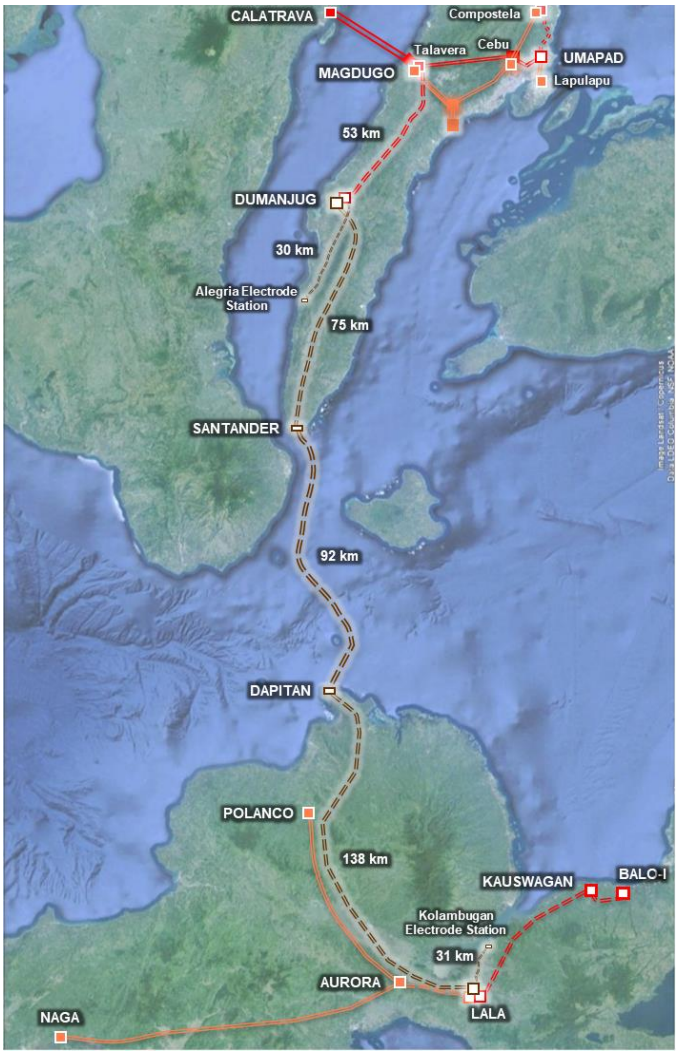


Figure 12.6: Connection Configuration of MVIP

12.2.4 **Luzon–Visayas 230 kV AC Interconnection Project**

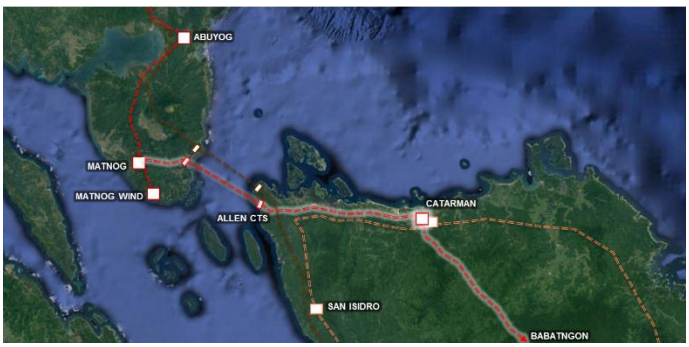


Figure 12.7: Leyte-Luzon Interconnection Project

Currently, Samar Island is highly dependent to Leyte due to the absence of generating power plants in the Island and since the existing Luzon-Visayas HVDC transmission system is terminated in Ormoc in Leyte. Isolation of Samar Island is possible in case of troubles that occur in Leyte thus, resulting to power interruption in the island. The Samar–Sorsogon AC Interconnection Project aims to provide Samar Island an alternate power source. This will address the high dependency of Samar to Leyte. Two circuits of 230 kV submarine cable with a transfer capacity of 400 MW per circuit will be laid connecting Sorsogon to Samar. Shown below are the major components of the project. This project will be pursued when the Luzon 230 kV backbone is already extended to the southern part of

Sorsogon. This will provide operational flexibility for the loads in Samar. Operationally, some substations in Samar will normally draw supply from Sorsogon.

Major Project Components:

Substation Portion
- Catarman 230 kV Substation: 2x300 MVA, 230/138-13.8 kV Power Transformers, 2x70 MVAR 230 kV Line Reactor, 6-230 kV PCB and 4-138 kV PCB and associated equipment
- Matnog 230 kV Substation (Expansion): 2x70 MVAR 230 kV Line Reactor, 4-230 kV PCB and associated equipment;

Transmission Line Portion
- Allen CTS–Catarman 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR, 27 km;
- Catarman–Babatngon 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR, 150 km;
- Matnog–Sta. Magdalena CTS 230 kV Transmission Line, ST-DC, 2-795 MCM ACSR, 18 km;

Submarince Cable Portion
- Sta. Magdalena CTS–Allen CTS 230 kV XLPE Submarine Cable, Double circuit with 400 MW transfer capacity per ckt, 23 km;
- Allen CTS: Cable Sealing End;
- Sta. Magdalena CTS: Cable Sealing End.

12.2.5 **Mindoro–Panay 230 kV Interconnection Project**

The Mindoro–Panay 230 kV Interconnection Project creates a new interconnection between Luzon and Visayas Grids via Mindoro Island in the western region of the Philippines. It increases the power transfer capability of the system as this new transmission corridor accommodates the power generation in Luzon and Visayas especially power plants that are located within Competitive Renewable Energy Zones.

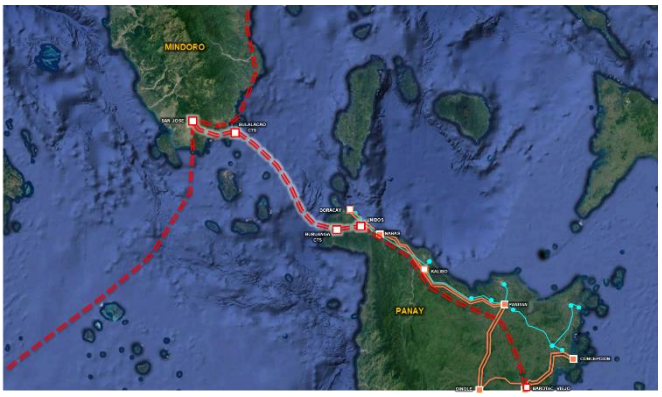


Figure 12.8: Mindoro-Panay 230kV Interconnection Project

Major Project Components:

Substation Portion
- San Jose 230 kV Substation: 2x70 MVAR 230 kV Line Reactors,6-230 kV PCBs and associated equipment
- Unidos 230 kV Substation: 2x70 MVAR 230 kV Line Reactors,6-230 kV PCBs and associated equipment

Transmission Line Portion
- San Jose S/S–Bulalacao CTS 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR, 15 km;
- Buruanga CTS–Unidos S/S 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR, 22.5 km;

Submarince Cable Portion

- Bulalacao CTS–Buruanga CTS 230 kV XLPE Submarine Cable, Double circuit with 600 MW transfer capacity per ckt, 75 km;
- Bulalacao CTS: Cable Sealing End;
- Buruanga CTS: Cable Sealing End.

12.3 Small Island/Off-Grid Interconnection

A significant number of islands and far flung areas in the country remain isolated from the main grids. These are classified as off-grid areas and the power systems in these areas are being operated and managed by NPC-SPUG. Some of these small islands were initially considered for further assessment. Shown in Table 12.2 below are the potential small island interconnections indicating the length of the required facilities and the peak load in the island.

Table 12.2: Potential Small Island Interconnections

Island	Interconnection Point	Length (km)			Population[a]	Land Area[b] (km^2)	2019 Peak Demand (MW)	2040 Peak Demand (MW)
		Submarine	Overhead	Total				
LUZON								
Catanduanes	Presentacion	32	8	40	260,964	1,492	13.54	34.39
Marinduque	General Luna	23	11	34	234,521	953	11.65	31.05
Ticao	Abuyog	20	35	55	95,129	385	2.59	7.49
Masbate	San Jacinto	16	16	32	706,897	3,337	21.99	56.12
Tablas	San Jose	61	36	97	164,012	844	8.72	23.15
Lubang	Calaca	54	20	74	28,920	245	1.19	4.77
Busuanga	San Jose	84	52	136	22,046	393	7.85	25.69
VISAYAS								
Bantayan	Medellin	21	24	45	144,116	134	8.90	28.36
Siquijor	Bacong	20	24	44	95,984	337	6.10	23.04
Camotes[1]	Isabel	18	8	26	91,688	204	3.72	12.51
Semirara	San Jose	33	0	33	14,892	55		
MINDANAO								
Siargao	Cagdiano	13	7	20	116,587	623	10.08	45.29
Samal[2]	Lasang	9	21	30	95,993	272	2.96	19.99
Basilan	Pitogo	27	12	39	297.306	690	10.90	25.98
Dinagat	Canlanipa	30	15	45	127,152	1,036	4.40	13.58
Camiguin	Esperanza	30	37	67	88,478	238	4.76	25.93
Siasi	Parang	43	32	75	67,705	193	0.90	1.91
Sulu	Taberlongan	100	34	134	607,735	2,055	9.44	22.19
Tawi-Tawi	Pagatpat	84	60	144	207,595	1,636	8.42	34.29

[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

As part of the country's power infrastructure development, the DOE published in February 2019 the Department Circular No. DC2019-01-001 entitled, "Prescribing the Omnibus Guidelines on Enhancement of Off-Grid Power Development and Operation". The main objectives are as follows:

a) Rationalize the operation and plan for the eventual phase-out of subsidies in missionary areas; and

b) Assess the economic feasibility and timeline for the eventual interconnection of off-grid areas into the grid.

As a way forward, NGCP will be undertaking the following:

a) Conduct overall due diligence leading to the prioritization of island/off-grid areas proposed to be interconnected to the grid; and

b) Conduct Techno-Economic Feasibility Study (Techno-Eco FS) on each proposed island/off-grid interconnection.

In the conduct of Techno-Eco FS, NGCP requires the following data from each island/off-grid area:

a) List of existing generating plants;
b) Generation capacity addition;
c) Historical/actual monthly power and energy demand;
d) Forecasted annual power and energy demand;
e) Updated off-grid power development;
f) True Cost Generation Rate (TCGR);
g) Historical UCMC subsidy;
h) Subsidized approved Generation Rate (SAGR); and
i) Available energy sources

Furthermore, under Rule 9 of the said DOE Circular requires NGCP as the TNP to:

a) Submit an annual program for the interconnection of off-grid areas into the grids; and

b) Include the same to the annual updating of the TDP.

Chapter 13 - Operation and Maintenance

NGCP has the mandate to maintain, operate, expand, and improve the high voltage backbone transmission system and facilities throughout the Philippines. This chapter contains the operation and maintenance Capital Expenditures (CAPEX) programs for the years 2021 to 2040 with the objective of increasing the reliability of the Grid and to improve the transmission system and facilities throughout the country for the reliable, adequate, secure, and stable service for all users of the nationwide electricity transmission system.

NGCP has an estimated total of around 157,654 operational assets[12]. These assets vary from substation primary equipment, protection relays, secondary devices to transmission line towers and other structures. In order to evaluate the condition of these assets, proper asset management must be observed.

The 20-year operation and maintenance program covers the major categories of expenditures enumerated below:

a. Installation, replacement, rehabilitation, and relocation of High Voltage Equipment.
b. Acquisition, Installation and replacement of Protection and Secondary Devices.
c. Rehabilitation of Transmission Lines and Subtransmission Lines which were not divested.
d. Acquisition and replacement of Test & Measuring Equipment, Maintenance Tools and Maintenance Vehicles
e. Acquisition of Spares for High Voltage Equipment, Transmission Lines and Secondary Device.
f. Construction and rehabilitation of Substation and Support Facilities that include projects to:
    i. Control and mitigate the effects of Fire and Flood;
    ii. Preserve and protect the Environment;
    iii. Resiliency Projects

13.1 CAPEX Program

With the goal of meeting the Performance Incentive Scheme (PIS) targets set forth by ERC, several O&M projects will be implemented through CAPEX programs. These programs will also be filed to ERC for each regulatory period:

13.1.1 Substation Reliability Program

This program covers acquisition, installation, and replacement works for high voltage equipment, protection and secondary devices, substation upgrading/automation and operation resiliency plans to ensure the reliable operation of the power grid. The prioritization of every equipment is dependent on planning criteria on Asset health index, as well as its risk assessment of the equipment discussed in Chapter 3.

In addition, with the DOE's initiative on the adoption of Resiliency Planning and Program in the Energy Industry, NGCP has identified and proposed risk reduction programs to ensure the reliable operation of the grid during times of disastrous events. Furthermore,

[12] as of December 2020

the foreseen adverse effects to be brought by disasters will be addressed in the most timely and efficient manner.

Program Scope

Ensuring the reliability of substation based on the planning criteria requires specific programs that will facilitate the replacement / installation / acquiring of the following equipment:

a. Replacement of Substation High Voltage Equipment

1) Power Transformers
2) Capacitor Banks
3) Shunt Reactors
4) Power Circuit Breakers
5) Surge Arresters
6) Voltage Transformers
7) Current Transformers
8) Disconnect / Earthing Switches
9) Station Service Transformers

b. Replacement of Protection and Secondary Devices

1) Power Transformer Protections
2) Capacitor Bank Protections
3) Shunt Reactor Protections
4) Bus Protections
5) Breaker Fail Protections
6) System Integrity Protection Scheme (SIPS) Relays
7) Power Transformer Fire Protections
8) IED Meters
9) Battery Banks
10) Battery Chargers
11) Uninterruptible Power Supply (UPS)
12) Back-up Generator Set

c. Substation Automation Program

1) Upgrade and Conversion to Microprocessor-based Substation Control (MBSC)
2) Installation of Central Control and Monitoring System (CCMS)
3) Conversion of manual to motorized Disconnect switches

4) MBSC components i.e. Servers, Bay Control Units, Workstations
5) Online Bushing Monitoring
6) Online Dissolve Gas Analyzer (DGA)

d. Resilient Operation

1) Mobile Transformer
2) Power Voltage Transformer
3) Spares Acquisition

13.1.2 Transmission Line Reliability Program

These projects include replacement of line-associated high voltage equipment, secondary devices and other accessories that are classified as transmission assets. All Transmission Lines which are subject to maintenance will require shutdown schedule, and materials dependent on the type of projects.

NGCP has identified transmission lines assets that needs necessary and requiring rehabilitation works to include major works such as replacement of steel pole, cross-arms, insulator, conductor and OHGW, etc. due to period of service, natural wear and tear and exposure to harsh environment.

a. Wood Pole Replacement Program

1) Steel Poles
2) Associated Line Hardware

b. Line Structure Relocation Program

1) Tower / Pole

c. Line-associated HVE Replacement Program

1) Power Circuit Breakers
2) Voltage Transformers
3) Current Transformers
4) Surge Arresters
5) Disconnect / Earthing Switches

d. Line-associated Secondary Devices Acquisition and Replacement Program

1) Line Protection
2) Feeder Protection
3) IED Meters

e. Line Equipment Installation / Replacement / Uprating

1) Air Break Switches
2) Line Arresters
3) Power Conductors
4) Overhead Ground Wires

13.1.3 Subtransmission Assets Reliability Program

These projects include acquisition, installation and replacement of associated high voltage equipment, secondary devices and other accessories that are classified as subtransmission assets. Subtransmission Assets which are subject to maintenance will require shutdown schedule, and materials dependent on the type of projects.

NGCP has identified subtransmission assets that requires installation / replacement plans due to prolonged period of service, natural wear and tear and exposure to harsh environment and compliance to safety and environmental mandate.

a. Subtransmission HVE Replacement Program

1) Power Transformers
2) Capacitor Banks
3) Power Circuit Breakers
4) Surge Arresters
5) Voltage Transformers
6) Current Transformers
7) Disconnect / Earthing Switches
8) Station Service Transformers

b. Wood Pole Replacement Program

1) Steel Poles
2) Associated Line Hardware

c. Subtransmission–associated Secondary Devices Acquisition and Replacement Program

1) Line Protection
2) Feeder Protection
3) Fault Locator
4) IED Meters
5) Uninterruptible Power Source (UPS)

6) Back-up Generator Set

d. Subtransmission Equipment Installation/Replacement

1) Air Break Switches
2) Line Arresters
3) Power Conductors
4) Overhead Ground Wires

e. Subtransmission Facility and Compliance Program

1) Transformer Firewalls
2) Transformer Fire Protections
3) Oil-Water Separator

13.1.4 O&M Tools and Equipment Program

In accordance with the standard test for all equipment, the following group of test equipment are being replaced & augmented:

a. Standard Maintenance Tools and Equipment

1) Primary Test Equipment

These are Test and Measuring Equipment (TME) used by the test group in the conduct of routine checking of all high voltage equipment in the substations.

2) Secondary Test Equipment

These are TMEs used by the protection, secondary devices and systems maintenance group in troubleshooting and routine test for the relays, batteries, SCADA / MBSC systems, cables and other auxiliaries in the substation.

3) Repair Tools and Equipment

Used by Substation Maintenance and Repair Group, basically in performing annual preventive maintenance, such as SF6 gas refilling and leak correction, mechanical correction and other repair works in the substation.

4) Common Tools

Substation operators and future Quick Response Team, upon the emergence of CCMS, are assigned to conduct routine patrol which are part of their daily assignment. Part of the tools needed are the grounding clusters, voltage detector and IR scanner.

5) Line Maintenance and Inspection Tools

Aside from the preventive and corrective maintenance activities that requires standard tools, transmission line personnel were assigned to conduct routine inspection of transmission asset. One of the latest technologies that will be acquired is the Aerial Drones. This new technology will expedite the inspection and assessment of the transmission line assets.

6) Maintenance Vehicles

TMEs, Tools and Equipment by the maintenance personnel shall be carried to site by an appropriate type of vehicles intended for the same purpose and activity. These vehicles form part of basic fleet of equipment which are also being maintained and subject to replacement as necessary to ensure the safety and performance of the maintenance personnel and equipment.

13.1.5 Network Facility Improvement Program

Most of the NGCP facilities and buildings were constructed several decades ago. Security and safety standards were different back then. To comply with the IMS Certification, additional security and safety standards must be implemented.

Also, from the time that NGCP took over the operation of the transmission network, additional equipment are utilized to cope up with the fast-technological advancements in the field which require additional facilities or extension of existing buildings for proper storage and also to provide the personnel with good working environment.

In addition to these improvements, NGCP must construct facilities to comply with environmental standards, regulations and practices under Philippine Environmental Laws and Regulations, and NGCP's Integrated Management System (IMS) such as oil catch basin, water separator for generator set, transformers, station service and shunt reactors, hazardous waste storage facilities, etc.

1) Anti-Flooding

Due to previous incidents of typhoons hitting the country and the recent changes in the weather conditions, several substations that were not susceptible to flooding in the past are now vulnerable to flooding, thus, it is necessary to design and construct an anti-flooding system to prevent interference with the operation of the substation.

2) Anti-Fire

Anti-fire projects are proposed to detect, prevent or control, and extinguish the fire as soon as possible. This project aims to avert if not lessen the impact of destruction brought by an unanticipated outbreak of fire. In addition, the replacement and upgrade of the fire prevention system of old NGCP facilities are necessary for compliance with existing international, national, and local regulations on the installation of the fire protection system.

3) Environmental Compliance

The tendered generator set houses, hazardous waste facility, some installed transformers/station service, and shunt reactors have no oil catch basins and water-oil separators. As part of the legal requirement and other applicable laws and regulations, there is a need to construct these structures.

The purpose of the project is to provide all necessary environmental, civil, and electrical works to comply with the new safety, security, and environmental standards set by Philippine Environmental Laws and Regulations, Bureau of Fire, and NGCP's Integrated Management System (IMS) compliance requirements. This project may require new installation and upgrading of the existing structures to comply with these requirements.

4) Construction/Expansion/Improvement of Control Building and other facilities
NGCP has set new safety and security standards including IMS requirements for civil works of buildings and other facilities. These standards and requirements require new buildings or upgrading of the existing structures.

1) New Buildings/Building Extension

New buildings/building extensions are often constructed due to lack of office/equipment space, especially during substation upgrading. NGCP adheres with the provisions of the Philippine National Building Code, hence, the building design considers proper security against pilferage and sabotage, and the provision of safety equipment for fire and earthquake scenarios.

2) Perimeter fences/Gates and Guard House

Existing perimeter fences and gates are being upgraded to comply with the new security standards; Provision of additional walls, columns, and beams to increase the structure's height and the replacement of dilapidated and non-compliant gates is being implemented.

3) Laydown Area

In NGCP's rigorous effort to upgrade and expand transmission facilities, new laydown areas will be constructed to expand the capacity of the substation to house new equipment in compliance with proper handling and storage of equipment prior to installation.

13.1.6 Summary of 2021- 2040 CAPEX Budget Requirements

The estimated CAPEX Budget for the 2021-2040 TDP is shown in Table 13.1.

Table 13.1: Summary of CAPEX Cost 2021-2040 (in Million Php)

TDP 2021-2040 O&M PROJECTS	Asset Replacement	Compliance to Standards	Technology Installation	Maintenance Equipment	Resilient Operation	TOTAL
Substation Reliability Projects	22,742.91	2,731.64	3,331.41	-	7,229.09	**36,035.04**
Transmission Line Reliability Projects	12,912.23	2,850.83	168.62	-	2,571.80	**18,503.48**
SubTransmission Line Reliability Projects	4,615.95	1,453.41	22.30	-	16.49	**6,108.14**

O&M Tools & Equipment	-	-	169.15	7,590.78	45.44	**7,805.36**
Network Facility Improvement	-	1,176.97	-	-	-	**1,176.97**
TOTAL	**40,271.09**	**8,212.85**	**3,691.47**	**7,590.78**	**9,862.82**	**69,629.00**

The O&M CAPEX Program will also include the Grid Protection Relay Replacement Project (Priority 1, 2 and 3) or GPRRP. The project involves the replacement of protection relays in Luzon, the Visayas and Mindanao Grids to ensure the safe, secure and reliable system operations.

The protection relay replacements also include other protection associated equipment, such as control system, auxiliary system, teleprotection system, construction of control buildings, which are necessary to efficiently and properly operate the protection relays.

The implementation of GPRRP commenced in 2019 and targeted to be completed in 2025. The bulk cost estimate of the project is Php 8,893.80 Million.

13.2 Metering Facilities

13.2.1 Obligations of Metering Service Provider for the Wholesale Electricity Spot Market

The NGCP, as the entity granted by the ERC with the Certificate of Authority as Metering Service Provider (MSP) for the WESM, is responsible for ensuring compliance of Grid-connected Facilities to the metering requirements prescribed by the OATS Rules, WESM Rules and Metering Manual, PGC, PEC, other applicable laws and supplemental guidelines issued by the ERC and the DOE. This responsibility of the MSP is defined under Article III of ERC Resolution 28 Series of 2006 – Guidelines for the Issuance of Certificate of Authority for WESM Metering Service Provider (WMSP).

According to the ERC Resolution, only an ERC-licensed WMSP shall be allowed to enter into a contract with a WESM Trading Participant for the provision of metering services which include in its scopes the installation, operation and maintenance of metering facilities. In addition to these scopes of metering services, OATS Rules also requires the WMSP to provide additional services as may be required by WESM Rules and applicable WESM Manuals.

The PGC 2016 Edition, consistent with the ERC Resolution and OATS Rules, states that a metering facility may only be declared as ready for revenue metering service when prescribed regulatory conditions are satisfied as certified by the WMSP.

a. Revenue Metering Capital Projects

In order to satisfy these technical and commercial obligations as WMSP, NGCP is required to continuously undertake metering capital projects, in addition to the usual

operation and maintenance activities. These projects are classified into two major categories, namely:

1) Regulatory Requirements Compliance Projects

The main driver for this project category is compliance to the metering requirements prescribed by the applicable rules governing the WESM. There are four sub-categories under the regulatory requirements compliance projects:

i. New Metering Facilities – this will ensure that all new connections to the grid will be properly metered and certified as WESM Ready.

ii. Relocation of Metering Facilities – this will ensure that all power and energy delivered to and withdrawn from the Transmission Grid will be properly metered with respect to the prescribed connection point.

iii. Compliance of Metering Facilities – this will correct existing non-compliances of metering facilities.

iv. Measurement Assurance Program – this will enable NGCP to continuously perform its obligation of providing calibration traceability to WESM metering facilities.

2) Metering Systems Reliability Projects

The main drivers for this project category are security and reliability of metering facilities in order to maintain state of compliance to regulatory requirements. There are two sub-categories under the metering systems reliability projects

i. Metering Spares – this will ensure the timely replacements of failed and fully-aged metering equipment

ii. Automated Meter Data Retrieval (AMR) System Operation – this will ensure the accurate and timely provision of metered data for energy settlement in the electricity market

b. Revenue Metering Capital Assets

The following rules of WESM Metering provide the rationale for the NGCP metering Capital Projects and the necessary revenue metering Capital Assets required to implement the projects:

Table 13.2: Metering Capital Asset Requirements

Project Sub-Categories	Capital Asset Requirements	Governing Rules
New Metering Facilities a. Full Metering b. Meter Only	Meters Current Transformers Voltage Transformers Lightning Arresters Communication Devices Meter Enclosure Test Switches	OATS Rules ▪ E3 ▪ E11.1* ▪ E11.3 ▪ E11.4 ▪ F(AIII) 3

	Cablings Grounding System Conduit System Mounting Structures* Concrete Foundations* Exclusion fence*	WESM Metering Manual ▪ 2.3.1 PGC 2016 Edition ▪ GRM 9.2.2.3 ▪ GRM 9.2.4.3 ERC Resolution 23 S2016 ▪ 6.0
Relocation of Metering Facilities a. Transmission Customer b. NGCP Station Service	Meters Current Transformers Voltage Transformers Lightning Arresters Communication Devices Meter Enclosure Test Switches Cablings Grounding System Conduit System Mounting Structures* Concrete Foundations* Exclusion fence*	OATS Rules ▪ E2.1 ▪ E11.8 ▪ F(AIII) 3 WESM Metering Manual ▪ 2.2-2.3 PGC 2016 Edition ▪ GRM 9.2.1 ▪ GRM 9.2.2.3 ERC Resolution 23 S2016 ▪ 6.0 DOE DC 2018-05-0015 (c) Clause 3.2.2.2 DOE DC2016-05-0007 ▪ Section 2
Compliance of Metering Facilities	Meters Current Transformers Voltage Transformers Lightning Arresters	WESM Metering Manual ▪ 2.4-2.11 PGC 2016 Edition ▪ GRM 9.2.2 ▪ GRM 9.2.3 DOE DC2016-05-0007 ▪ Section 1
Measurement Assurance Program a. Laboratory Standards b. Field Test Instruments c. Other O&M Tools	CMCL Standards Multi-meters Clamp Meters CT/PT Test Sets Meter Test Sets Insulation Testers Earth Testers Thermal Scanners	PGC 2016 Edition ▪ GRM 9.2.4.2 ▪ GRM 9.2.5 ERC Resolution 28 S2006 ▪ 2.2.2.3 ▪ 2.2.2.4 DOE DC2016-05-0007 Section 1
Metering Spares a. Equipment Failure b. Ageing Assets	Meters Current Transformers Voltage Transformers Lightning Arresters Communication Devices	OATS Rules ▪ E3 ▪ E11.3* PGC 2016 Edition ▪ GRM 9.2.4.1 (f) (g) ▪ GRM 9.2.4.3 ▪ GRM 9.2.8.4 ERC Resolution 23 S2016 ▪ 6.0 ERC Resolution 28 S2006 ▪ 3.4.5
AMR System Operation	Meter Data Retrieval and Validation System	OATS Rules ▪ F(AIII) 3

	Communication Devices	WESM Metering Manual ▪ 2.9.2 PGC 2016 Edition ▪ GRM 9.3 ERC Resolution 28 S2006 ▪ 2.2.2.3.4

*Owner of the metering perimeter where the Metering Point is located shall cover the cost of permanent structures such as Concrete Foundations and Perimeter Fence.

Recovery of capital investments in revenue metering capital assets and the operating costs in providing metering service is provided for under the ERC's Transmission Wheeling Rates Guidelines, OATS Rules, and the WESM Rules.

13.2.2 Requirement Analysis

The metering capital project requirements, which translate into revenue metering capital assets were derived from the technical and commercial obligations of a Metering Service Provider as defined by the authorities that governs WESM Metering through the OATS Rules, WESM Metering Manual, PGC and guidelines issued by ERC or DOE.

a. New Metering Facilities

This project, formerly referred to as Expansion Project, covers the installation of Metering Facilities for new Generator and/or Load Customer connections to the Grid.

According to OATS Rules, the Transmission Customer may provide the metering equipment installed at the connection point except for the revenue meters, which shall be provided by the Metering Service Provider. This requirement serves as the basis for the following project classifications for New Metering Facilities and the corresponding metering tariffs applied to the Transmission Customers:

1) Full Metering – all metering equipment are provided by NGCP

2) Meter Only – all other equipment, except for the meters, may be provided by the Transmission Customer subject to agreement with NGCP.

However, in line with the issuance of ERC Resolution 23 Series of 2016 which excludes the metering equipment used for Metering Service from the connection assets of Transmission Customers and requires the disposal or transfer assets with transmission function in favor of the Transmission Provider, all projects included in this 2021-2040 TDP will be classified under Full Metering Projects.

The list of new metering facilities will be determined based on the following considerations:

1) Requirements for new metering facilities for Transmission Customers which have already been communicated to NGCP through requests for facility studies et al.

2) Private Sector Initiated Power Projects as published at the DOE Website

3) Growth forecast for new load customer connections

b. Relocation of Metering Facilities

This project covers the relocation of Metering Facilities to the prescribed connection point as defined by the technical requirements governing WESM Metering.

According to PGC and WESM Metering Manual, the Metering Point shall be located at the Connection Point or Market Trading Node. DOE DC2018-05-0015 further clarified that the metering equipment for the market trading node shall be installed no more than 500 meters from the connection point. ERC Resolution 23 Series of 2016, on the other hand, redefined the connection point based on the functionality of assets, regardless of its ownership.

These requirements and new definition of connection point serve as the basis for the following project classifications under Relocation of Metering Facilities:

1) Transmission Customer Metering – existing transmission customer metering point/s not located at the prescribed connection point will be transferred or totalized at the prescribed connection point

2) NGCP Station Service Metering – permanent metering facilities will be installed at the prescribed connection points using WESM compliant metering equipment

The Full Metering and Meter Only classifications should also apply to this project since according to OATS Rules, the owner of the metering equipment shall assume the cost of relocation. However, in consideration of the ERC Resolution 23 Series of 2016, Meter Only metering facilities affected by the relocation by function requirement will be re-classified into Full Metering.

The list of metering facilities for relocation will be determined based on the following considerations:

1) Connection point/s as defined by ERC Resolution 23 Series of 2016

2) Metering points located more than 500 meters from the connection points

3) Existing NGCP Station Service Transformers and corresponding locations of temporary metering points

c. Compliance of Metering Facilities

This project, formerly referred to as Upgrading Project, will address non-compliances of installed metering equipment against the standards prescribed by PGC and WESM Metering Manual such as, but not limited to, the following:

1) Metering Equipment or Facilities not meeting required specifications

2) Metering Equipment not used exclusively for WESM revenue metering purpose

According to WESM Metering Manual, continued non-compliance of metering installations shall be subject to sanctions or penalties. To ensure full compliance to this requirement, NGCP will undertake the procurement of replacement assets regardless of the ownership of the existing equipment. This is also in consideration of ERC Resolution 23 Series of 2016.

The list of metering facilities for compliance will be determined based on the following audit results:

1) Self-audit performed by NGCP

2) Metering Arrangement Reviews by PEMC/IEMOP

d. Measurement Assurance Program (MAP)

This project covers the procurement of the following Other Utility Plant (OUP) to support the compliance of NGCP to the Measurement Assurance System requirements of PGC 2016 and ERC Resolution 28 Series of 2016:

1) Laboratory Standards

2) Field Test Instruments

3) Other Operations and Maintenance (O&M) Tools

According to PGC, the Metering Service Provider shall operate and maintain a measurement assurance system consisting of procedures, meter calibration standards and testing equipment and a central meter calibration laboratory. The purpose of this according to ERC Resolution 28 Series of 2006 is to ensure the traceability of measurements of metering equipment to National Institute of Standards or to any reputable international standard body.

The list of Laboratory Standards and Field Test Instruments will be determined based on the following Considerations:

1) Calibration traceability requirements for field test instruments and installed metering equipment

2) Operational requirements per field metering sections (existing vs. required test instruments and O&M tools)

3) Triggers such as end of asset life, obsolescence, asset condition and failure

e. Metering Spares

This project covers the procurement of spares for metering equipment to handle the following scenarios:

1) Equipment Failure

2) End of Asset Life

According to PGC, metering equipment which failed the accuracy test or malfunctioned shall be replaced immediately. The replacement of failed instrument transformers and restoration of the metering facility to the prescribed configuration shall be undertaken by the concerned Metering Equipment Owner.

In consideration of ERC Resolution 23 Series of 2016, which excludes the metering equipment from the connection assets, NGCP shall undertake the procurement of metering spares including the requirements for transmission customer owned equipment to ensure immediate replacements of failed metering assets. Consequently, meter only metering facilities will be converted to full metering upon replacement of their equipment with NGCP owned assets.

Also, since the likelihood of failure of older equipment is higher due to natural deterioration process, NGCP shall incorporate its asset management system for ageing assets to this project category.

The metering spares level will be determined based on the following considerations:

1) Age of metering assets

2) Present asset conditions

3) Historical failure rates

4) Procurement lead time

5) Geographic location of spares storage facilities

6) Transformation ratio of installed Instrument Transformer

f. AMR System Operations

This project covers the operation, maintenance and upgrade of Automatic Meter Reading (AMR) which is composed of hardwares, softwares and communication infrastructures necessary for the delivery of settlement-ready meter data to WESM

at the prescribed delivery schedules as required by ERC Resolution 28 Series of 2006. Also included in the project is the establishment of an integrated meter data validation system to aid NGCP in the validation process.
The timelines and activities will be determined based on the following considerations:

1) Age and conditions of AMR system hardware

2) Maintenance contract with the AMR system provider

3) Availability of alternative AMR system in the market

4) Availability of new communication technologies in the market

5) Management decision, driven by business considerations

13.2.3 Project Development

a. New Metering Facilities

The accuracy of the list of proposed projects under new metering facilities relies heavily on the correctness and timeliness of information received by NGCP with regards to incoming connections to the grid.

For incoming generators, the list of committed and indicative Private Sector Initiated Power Projects sourced from the DOE website and the received requests for facility studies and operational assessments by NGCP provide useful references for the proposed projects.

Recently, NGCP has also started receiving load growth forecast from Trading Participant for incoming load customer connections; however, the quantity of planned connections submitted for reference are still relatively few. Thus, it is still necessary to make an estimated forecast of annual requirements for new load customer metering facilities. Table 13.3 provides the estimated new load customer connections per year to the transmission grids based on the historical average numbers of Metering Facilities commissioned annually. These estimates will serve as reference for the anticipated metering points for load customers proposed in this 2021-2040 TDP.

Table 13.3: Annual Growth Forecast for new Load Customer Connections

Metering Points/ Year	Luzon	Visayas	Mindanao
138kV	0	1	1
115kV	1	0	0
69kV	10	5	5
Total	11	6	6

b. Relocation of Metering Facilities

Transmission Customers: Table 13.4 provides the status of compliance of existing metering points to the DOE DC2018-05-0015 and ERC Resolution 23 Series of 2016's definition of connection points. These figures will serve as reference for the relocation

projects proposed in this 2021-2040 TDP. Unless there will be space and security constraints at the proper connection points, NGCP will undertake and complete the relocation projects by 2025.

Table 13.4: Status of Compliance to ERC Resolution 23 Series of 2016

Region	Total Metering Points	Compliant	Non-compliant	Percentage (Compliant/ Total)	Required Relocation	Total MP after Relocation
Luzon	586	355	231	60.58%	135	490
Visayas	294	186	108	63.27%	90	276
Mindanao	258	164	94	63.57%	51	215
Total	**1,138**	**705**	**433**	**61.95%**	**276**	**981**

NGCP Station Service: The station service consumptions of NGCP Substations are presently being metered using temporary WESM meters installed in series with the statistical meters of the substations at the 480Vac distribution system. This project intends to relocate the metering to the proper connection points which is at the 13.8kV tertiary winding of the main transformer. Table 13.5 provides the list of Station Service Transformers requiring proper metering. These figures will serve as reference for the NGCP Station Service Permanent Metering proposed in this 2021-2040 TDP. Unless there will be space constraints at the proper connection points, NGCP will undertake and complete the relocation projects by 2025.

Table 13.5: Metering Facilities for NGCP Station Service

Region	Total Station Service Transformers	Existing Temporary Metering Points	Total MP after Relocation
Luzon	88	99	88
Visayas	47	50	47
Mindanao	48	52	48
Total	**183**	**201**	**183**

c. Compliance of Metering Facilities

The PEMC of WESM, conducts Metering Arrangement Review once every two years covering around 30% of Metering Points in Luzon and Visayas. The audit aims to determine the compliance of NGCP as MSP to the standards set by WESM.

Metering Facilities that were found non-compliant to the WESM standards demands corrections by MSP. Some of the audit findings for the year 2016 were already corrected and others already have compliance plans which includes replacement of non-compliant metering equipment, rearrangement of metering equipment in accordance with the WESM requirements and others.

In anticipation of the Metering Arrangement Review, it has become a regular practice of NGCP to perform internal audits to be able to come up with compliance plans. Table 13.6 provides the statistics of Metering Points with Non-compliances based on the audit reports. These figures will serve as reference for the compliance projects proposed in this 2021-2040 TDP. NGCP will undertake and complete the compliance projects for both Full and Meter Only Metering Facilities by 2025.

Table 13.6: Remaining Metering Facilities for Compliance

Region	Full Metering	Meter Only	Total
Luzon	67	66	133
Visayas	15	32	47
Mindanao	42	59	101
Total	**124**	**157**	**281**

d. Measurement Assurance Program

The majority of existing laboratory standards and field test instruments were bought during the 4th regulatory period. By the 6th and 7th Regulatory Periods, most of these instruments will reach the end of their asset life:

1) Laboratory Standards – asset life of 12 years

2) Field Test Instruments – asset life of 10 years

Metering Assets are expected to go through natural wear-and-tear. Our record shows that the established asset life accurately defines the economic and technical performance of this asset category (GPE). Majority of the test instruments procured during the 2nd Regulatory Period have shown signs of deterioration around the time they have reached their assigned regulatory life including, but not limited to, the following:

1) Accuracy and Performance Issue

2) Power Supply and Component Failure

3) FirMWare Error

Existing instruments will be programmed for replacement as soon as they reach their asset life and have also exhibited signs of decline in performance. The proactive asset management system that NGCP implements is consistent with the policies of the ERC, which continuously monitors the age and conditions of the assets to come up with a reasonable replacement program. While NGCP considers both as important triggers, the actual asset conditions are given more importance than the age of the assets. Run-to-failure approach will be implemented for fully-aged serviceable instruments. These assets will be utilized for redundancy purpose.

Other instruments included in this proposal are intended to address operational, maintenance and automation requirements which are also based on regulatory obligations of the MSP such as testing, calibration and maintenance of metering installations as defined by PGC 2016 and further clarified by DOE DC2016-05-0007.

e. Metering Spares

Maintaining an optimal level of metering spares is critical for ensuring the continuous and reliable operation of the metering systems. The standard quantity of 3% of installed metering equipment, previously used to determine the spares requirements, failed to completely provide the operational requirements of NGCP due to the following scenarios:

1) Unexpected higher failure rates of some metering equipment (meters and modems) prior to assigned asset life

2) Transmission customers' failure to provide spares for their meter only metering facilities

3) Unplanned metering requirements e.g., new grid connections, new regulatory guidelines

NGCP was forced to utilize not only its limited spares but also other metering equipment originally intended for different projects to partially address the above-mentioned scenarios. For other requirements which can no longer be provided, the following measures were temporarily implemented:

For failed CT, VT and Meters: Manual estimations or application of correction factors to the metered data

It is evident, based on the above-mentioned scenarios, that there is a need to revisit the method on how the spares level are determined to be able to provide a reasonable spares program that can support the operational requirements of NGCP.

Fully Aged Metering Assets

Metering Assets are expected to go through normal wear-and-tear. Our statistics show that the established asset life for the following metering equipment accurately defines their economic and technical performance:

1) Voltage Transformers – asset life of 30 years

2) Current Transformers – asset life of 30 years

3) Combined Instrument Transformers – asset life of 30 years

4) Lightning Arresters – asset life of 30 years

However, the meters, with assigned asset life of 10 years, has the tendency to fail earlier than their expected lifespan. Obsolescence is also an added consideration for these types of asset.

These items are to be replaced towards the end of their assigned Asset Life and when they exhibit impending failure. Information on asset age and condition shall serve as primary reference for the replacement program for installed metering equipment included in this 2021-2040 TDP.

f. AMR System Operations

The proposal for this 2021-2040 TDP project sub-category will include:

AMR System communication infrastructure: which presently utilizes GSM Modems, will be upgraded to IP-based 3G modems. The project will replace the existing modems at the remote metering facilities. A Network Service Provider (TelCo) backhole system will be installed at the AMR Workstations Site. Subscription to TelCo VPN is necessary for this system.

On the other hand, for facilities installed inside NGCP premises, NGCP will utilize its existing IP network in lieu of the TelCo VPN. This will entail the procurement of IP Telephony accessories such as routers and serial to Ethernet converters.

AMR System Hardware: will be replaced as they reach their assigned Asset Life or when they become obsolete or fail in service.

AMR System Software (currently the MV-90 System): will be replaced or upgraded as they reach their assigned Asset Life (5-years) or when they become obsolete or fail in service.

Integrated Meter Data Validation System: has started full operation in 2019 and system enhancement will be done in 2021. This software and database system has partially automate the validation process to minimize human intervention in handling the metered data for billing settlement.

13.2.4 Summary of 2020- 2040 CAPEX Budget Requirements

The estimated CAPEX Budget for the 2021-2040 TDP is shown in Table 13.7.

Table 13.7**:** 2021-2040 CAPEX Budget

Project Sub-Category	Estimated Cost in Millions (PhP)
	2021-2040
New Metering	2,644.77
Relocation	740.90
Compliance	162.44
MAP	447.05
Replacement	298.01
Spares Program	333.03
AMR System	177.64
Total	4,803.84

Chapter 14 - System Operations

14.1 Developmental Objectives

The development plan for the SCADA, telecommunication and protection components of the Power Grid is characterized by the need to cope with the market-driven demand for consolidation of enterprise and operations applications in the energy management systems (EMS), subsequent necessity for bandwidth and interoperability in the communications network and indispensability of redundancy, i.e., N-1 in the protection systems. The importance of integrating embedded variable renewable sources of energy into the Grid has also made it a point to provision readiness in both the SCADA-EMS and telecommunication systems for addressing connectivity and data organization and for the protection system to be able to handle the peculiar power quality management issues.

The following are the objectives of the developmental program for the 2021–2040 planning horizon and the respective major CAPEX issues of interest.

1. Migration to Efficient Technologies

    a) Shift to IP-based transport/network
    b) Completion of optical telecom backbone
    c) Adoption of Smart Grid model; implementation of IEC 61850 standard
    d) Use of hybrid power supplies
    e) Supervision/monitoring functions employing public infra

2. Sustenance of Systems to Maximize Economic Lives

    a) Stagger the retirement/replacement of systems running through obsolescence;
    b) Technological prudence: specified functions and upgradability should be realized within expected service life;
    c) Manage maintenance and replenishment of battery banks;
    d) Employ remote fiber monitoring systems for quick detection of damaging factors

3. Prioritization of Infra Expansion/Upgrade to Areas of Most Benefits at Least Cost

    a) Enhanced EMS applications, with emphasis on VRE management
    b) OPGW retrofitting to enable access to bandwidth
    c) Upgrade of power supply systems and other support infra
    d) Compliance with data center standards
    e) Cyber security

4. Address Deficiencies that Prevent Optimized Network Performance

    a) Completion of network synchronization system
    b) Retrofitting of submarine T/L with fiber
    c) Integration of telecom network management systems
    d) Securing RCC interfacing to HVDC control system

e) Equipping RTUs with IP interfaces

5. Compliance with Grid Code and Regulatory Directions

a) Monitoring and control of embedded generators
b) VRE forecasting
c) Consistency with Protection, SCADA and Telecommunication Philosophies
d) Meeting power quality and system availability requirements
e) Grid resiliency measures
f) Real-time monitoring and control at connection points

14.2 Situational Analysis

14.2.1 Telecommunications

As the pace of development vis-à-vis geographic peculiarities of the electricity grids in Luzon, Visayas and Mindanao varies significantly, the characteristics of the respective telecommunication systems and facilities differ appreciably among each other. On a nationwide scale, backbone infrastructure is dependent on the continuity of transmission-line-embedded fibers—for this matter, relatively-recent transmission line segments without OPGW have to be retrofitted to interconnect the already-fiber-embedded lines in the new installations.

From the register of our existing telecom facilities, we define:

a) The need to replace part of the installed base already without spare parts support as well as the program for replenishments of equipment upon obsolescence;

b) Required upgrades or replacements to address capacity/bandwidth issues resulting from a particular element's deficiency;

c) Additional facilities that will provide element and path redundancy in compliance with our N-1 philosophy; and

d) Additional network management components to consolidate remote control capability over telecom network elements.

On the network level, as the open market integrates, the respective characteristics of the telecommunication networks in Luzon, Visayas and Mindanao become more similar as common performance parameters are adopted and the same operating philosophies are shared. Further, the requirement for more backbone bandwidth (and the subsequent need to reinforce synchronization of the high-speed transport network) is nonetheless increasingly and universally felt, catering to the demands of the now-mainly-IP-based applications. The 2021–2040 CAPEX projects identified in this volume reflect this trend as an integrated NGCP telecommunication network develops over the course of the planning horizon.

Following is an illustration of the geographic extent of the optical infrastructure on which basis the collective performance of NGCP's operations and business applications are

founded on:

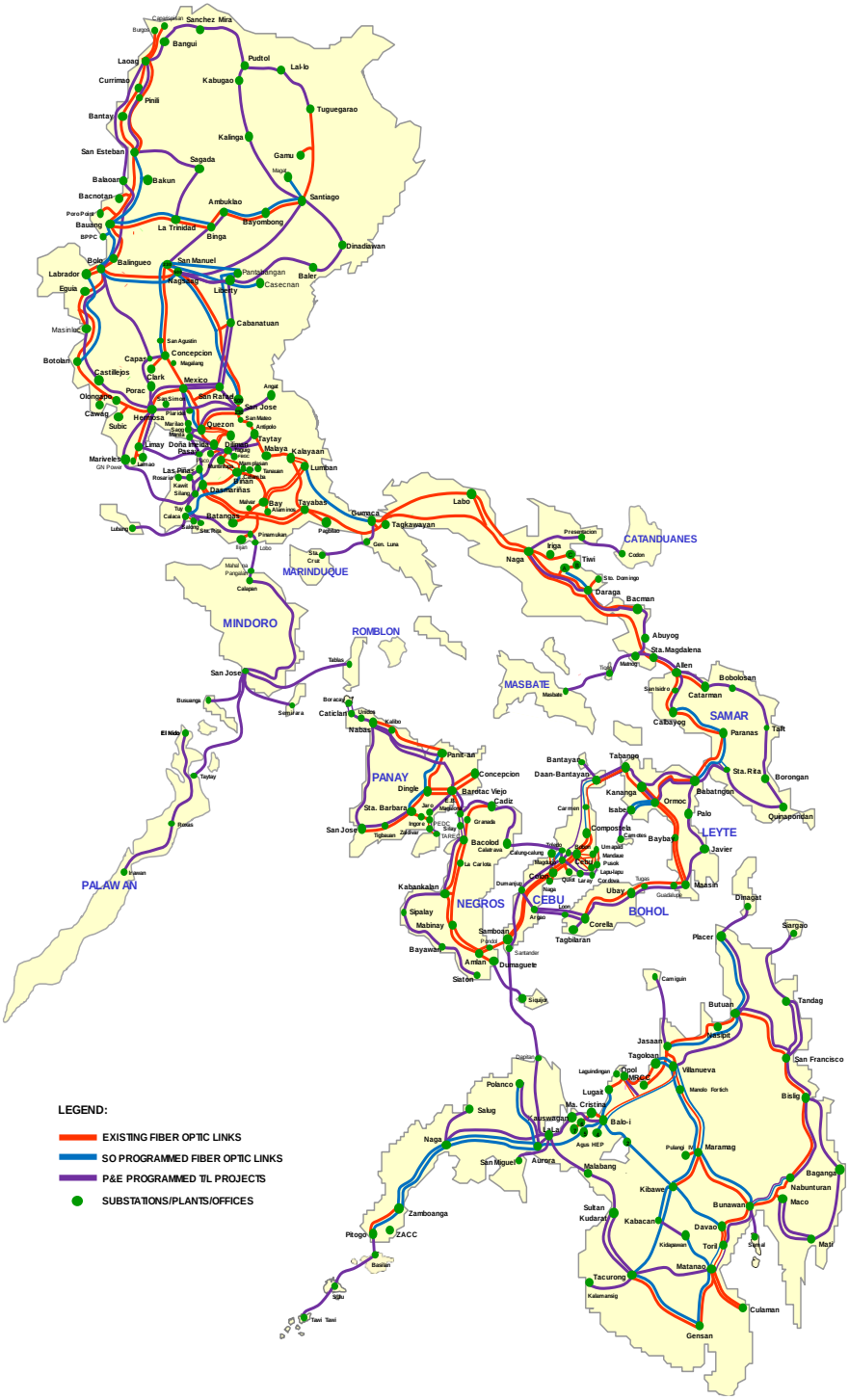


Figure 14.1: Telecommunication network

14.2.2 SCADA-EMS.

The entry into the Electricity Market of Visayas and Mindanao has resulted in significantly more complex operations in the regions. The need for comprehensive SCADA/EMS coverage has also been made more difficult by the rapid changes in Grid configuration brought about by the integration of new players.

The major issues for improvement of the existing SCADA/EMS arrangement are characterized below:

a) The responsiveness of the existing SCADA system to the requirements of VRE integration as well as to the 5-minute real-time dispatch mechanism depends on enhanced computing resources as well as improved accuracy of the telemetry system;

b) Inadequacies in auxiliary support facilities for some of the control centers should be addressed to avoid unreliable SCADA operations and accelerated equipment ageing and failure;

c) Exposure of the SCADA-EMS system to cyber security risks has become more prominent as threats grow alongside technology-driven commerce.

d) There is limited infrastructure reach to readily address supervision of embedded generators.

The development of the Grid in response to Market demand in terms of capacity growth, geographic expansion and challenges in dispatching generators of renewable energy has manifested itself in the SCADA-EMS system through the consolidation and standardization of data collection and management processes and the employment of specialized modeling and analytical applications as part of EMS. The 2021–2040 CAPEX projects are in line with this development trend.

Figure 14.2 is an illustration of the pertinent SO-MO process flow involving NGCP's SCADA-EMS and its interface to the Market.

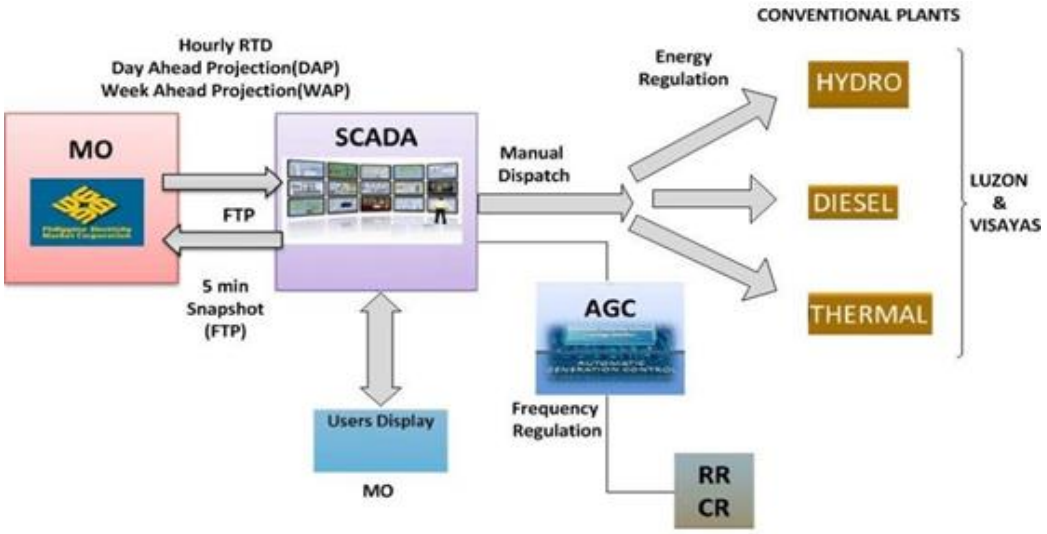


Figure 14.2: Existing SO-MO Process Flow

14.2.3 Protection Systems.

A resilient Power Grid made possible through an effective protection system is a requisite for the realization of the Smart Grid environment. However, the existing protection facilities are significantly lagging in terms of compliance with the Network Protection Philosophy, especially in Mindanao where complementary telecommunication facilities to support path redundancy requirements are still under development.

The challenges presently faced by the existing protection system are described by the following needs:

a) Replacement of obsolete protection equipment—which has no more manufacturer support and lacks modern communication features—have to be accelerated to minimize equipment failures as well as to consolidate (remote) management and maintenance.

b) Redundancy requirements to meet the N-1 objective necessitate addition of relay equipment where no Main 2's are present and upgrade of existing relays where the required philosophies governing Main 1 and Main 2 modes have not yet been realized.

c) Strategic deployment of NDME and PQA to ensure quick and accurate diagnostics of network disturbances and power quality issues in compliance with PGC requirements.

d) Present state of stability still requires continued employment of SIPS in strategic areas of the Grid.

While programmed substation upgrades address the above needs through the accompanying upgrading of the secondary equipment attributed to the transmission lines (radiating from the substation), such substation upgrades would not significantly cover the deficiencies in due time given the respective implementation schedules. Thus, the 2021–2040 CAPEX for protection builds up on relay, NDME, and PQA equipment—the lack of which compromises NGCP's performance objectives.

14.3 Summary of CAPEX Costs

CAPEX Costs 2021–2040 (In Million Pesos)

Table 14.1:CAPEX Proportion by Function

Function	Replenishments	Rehabilitation/ Upgrades	Expansions	Total
Telecoms	8,070	743	4,139	12,953
SCADA	3,988	795	3,374	8,157
Protection*	1,153	32	227	1,412

Connection Point Monitoring/Control	0	0	3,736	3,736
TOTAL	**13,211**	**1,570**	**11,476**	**26,258**

Table 14.2:CAPEX Proportion by Region

Function	Replenishments	Rehabilitation/ Upgrades	Expansions*	Total
Luzon	4,844	475	4,169	9,488
Visayas	3,778	811	3,144	7,733
Mindanao	4,589	284	4,163	9,037
TOTAL	**13,211**	**1,570**	**11,476**	**26,258**

Table 14.3: Telecom Projects According to Nature of Facilities

Telecom Facilities	Luzon	Visayas	Mindanao	Total
Fiber Optics and OPGW	2,238	1,027	2,183	5,448
Microwave Radio	478	242	310	1,030
Network Management and Synchronization	549	826	605	1,979
Teleprotection Equipment	134	126	136	396
WAN and Access Equipment	512	366	715	1,593
Power Supply and Auxiliary	657	541	809	2,007
Cyber Security	0	30	0	30
Mobile Radio Network	108	31	74	213
Test Equipment	97	63	98	257
TOTAL	**4,773**	**3,251**	**4,929**	**12,953**

Table 14.4:SCADA/EMS Projects Categorized by Component Function

SCADA/EMS Components	Luzon	Visayas	Mindanao	Total
SCADA	2,051	2,157	1,892	6,101
EMS Applications	95	49	84	228
Cyber Security	168	63	182	413
WAMS	429	439	548	1,416
TOTAL	**2,743**	**2,708**	**2,706**	**8,157**

14.4 Strategies

1. Sustenance of Assets Against Technology Shifts. System Operations' primary asset management objective—and the main CAPEX driver—is to optimize the serviceability of its existing facilities, i.e., maximizing service lives up to the extent that the costs of ownership vis-à-vis strategic benefits justify continued maintenance. Therefore, given SO's dependence on software and electronics, rapid technological advances in either field increases the need for frequent reassessment of the relevance of such assets to SO's functional objectives. Technologies and applications approaching obsolescence should be retired—albeit on an optimized schedule—and replaced with the more efficient ones for the sake of improved performance and economics. Thus, we are reducing and eventually ending acquisition of spares and maintenance support for the assets due for retirement and investing on their replacements, as follows:

Decreasing Functionality	Current Paradigm
1) Power Line Carriers (PLCs) cannot be used to provide *differential* line protection and cannot be used as a redundant backbone access channel given the bandwidth requirements of current business and operations applications. PLC is also quite expensive for stations which have ready access to fiber-embedded transmission lines.	Fiber is the preferred media for line protection offering both the best bandwidth and reliability. All new transmission lines are already embedded with fiber and existing lines continue to be retrofitted with OPGW. Optical terminals are cheaper to acquire and maintain and protection relays can be outfitted with optical transceivers enabling "direct fiber" line protection setups.
2) Microwave radio shall be limited to spur link applications and backup routes where no transmission lines can be used to establish optical transport.	Retrofitted fiber is much cheaper in addressing backbone needs given the exponential bandwidth growth.
3) There would be less use of TDM channel multiplexers as service access is shifted to IP.	Routers and Ethernet switches shall begin to displace TDM multiplexers along the service access points as applications migrate towards IP communication.
4) SDH transport facilities are already being migrated to packet-switched networks.	IP-based transport facilities shall gradually replace SDH networks that are now reaching obsolescence.
5) PABX equipment shall be totally phased out as circuit-switched arrangements become obsolete.	Telephony and other multimedia services shall run through the IP network not unlike other applications using networked servers.
6) RTUs for Power Grid SCADA shall become less relevant as automation and data communication is integrated into substation and power plant design.	Remote data collection requirements shall be reduced to compliance with supervisory and communication protocol and hardware limited to intermediary access terminal for security purpose.
7) User owned telecommunication facilities to reach remote IPPs will be less favored especially when no teleprotection complement is required.	Less CAPEX-involved public infrastructure to establish access among IPPs (especially embedded ones) shall be taken advantage of but cyber security arrangements shall be given due attention.

8) Use of Distance Relays shall be limited only to areas where differential protection cannot be applied on account of bandwidth limitation.	Differential Relays (with direct-fiber interfaces) shall displace more and more Distance Relays as fast communication interfaces through fiber and radio become pervasive.

2. Timing of Projects. Given the interdependence of technology and infrastructure—as well as the role of organizational evolution adapting to market trend—in defining developmental direction, outlined below are the implementation sequence of major projects for the purpose of validation and prioritization. It is also the purpose of this development plan to make rescheduling of projects convenient when faced with limited budget or implementation resources. Optimization demands that just enough infrastructure is ready to accommodate the applications as they come and that right applications are chosen to take advantage of the minimum infrastructure components in place at the time of need.

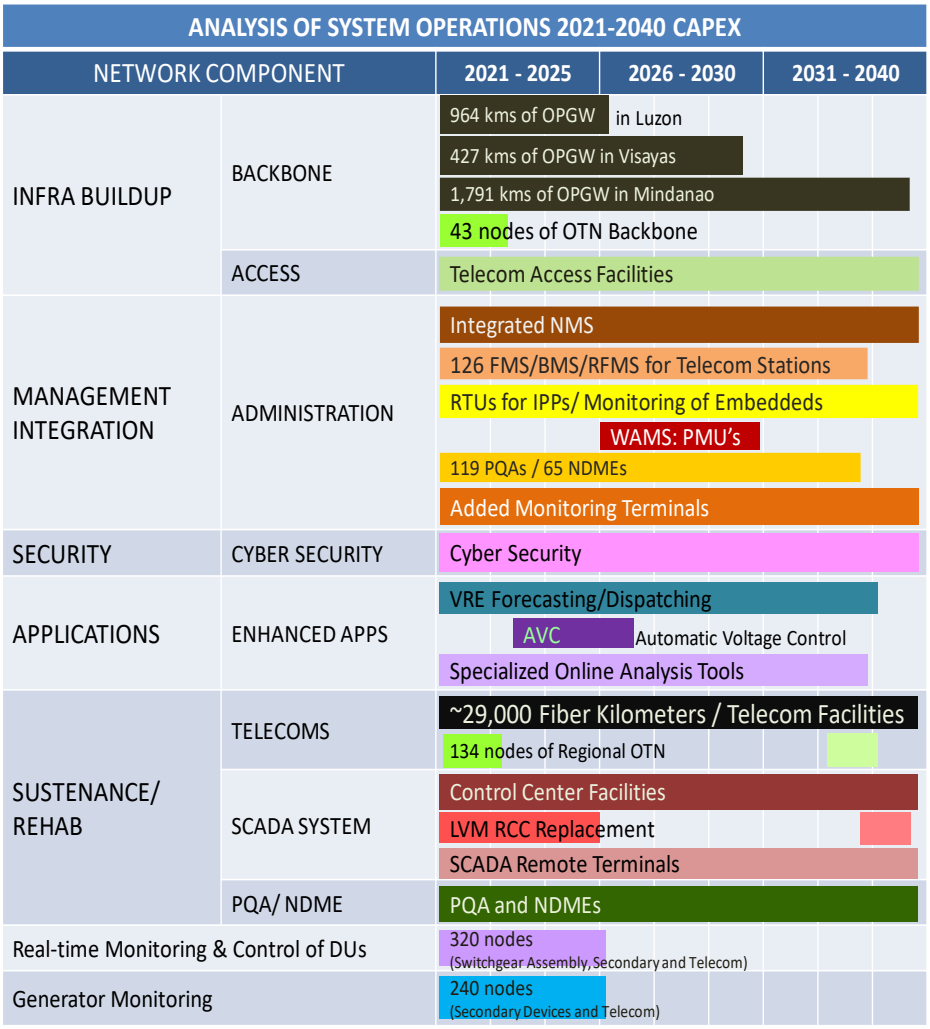


Figure 14.3: Analysis of SO 2021-2040 CAPEX

3. CAPEX Priorities. As shown in the above schedule, 56% of projected CAPEX is allocated for sustenance of existing facilities and the rest for programs to address current deficiencies and new requirements. This does not mean that the same apportionment

would be observed in case of budget constraints. While sustenance would ideally be the priority, the new facilities are also meant to address deficiencies in existing service areas. Should CAPEX limits be apparent as a result of transmission regulation, prevailing demand for pertinent applications shall be prioritized.

As an example, EMS enhancements for the purpose of improving SO response to Grid dynamics and maximizing access to energy sources according to market conduct are lined up for implementation through the 4th and 5th regulatory periods. Projects for either infrastructure reinforcement or sustenance/upgrade programs would hence depend on the relative significance of the affected network elements or sections in support of said EMS applications. Prominent in this respect are the VRE forecasting and modeling applications.

Imperative also during the early years is putting in place the pertinent synchronization mechanisms and enforcing communication protocols which govern the building blocks of our automation and control systems.

Finally, given the increasing dependence of SO on IT and communications systems—amid the growing pervasiveness of the internet in the business environment—the need to protect System Operations against cyber threats has manifested itself as an indispensable determinant in development planning and engineering design.

Table 14.5: CAPEX Summary

PROJECT LIST	5th REG					6th REG	7th REG	8th REG	TOTAL 2021-2040
	2021	2022	2023	2024	2025	2026-2030	2031-2035	2036-2040	
Fiber Optic and Microwave Radio Equipment Replacement	31	51	141	370	400	499	1383	223	**3,097**
Teleprotection Equipment Replacement	23	42	15	6	15	85	129	80	**396**
Telecom Access and Remote Management Component Replacement	74	37	154	73	38	922	702	902	**2,901**
Power Supply and Auxiliary Equipment Replenishment	64	75	67	122	146	651	617	498	**2,239**
Infra and IT Support Facilities Replacement	74	81	90	66	100	837	392	431	**2,071**
SCADA/EMS Facilities Replacement	245	553	108	298	238	263	289	899	**2,893**
NDME and PQA Replacement	24	75	35	15	18	216	574	227	**1,184**
SCADA Expansion—Added RTUs and Monitoring Points	167	23	70	50	48	247	224	214	**1,043**
Telecom Access for Added Locations, Subscribers and Application Points	57	35	30	35	46	60	66	60	**388**
Fiber Optic and Microwave Radio Expansion	691	302	370	136	144	800	453	402	**3,298**
Submarine Fiber Optic Link	0	0	0	0	0	0	0	0	**0**
Cyber Security	118	4	82	89	14	71	30	35	**443**
Network Synchronization System	0	0	0	0	0	0	0	0	**0**
Network and Facilities Management System and IT Support Facilities	100	104	46	43	145	90	90	80	**698**
EMS Enhancements	4	0	15	10	35	47	100	17	**228**
Wide Area Measurement System (WAMS)	0	0	0	0	0	1416	0	0	**1,416**
NDME and PQA Expansion Program	34	37	39	25	18	46	25	4	**227**
Monitoring and Control of DUs	1074	1127	361	361	393	0	0	0	**3,317**
Generator Monitoring	164	166	28	30	31	0	0	0	**419**
TOTAL	**2,944**	**2,711**	**1,649**	**1,730**	**1,830**	**6,249**	**5,073**	**4,072**	**26,258**
	10,864								

14.5 Telecommunications

14.5.1 Fiber Optic Network Expansion

The following are diagrams for the 2021–2040 programmed additions for the Fiber Optic network. The expansions include optical fiber links resulting from new transmission line projects as well as OPGW retrofitting on existing T/Ls programmed in this Volume:

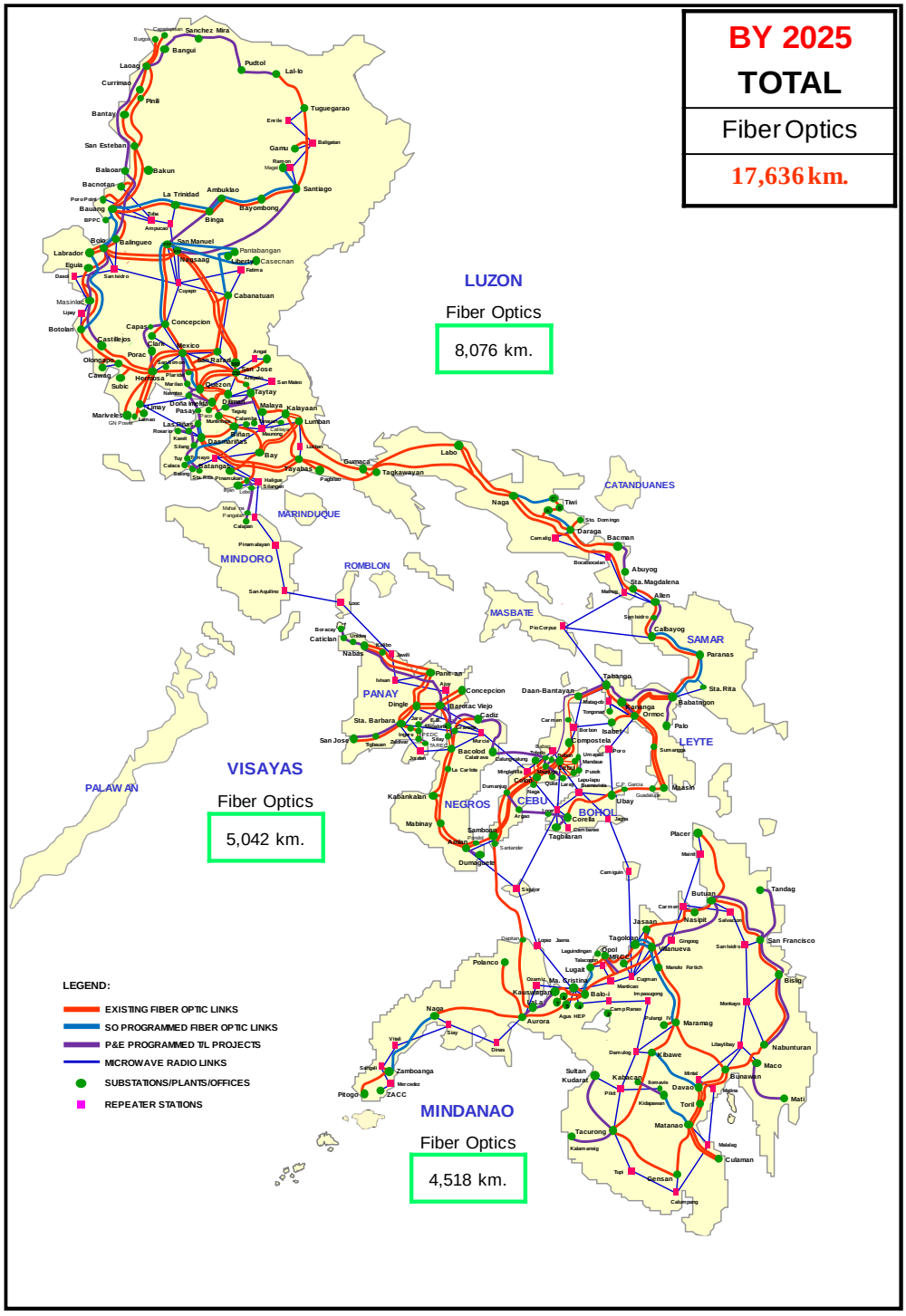


Figure 14.4: Telecom Network by 2025

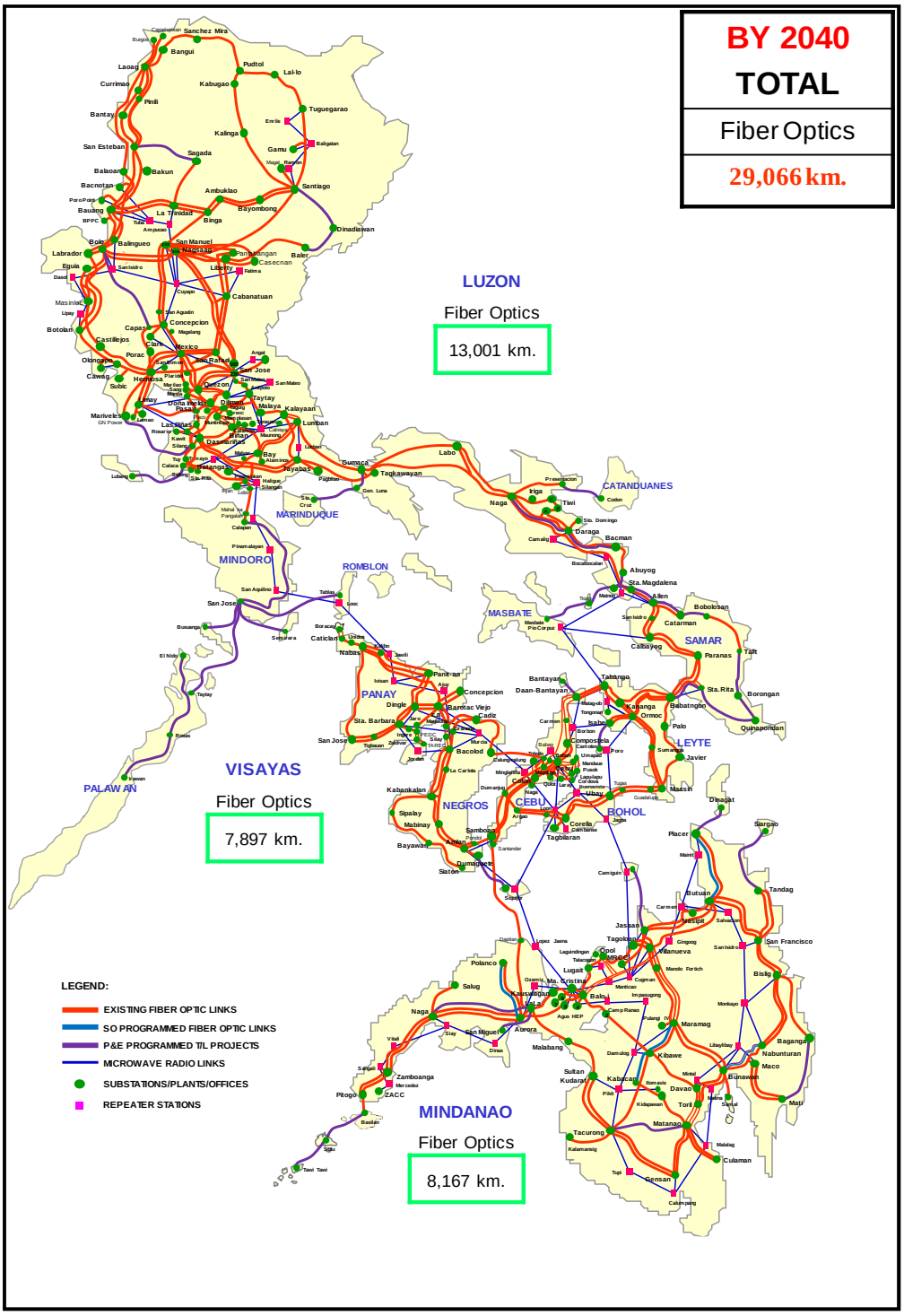


Figure 14.5: Telecom Network by 2040

14.5.2 IP Transport Network Implementation

The need to adopt a high capacity and purely-IP-based telecommunication infrastructure calls for a phased implementation of the telecommunication transport system migration to optimize the life of existing TDM/SDH equipment. The cost for migration has been outweighed by the cost of sustaining and provisioning for legacy equipment whose

respective O&M efficiencies have been surpassed by modern technology. Thus, the current SDH transport network would be sustained only up to the elements' economic lives where feasible and legacy TDM applications would be run on emulated mode (over IP) until such time that the applications themselves have migrated into their respective IP modes. New application requirements which demand for high bandwidth and secure telecommunication network render SDH transport system obsolete for obvious capacity limitation. The fairly mature Optical Transport Network (OTN) technology is preferred to address the new mission-critical network requirements. It offers the advantages of being flexible, open technology, scalable, and cost-effective long-term infrastructure solution. It is aimed to increase network performance by lowering latency, increasing network manageability, and paving the way for the network to embrace purely IP-based Cloud and Software-Defined Networking as planned.

The acquisition of new IP-based transport appliances, therefore, should be complemented by the choice of the adequate transport protocols, reinforcement of the network management centers and putting in place of appropriate out-of-band network probes to ensure that performance thresholds are met.

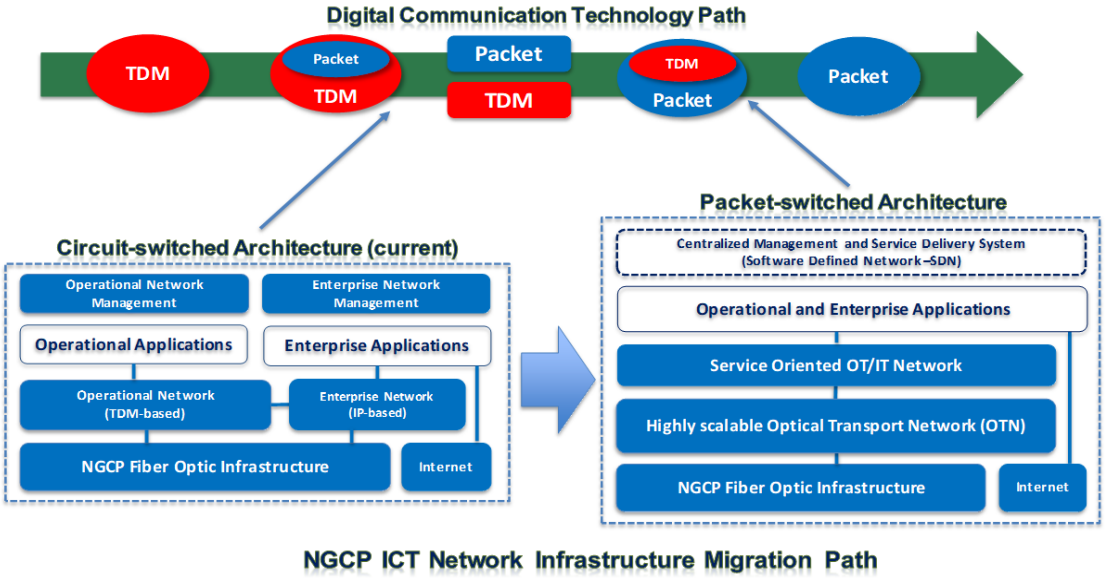


Figure 14.6: NGCP ICT Infrastructure Migration Path

14.5.3 Network Synchronization

The following NGCP network elements require a common reference clock—i.e., they need to be synchronized—for reasons peculiar to their respective functions and nature of operations:

- Telecommunications—High-speed digital transmission technology requires synchronous telecommunication nodes, i.e., SDH will not work without synchronized terminals;
- SCADA/EMS—Data monitoring/recording especially those from synchrophasor measurements, for purpose of power flow analysis and eventual automated control, must be synchronized;

- Grid Protection—Protection relays and event/waveform recorders require accurate time stamps for network performance analysis and post-event diagnostics; and
- Metering—Accurate billing information requires standard time reference.

On a national scale, a synchronized timing system is also necessary to coordinate events and activities among the various collaborating government agencies and public utilities. Republic Act No. 10535, also known as The Philippine Standard Time Act of 2013, orders the synchronization of all clocks in the country under the Philippine Standard Time (PST).

Such need for synchronization is especially relevant as NGCP prepares for Smart Grid. Precise timing is necessary if coordinated supervisory control and quick reaction to fast changes in real-time data would be realized to meet Smart Grid standards.

A unified synchronization system with stratum 1 traceability to a primary reference clock source shall be established for NGCP to provide synchronization requirements to all the installed based network elements. This shall cover all telecommunications, SCADA, protection, metering, enterprise data network and other substation devices. The new sync system shall continue to provide legacy timing protocols such as IRIG-B, 1PPS and 1PPM to old but functional network elements requiring such. Following is the planned configuration.

The installation of synchronization clocks at 138kV, 230kV and 500kV substations have been completed (refer to Annex 3) and all network elements are currently being integrated for unified clock reference.

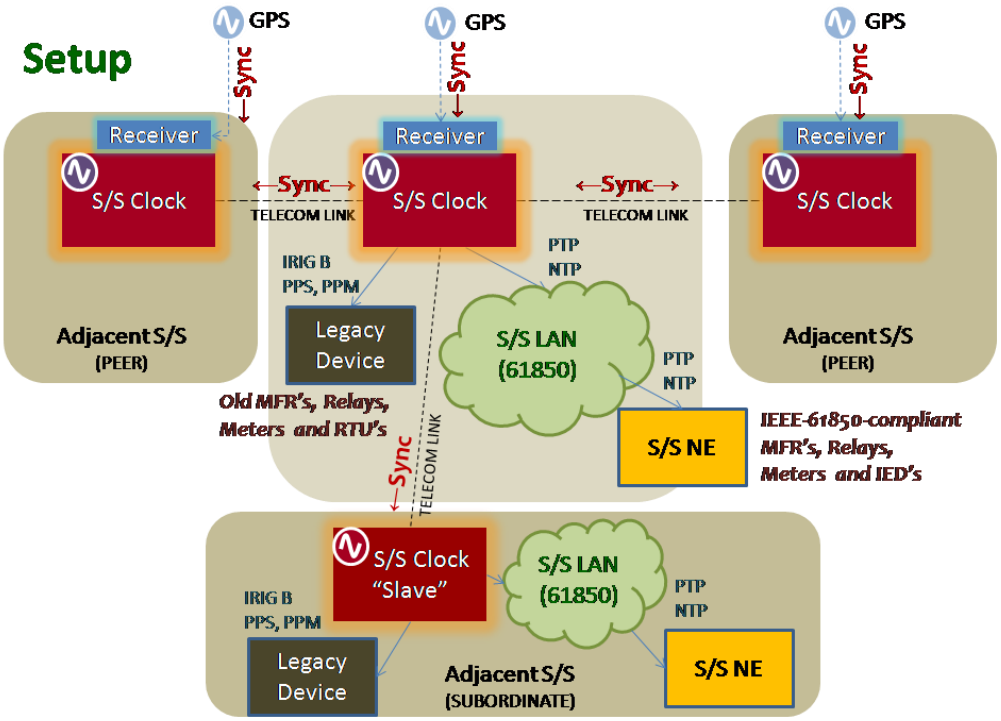


Figure 14.7: Synchronization Arrangement

14.6 SCADA Programs

14.6.1 National System Operations

The Visayas and Mindanao Grids will soon be interconnected via HVDC transmission system. As such, there should be a holistic view of the Philippine Grid as a single interconnected network. In consonance with this concept, a cloud-based computing control is envisioned to be established to support the integrated operation of the transmission system and dispatch of all generation in the Philippines. The National System Operations (NSO) would be responsible for the whole grid operations once the Luzon, Visayas and Mindanao interconnection is complete. The following are the functions of the NSO:

- Supervise, monitor and control all interconnection of the three Regions (Luzon, Visayas and Mindanao);
- Monitor and control HVDC interconnection system during normal and emergency conditions;
- Manage the respective transmission backbones of the three regions (i.e. 500kV of Luzon, Visayas interconnection and 230kV of Mindanao;
- Conduct of simulation studies for the whole grid necessary for decision making;
- Supervise the implementation of Planned Activity Notice (PAN) of HVDC interconnection and the transmission backbone;
- Supervise the operations of the three Regional Control Centers;
- Coordinate with the Market Operator for the implementation of the RTD schedules of the three Regions;
- Forecast week ahead and day ahead of the three Regions;

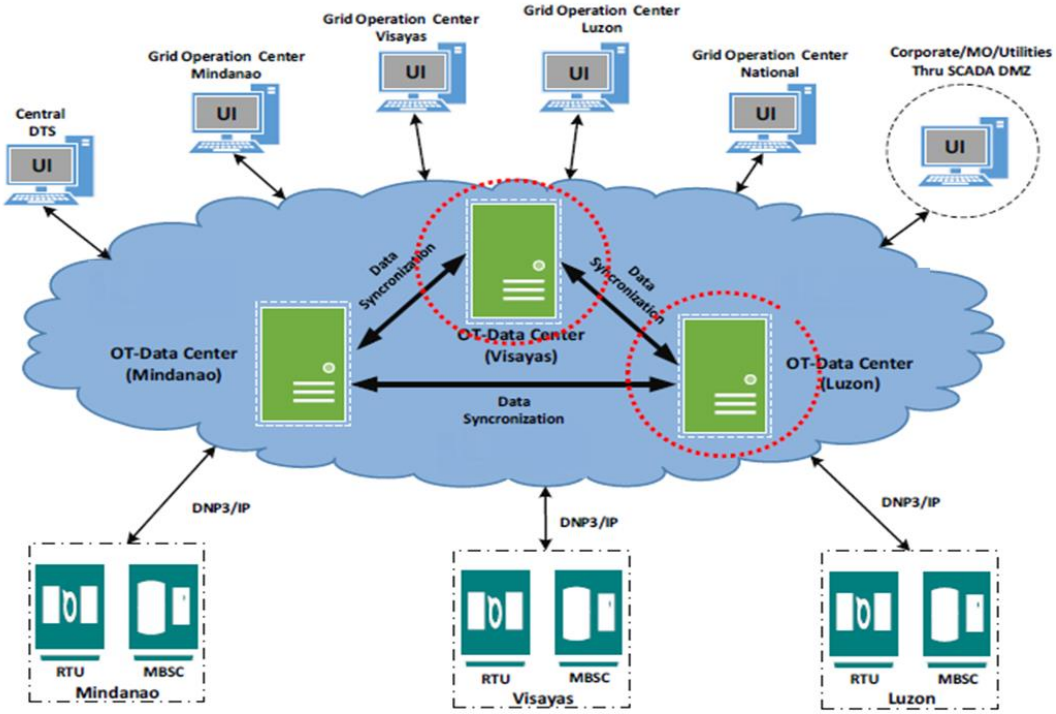


Figure 14.8: National System Operations Conceptual Framework

14.6.2 EMS Advanced Applications

Computer-aided EMS technology has been around since the 1980s and works in conjunction with SCADA systems to optimize generation and transmission resources. EMS advanced applications (software) are automation tools employed by electric power utilities designed for specialized tasks at hand within the realm of such resource optimization. NGCP EMS enhancement project involves the acquisition of preferred EMS advanced applications intended to:

a) Meet Current Market Demands

- The rapidly growing number of network elements—especially by the integration of embedded generators into the Market—requires more management attention and faster reaction; the 5-minute dispatch interval is expected to be implemented soon;
- Integration of more VRE into the supply pool requires quicker anticipation and more automated control; and
- Efficient dispatch means less cost of electricity.

b) Adapt to and Take Advantage of New Technology

- Lower cost of electronics means faster processing—an opportunity to pack more intelligence and automation into EMS; and
- Greater bandwidth and less latency in IP communications afford access to more network elements, thereby facilitating greater control.

c) Improve Performance

- We should tap all available tools within the bounds of economics which will allow us to ensure that service availability and power quality are within performance thresholds;
- EMS is the brain behind an automated Grid management system—there is always room for more intelligence.

NGCP's EMS enhancement program was started during the 3rd Regulatory Period driven by the above considerations—following is the development road map:

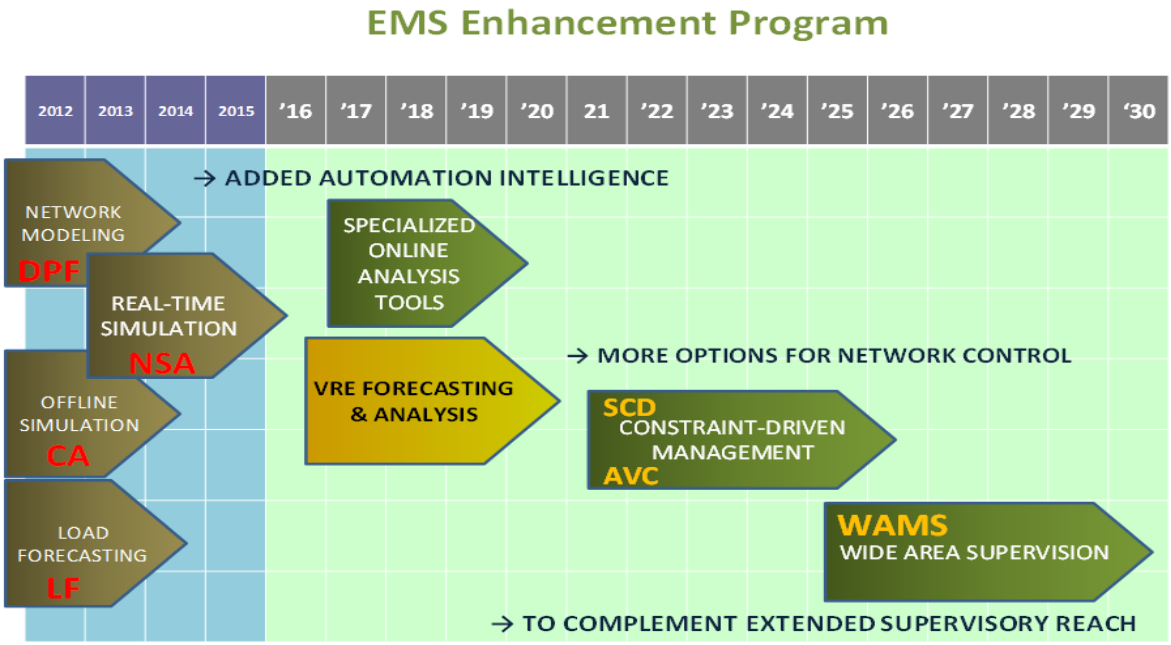


Figure 14.9: EMS Development Road Map

The project is aligned with the overall network development plan aimed to support Market growth and optimization of energy sources, especially the VREs.

14.6.3 Real-time Monitoring and Control for Distribution Utilities

The project to install Real-Time Monitoring and Control Equipment for DUs is in compliance with DOE's request for its inclusion in NGCP's 4th Regulatory Period CAPEX program. This is in compliance with the implementation of DOE's Circular No. DC2012-030994 and DC No.2010-08-0010, entitled, "Addressing Power Supply Situation including rationalization of Available Capacities in Mindanao Grid" and "Prescribing the Implementing Rules and Procedures for Department Circular No. DC2010-05-006, entitled, Terminating the Default Wholesale Supplier Arrangement for Philippine Wholesale Electricity Spot Market (WESM) and Declaring a Disconnection Policy", respectively.

At present, control of NGCP's load customers is up to the substation level only which—while adequate for managing load limits to sustain system stability and power quality—would not allow SO's selective control over the customers connected to one feeder.

Following is an illustration of the proposed installation at each DU's connection point.

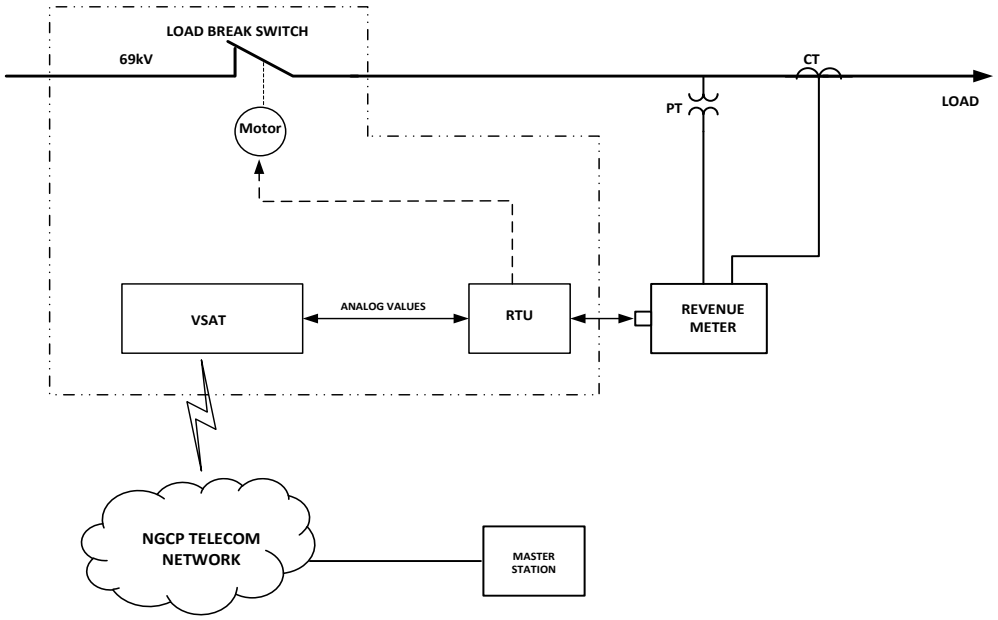


Figure 14.10: Connection Diagram for DUs

The connection diagram shows the wiring linkages of the new system facility including the telecommunication component. These will be remotely monitored and controlled by the master station located in NGCP's control center.

Figure below is an illustration of the physical setup at the customer side.

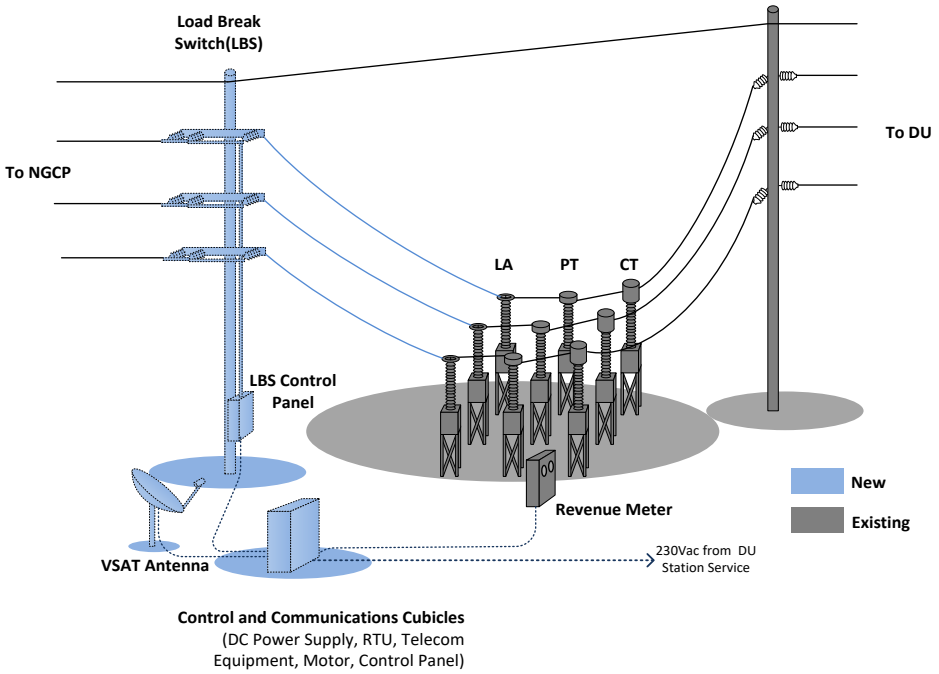


Figure 14.11: Physical Setup for DU Monitoring and Control

14.7 Network Protection and Power Quality

14.7.1 Network Disturbance Monitoring Equipment and Power Quality Analyzer Program

The undesired tripping of transmission lines and high voltage equipment in the grid are sometimes caused by non-operation or malfunction of the fault clearance system. The delay in the resolution of the cause of network failure and subsequent correction of network deficiencies is on account of the non-availability of fault data due to the lack of functional NDME's. Obsolescence and degradation as a result of age have also lessened the effectiveness of existing NDME's. Sustenance of NDME effectiveness should therefore be addressed through a replenishment program meant to meet outstanding deficiencies in this respect.

Power quality issues are prevalent in connection points along long multi-tap feeders, those subjected to significant supply-demand incongruence between peak and off-peak periods, lines with dynamic power flows, areas with connected inverters such as those used by VRE's and battery energy storage systems as well as nodes which are connected to large non-linear time-varying loads (e.g., steel mills).

NGCP's previous plan was to install PQAs at all NGCP customer connection points. However, an alternate less-costly compliance plan was formulated where PQAs will be installed at the secondary side of transformer which would cover the monitoring of all the connected feeders—reducing the total PQAs for installation. The proposed monitoring scheme is shown in Figure 14.12. The use of portable PQAs for deeper investigation into the customer side would complement this arrangement.

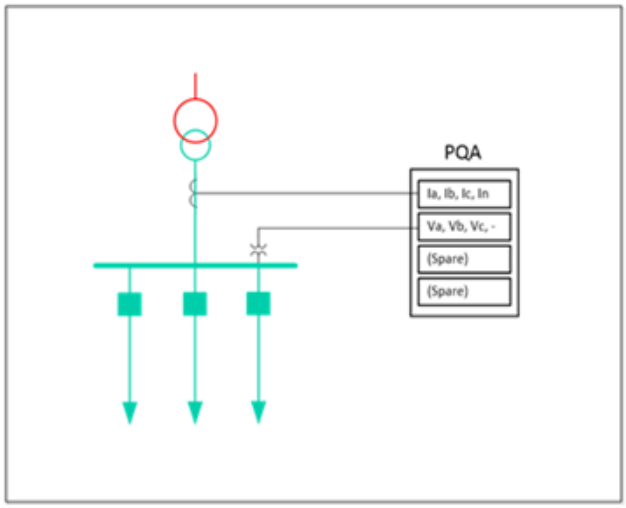


Figure 14.12: PQA installation at the secondary side of transformer

Hand-in-hand with the installation of PQAs is the establishment of a centralized Power Quality Management System (PQMS). With the growing number of installed PQAs, manual processing of PQ data will require extensive effort and become time-consuming. To address this, the proposed PQMS shall be able to manage bulk, raw data coming from different brands of PQAs and will automate report generation in accordance with PGC PQ parameters.

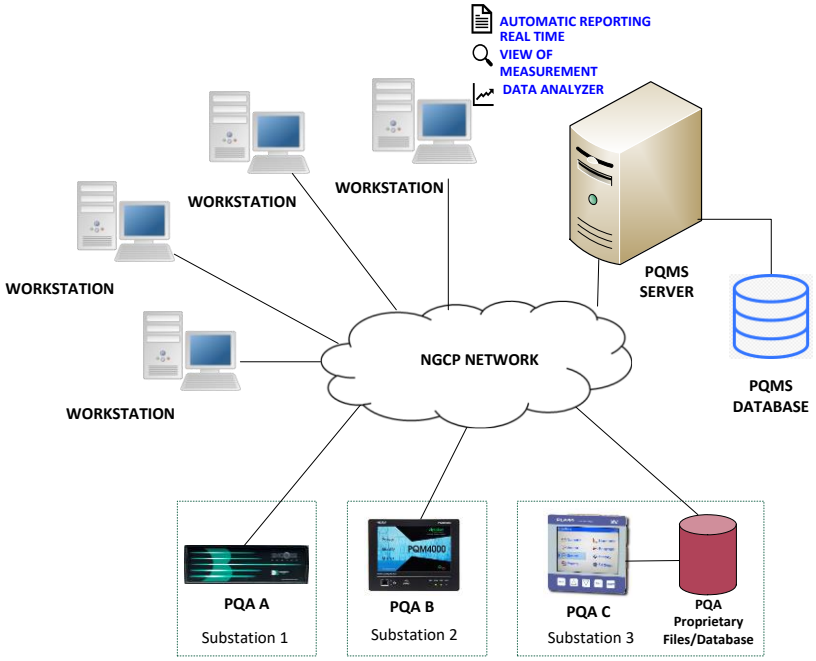


Figure 14.13: Proposed System Architecture

14.7.2 Protection Relay Replacement Program

To meet PGC security and reliability objectives, the fault clearance system needs to be enhanced through the replacement/upgrading of obsolete and defective protective devices and equipment as well as the installation of new protection systems. Aligned with the Smart Grid model, protective relays with enhanced communication systems and more interfacing options shall be incorporated to cover protection of all network elements which include transmission line, transformer, bus, and breaker-fail components. A relay replacement program prioritized according to results of risk assessment is as follows.

Table 14.6: Overall Priority Table for Relay Replacement Program

Category of Replacement	Line Protection	Transformer Protection	Bus Protection	Breaker Fail Protection	Feeder Protection	Reactor Protection	Total
No Main 1	0	0	5	25	0	0	30
No Main 2	0	42	64	n/a	0	0	106
Non-Compliant	170	34	36	39	0	0	279
Obsolete	352	54	52	375	1	6	840
Defective	9	0	0	0	0	0	9
Total	531	130	157	439	1	6	1,264

Appendix 1 – Generation and Load Distribution Per Area

Generation and Load Distribution in the Luzon Grid

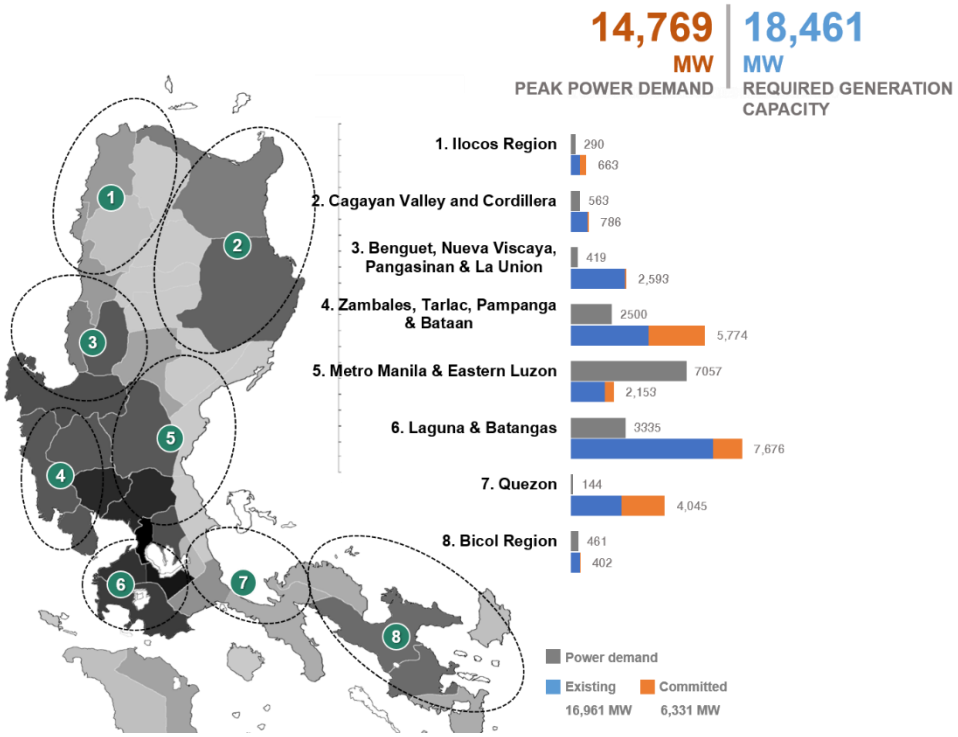


Figure A1.1 – Projected Luzon Grid Generation and Load Distribution in 2025

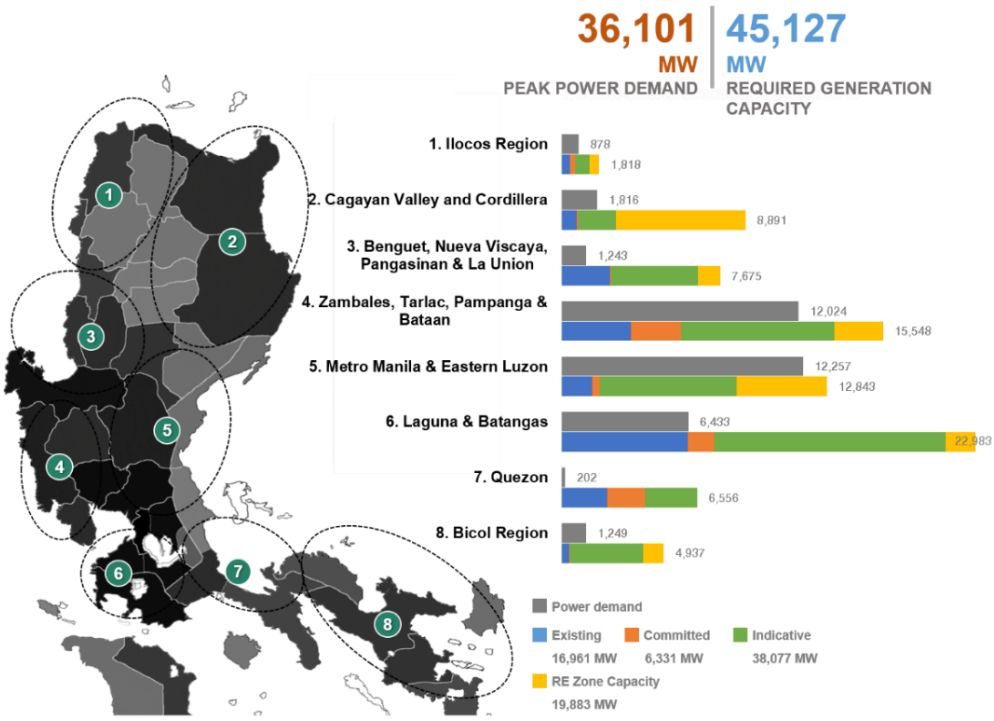


Figure A1.2 – Projected Luzon Grid Generation and Load Distribution in 2040

Generation and Load Distribution in the Visayas Grid

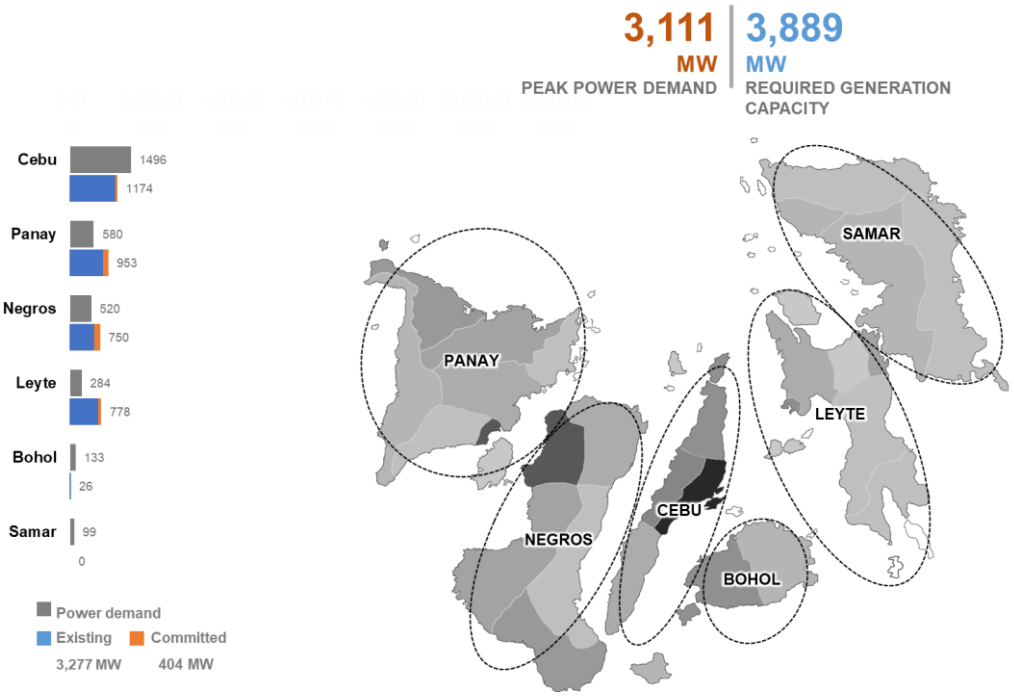


Figure A2.1 – Projected Visayas Grid Generation and Load Distribution in 2025

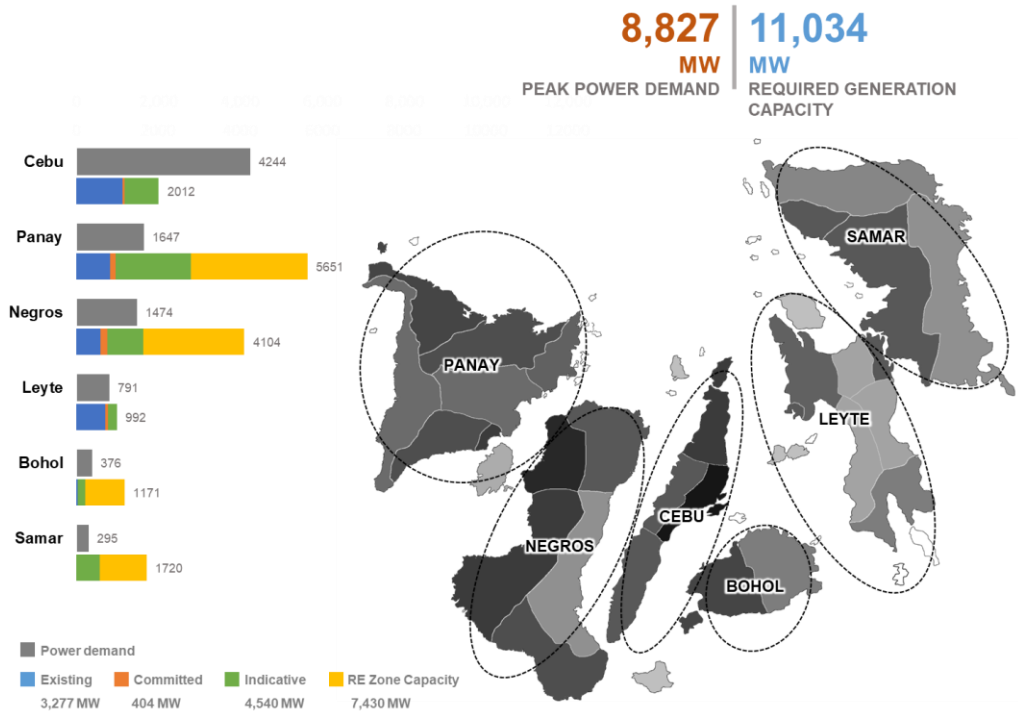


Figure A2.2 – Projected Visayas Grid Generation and Load Distribution in 2040

Generation and Load Distribution in the Mindanao Grid

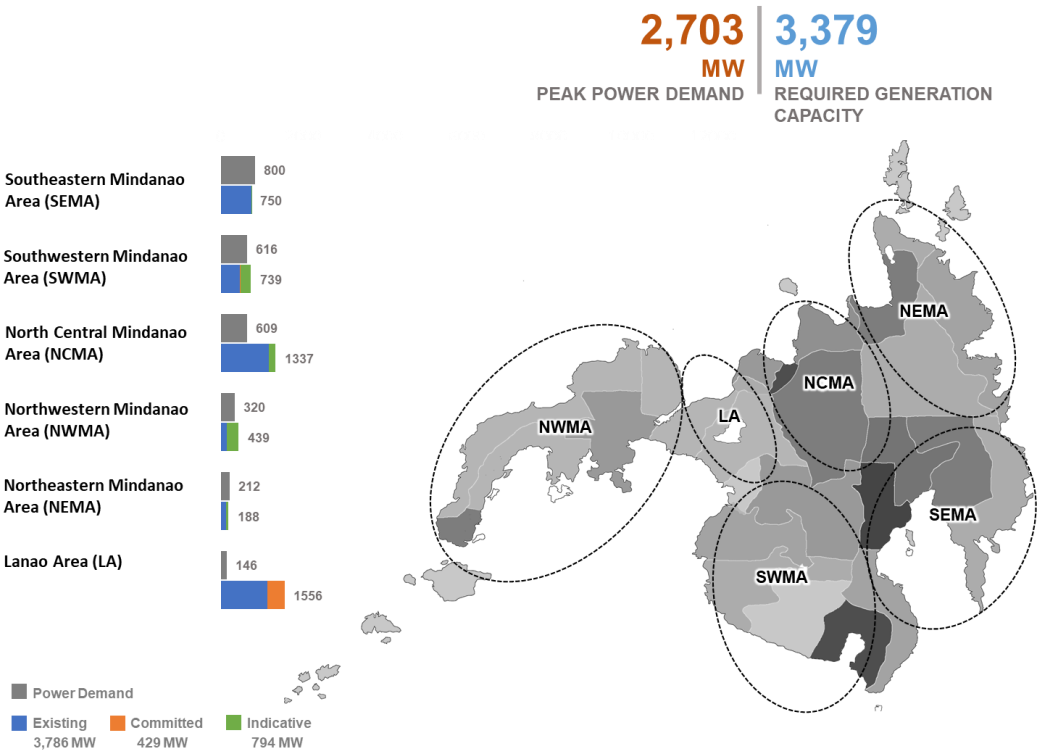


Figure A3.1 – Projected Mindanao Grid Generation and Load Distribution in 2025

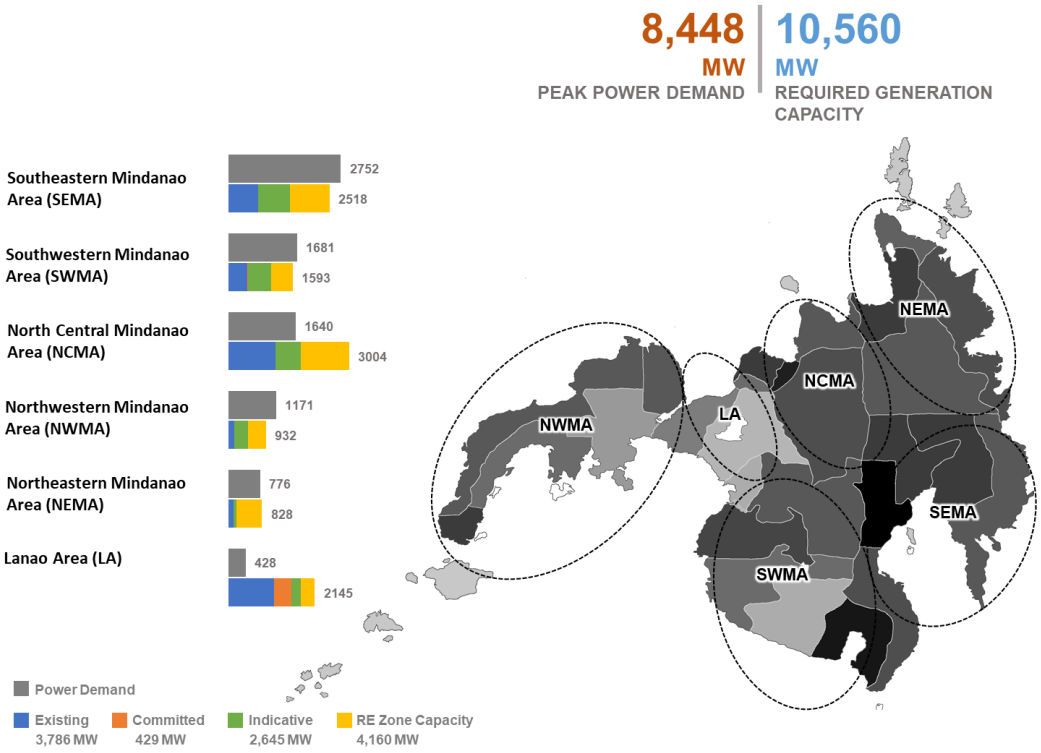


Figure A3.2 – Projected Mindanao Grid Generation and Load Distribution in 2040

Appendix 2 – Prospective Power Plants for 2020

Proponent	Projects	Installed Capacity (MW)	Location
Luzon			
Matuno River Development	Matuno River Hydroelectric Power Plant	8.661	Bambang, Nueva Vizcaya
JBD Management and Consulting Services, Inc	Pakil Pumped Storage Hydroelectric Power Plant	350	Pakil, Laguna
Solar Philippines Tanauan	Maragondon 1 Solar Power Project	1200	Maragondon, Cavite
3 Barracuda Energy Corp	Currimao Energy Storage Project	50	Currimao, Ilocos Norte
Solar Philippines Commercial	SM City Tuguegarao Solar Power Project	5	Tuguegarao, Cagayan
Universal Power Solutions, Inc.	Bacnotan R- HUB	40	Brgy. Cabugao, Bacnotan, La Union
Universal Power Solutions, Inc.	Subic R-HUB	40	Sitio Agusuhin, Cawag, Subic, Zambales
Universal Power Solutions, Inc.	San Jose R-HUB	40	Brgy. San Jose del Monte City, Bulacan
Universal Power Solutions, Inc.	Bolo R-HUB	40	Brgy. Bolo, Labrador, Pangasinan
Universal Power Solutions, Inc.	Tuguegarao R-HUB	40	Brgy. Libag Norte, Tuguegarao City, Cagayan
Universal Power Solutions, Inc.	Bayombong R-HUB	40	Brgy. Busilac, Bayombong, Nueva Vizcaya
Universal Power Solutions, Inc.	Calamba	40	Brgy. Prinza, Calamba, Laguna
Universal Power Solutions, Inc.	Gumaca R-HUB	40	Brgy. Progreso, Gumaca, Quezon
Universal Power Solutions, Inc.	Labo R-HUB	40	Brgy. Mahawan-hawan, Labo, Camarines Norte
Universal Power Solutions, Inc.	Naga R-HUB	40	Brgy. Del Rosario, Naga, Camarines Sur
Universal Power Solutions, Inc.	Calbayog R-HUB	20	Brgy. Carayman, Calbayog, Samar
Solar Philippines Commercial Rooftop Projects, Inc.	Sta. Rosa Nueva Ecija 3 Solar Power Project	1200	Sta. Rosa and Cabanatuan City, Nueva Ecija
Solar Philippines Commercial Rooftop Projects, Inc.	General Santos Solar Power Project	1200	General Santos, South Cotabato
Solar Philippines Commercial Rooftop Projects, Inc.	Padre Garcia Solar Power Project	1200	Lipa and Padre Garcia Batangas
Sunwest Water and Electric Co.	Daraga Ancillary Reserve Diesel Power Plant	50	Daraga, Albay
Sunwest Water and Electric Co.	Kiwalo Diesel Power Plant	100	Kiwalo, Daraga, Albay
Sunwest Water and Electric Co.	Namantao Diesel Power Plant	50	Daraga, Albay
Excellent Energy Resources Inc.	Ilijan Natural Gas Fired Plant Project	1,200	Brgy. Dela Paz Proper, Batangas City

Proponent	Projects	Installed Capacity (MW)	Location
VISAYAS			
SMCGP Philippines Energy Storage Co. Ltd.	Kabankalan Integrated Renewable Power Hub Facility (R-Hub)	20	Kabankalan, Negros Occidental
Triconti Southwind Corporation	Guimaras Strait Wind Power Project	600	Guimaras
Universal Power Solutions, Inc.	Calbayog R-Hub	20	Brgy. Carayman, Calbayog, Samar
MINDANAO			
20 MW Villanueva BESS	SMC Global Power Corporation (SMGPC)	20	Villanueva, Misamis Oriental
20 MW Malita BESS	SMC Global Power Corporation (SMGPC)	20	Malita, Davao Occidental

Appendix 3– Private Sector Initiated Power Projects

Table A3.1: Private Sector Initiated Power Projects in Luzon as of 31 August 2020

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
COMMITTED POWER PLANTS			
COAL			
Masinloc Expansion Project*	300	Zambales	Unit 3 -Sep 2019 (commissioning test)
GNPower Dinginin Supercritical Coal-Fired Power Plant*	1,336	Mariveles, Bataan	Unit I Oct 2020 Unit 2 Feb 2021
AOE Coal-Fired Power Plant*	1,200	Atimonan, Quezon	Unit 1 - early Q4 2023 Unit 2 - TBD
RPEI Coal-Fired Power Plant*	600	Sitio Naglatore, Cawag, Subic Bay Freeport Zone	TBD
Sub-Total Coal	**3,436**		
OIL-BASED			
Ingrid Pililla Diesel Power Plant*	300	Pililla, Rizal	Dec 2019
SPC – Tarlac Bunker Fired Power Plant	11.04	Capas, Tarlac	Dec 2019
Sub-Total Oil-based	**311.04**		
NATURAL GAS			
EWC CCGT Power Plant*	650	Brgy. Ibabang Polo, Grande Island, Pagbilao, Quezon	2022
BCEI Natural Gas-Fired Power Plant	1,100	Pinamucan Ibaba, Batangas City	Q1 2025
Sub-Total Natural Gas	**1,750**		
SOLAR			
ELPI Pasuquin Solar Power Plant Project*	100	Pasuquin, Ilocos Nort	Jun 2020
Alaminos Solar Power Plant	120	Alaminos, Laguna	Dec 2020
Tarlac Solar Power Project Phase 2	20	Tarlac City	Apr 2019
Concepcion 1 Solar Power Project*	15	Concepcion, Tarlac	Dec 2020
Sub-Total Solar	**255**		
BIOMASS			
HEC Rice Husk-Fired Biomass Power Plant Project	12	Bulacan	May 2020
Isabela La Suerte Rice Husk- Fired Power Project	5	Aurora, Isabela	Nov 2019
Sub-Total Biomass	**17**		
WIND			
Pasuquin Wind Power Project	132	Pasuquin, Ilocos Norte	Jun 2020
Sub-Total Wind	132		
BESS			
Lumban Battery Energy Storage	40	Lumban, Laguna	Jan 2021
Laoag Battery Energy Storage	40	Laoag, Ilocos Norte	Jan 2021
Pampanga Battery Energy Storage	40	Mexico, Pampanga	Jan 2021
Navotas Battery Energy Storage	20	Navotas City, Metro Manila	Jan 2021
Limay Battery Energy Storage	40	Limay, Bataan	Jan 2021
Albay Battery Energy Project	20	Daraga, Albay	Jan 2021
San Manuel / San Roque Battery Energy Storage	20	San Roque / San Manuel	Jan 2021
Gamu Battery Energy Project	20	Gamu, Isabela	Jan 2021
San Rafael Battery Energy Project	20	San Rafael, Bulacan	Jan 2021
Magapit Battery Energy Storage	20	Magapit, Cagayan	Jan 2021
Concepcion Battery Energy Storage System	20	Concepcion, Tarlac	Jan 2021

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Angat Battery Energy Project	20	Angat, Bulacan	Jan 2022
Isabela Battery Energy Project	20	Isabela	Jan 2022
Zambales Battery Energy Storage System	30	Zambales	Jan 2022
Masinloc Battery Energy Storage	20	Masinloc, Zambales	Jan 2022
Alaminos Battery Energy Storage	40	Alaminos, Pangasinan	TBD
Sub-Total BESS	**430**		
TOTAL COMMITTED	**6,331**		
TOTAL COMMITTED W/O BESS	**5,901**		
INDICATIVE POWER PLANTS			
COAL			
SMC Mariveles Coal-Fired Power Project*	1,200	Mariveles, Bataan	Unit 1 - Dec 2021 Unit 2 - Mar 2022 Unit 3 - Sep 2022 Unit 4 - Dec 2022
H & WB PCB Supercritical Coal-Fired Power Project*	700	Jose Panganiban, Camarines Norte	Unit 1 – 2023 Unit 2 -subject to the completion of the proposed 500 kV Tagkawayan Substation, and to the demand and supply status in Luzon Grid/ under evaluation, schedule wise
2x500 MW KEPCO Pangasinan Coal-Fired Power Project*	1000	Sual, Pangasinan	Sep 2023
Quezon Coal Fired Thermal Plant Project	1,200	Tagkawayan, Quezon	Dec 2023
SRPGC 2x350MW Coal-Fired Power Project*	700	Brgy. San Rafael, Calaca, Batangas	2025
SMC Circulating Fluidized Bed Coal-Fired Power Project*	600	Brgy. Ibabang Polo, Pagbilao, Quezon	TBD
Global Luzon Coal-Fired Power Project*	670	Brgys. Carisquis and Nalvo Sur, Luna, La Union	TBD
Merbau Coal Fired Thermal Power Project*	600	Brgy. Pinamukan Ibaba, Batangas City	TBD
SMC Circulating Fluidized Bed Coal-Fired Power Project	600	Sariaya, Quezon	TBD
SMC Supercritical Pulverized Coal Thermal	1,005	Masinloc, Zambales	TBD
Sub-Total Coal	**8,275**		
OIL-BASED			
Isla del Fuego Bunker Fired Diesel Power Generating Facility	35	Redondo Peninsula, Subic, Zambales	TBD
Bataan Diesel Power Plant	150	Brgy. Batangas II, Mariveles, Bataan	TBD
Legaspi Ancillary Reserve Diesel power Plant	50	Legaspi, Albay	TBD
Sto. Domingo Ancillary Reserve Diesel power Plant	50	Sto. Domingo, Albay	TBD
Tiwi Ancillary Reserve Diesel power Plant	100	Tiwi, Albay	TBD
Daraga 1 Ancillary Reserve Diesel power Plant	100	Daraga Albay	TBD
Daraga 2 Ancillary Reserve Diesel power Plant	100	Daraga Albay	TBD
Daraga 3 Ancillary Reserve Diesel power Plant	50	Daraga Albay	TBD
Lumban Ancillary Service Diesel Power Plant	200	Lumban, Laguna	TBD

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Heavy Fuel Oil (HFO) Fired Thermal Power Plants	110	Navotas, Manila	TBD
IPC Diesel/Turbine Power Plant	300	Mariveles, Bataan	TBD
Sub-Total Oil-Based	**1,245**		
NATURAL GAS			
SMC Ilijan LNG Power Project	3,600	Batangas	TBD
VIRES LNG-Fired Power Barge Project*	500	Batangas Bay area, Batangas	TBD
Sta. Maria Power Plant (Phase II)*	450	Santa Rita, Batangas	TBD
Lucidum Liquefied Natural Gas Power Plant	300	Silanguin Bay, Zambales	TBD
Limay LNG Power Corporation CC GT Project	1,100	Limay, Bataan	TBD
Millennium Energy Inc. Gas Turbine Power Plant*	210	Navotas Fish Port	TBD
Lloyds Energy Philippines Inc. Floating Power Plant	1,200	San Pascual, Batangas Bay	TBD
First Gen Ecopower Solutions Inc. Santa Maria Combined -Cycle Power Plant Project*	1,260	Batangas City	TBD
Sub-Total Natural Gas	**8,620**		
GEOTHERMAL			
Bacon-Manito Geothermal*	80	Bacon-Manito, Sorsogon	Sep 2022
Bacman 4 Botong-Rangas Geothermal*	20	Bacon District, Sorsogon, Sorsogon City	Nov 2022
Kayabon Geothermal	30	Manito, Albay	2026
Kalinga Geothermal Power Project*	120	Pasil, Kalinga	2026
Maibarara Geothermal Power Project*	60	Laguna/Batangas	TBD
Sub-Total Geothermal	**310**		
SOLAR			
Sta. Maria Solar Power Project*	30	Sta. Maria, Isabela	Jan 2020
Santa Solar Power Project*	20	Brgy. Nagpanaoan, Santa, Ilocos Sur	Feb 2020
Talugtug Solar PV Power Project	125	Talugtug, Nueva Ecija	Apr 2020
Greenergy Capas Solar Power Project	50	Capas, Tarlac	Apr 2020
Ilagan II Solar PV Power Project	100	Ilagan City, Isabela	Apr 2020
Cabanatuan Solar Power Plant	6.25	Cabanatuan, Nueva Ecija	Apr 2020
Clark Solar Power Project*	35	Northern Runway Approach of Clark International Airport, Clark Pampanga	Sep 2020
Laguna Bay 2 Solar Power Project	300	Pililia, Rizal	May 2021
Binalonan Solar Power	46.09	Sison and Binalonan, Pangasinan	Q4 2021
Bongabon Solar Power Plant	18.75	Bongabon, Nueva Ecija	Mar 2022
Earthenergy Solar Power Plant	30	Balayan, Batangas	TBD
Gamu 2 Solar Power Project	84.55	Gamu, Isabela	2023
Armenia Solar Power Project	35.2	Tarlac City and San Jose, Tarlac	2023
Macabud Solar Photovoltaic Power Project	30	Brgy. Macabud, Rodriguez, Rizal	TBD
Cavite Solar Power Project	3	Cavite Economic Zone, Rosario Cavite	TBD
V-Mars Solar Power Project*	10	San Jose/Lupao, Nueva Ecija	TBD
SJC Solar Power Project*	10	San Jose City, Nueva Ecija	TBD
RGEC Solar Power Project*	30	Nasugbu and Tuy, Province of Batangas	TBD
Calabanga Solar Power Project*	50	Calabanga, Camarines Sur	TBD

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
FPI Solar PV Power Project	50	Tarlac City, Tarlac	TBD
Nueva Ecija Solar Power Project	100	Pantabangan, Nueva Ecija	TBD
Sta. Maria Solar PV Power Project	125	Sta. Maria, Isabela	TBD
Solana Solar Photovoltaic (PV) Plant Phase I*	24	Hermosa, Bataan	TBD
Solana Solar Photovoltaic (PV) Plant Phase II	14	Hermosa, Bataan	TBD
Cordon Solar PV Power Project*	50	Cordon, Isabela	TBD
Sta. Rita Solar Power Project - Phase II	67.86	Mt. Sta. Rita, Morong and Hermosa, Bataan	2021
Botolan Solar Power Project	39.27	Brgy. San Juan, Botolan, Zambales	TBD
Magsingal Solar Power Plant*	100	Magsingal, Ilocos Sur	TBD
Calamba and Tanauan Solar Power Project	100	Tanauan, Batangas	TBD
Capas Solar PV Power Project*	22	Capas, Tarlac	TBD
San Manuel 1 Solar Power Project	70	San Manuel, Pangasinan	TBD
San Manuel 2 Solar Power Project	70	San Manuel, Pangasinan	TBD
Horus Solar Power Plant Project	45	Morong, Bataan	TBD
Tanauan Batangas Solar I Power Project	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
Lumban Solar Power Plant	37	Lumban, Laguna	TBD
San Miguel Solar Power Plant	50	San Miguel, Bulacan	TBD
Bawi Solar Power Plant*	45	Lipa City & Padre Garcia, Batangas	TBD
Iba Palauig 1 Solar Power Project	1200	Iba, Zambales	TBD
Iba Palauig 2 Solar Power Project	1200	Iba, Zambales	TBD
Balayan Solar Power Project	600	Balayan & Calaca, Batangas	TBD
Sta. Rosa Nueva Ecija 2 Solar	1200	Sta. Rosa, Peñaranda, San Leonardo, Nueva Ecija	TBD
Concepcion Tarlac 2 Solar*	200	Concepcion City, Tarlac	TBD
Laguna Lake-Balibago SPP	140	Laguna de Bay and Santa Rosa, Laguna	TBD
Laguna Lake-Bay SPP	126	Bay-Calauan and Victoria, Laguna and Laguna de Bay	TBD
Laguna Lake-Cabuyao SPP	100.8	Cabuyao, Sta. Rosa and Calamba Laguna and Laguna de Bay	TBD
Laguna Lake-Calamba SPP	270	Calamba City, Laguna and Laguna de Bay	TBD
Laguna Lake-Los Baños SPP	100.8	Los Baños, Laguna	TBD
Laguna Lake-Lumban SPP	65.52	Cabuyao, Laguna	TBD
Laguna Lake-UPLB SPP	30	UPLB, Los Baños, Laguna	TBD
Gamu Solar Power Project	100	Gamu, Isabela	TBD
San Rafael Solar Power Project*	421.2	San Rafael, Bulacan	TBD
San Ildefonso Solar Power Project*	421.2	San Ildefonso, Bulacan	TBD
Tarlac Solar Power Project	150	Tarlac City, Tarlac	TBD
San Jose Del Monte SPP*	80	San Jose Del Monte, Bulacan	TBD
Maragondon-Naic-Tanza 2 Solar Power Project	600	Maragondon-Naic-Tanza, Cavite	TBD
Sunray Tarlac Solar Power Project	100	Capas and Bamban, Tarlac	TBD
Currimao Solar Power Project*	30	Currimao, Ilocos Sur	TBD
Sulvec Solar Power Plant	20	Narvacan, Ilocos Sur	TBD
San Miguel Solar Power Plant	100	San Miguel, Bulacan	TBD
San Pablo Solar Power Project	130	Isabela	TBD

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Cabatang Tiaong Solar Power Project	600	Tiaong, Quezon	TBD
Santa Rosa Nueva Ecija 1 Solar Power Plant*	300	Santa Rosa and Peñaranda, Nueva Ecija	TBD
San Ildefonso Solar Power Project	55	San Ildefonso, Bulacan	TBD
Currimao Solar Power Project	90	Currimao, Ilocos Norte	TBD
Bulacan 2 Solar Power Project	22	San Ildefonso, Bulacan	TBD
Mabacong Solar Power Project	50	Batangas City	TBD
Gigasol3 Solar Power Project	63	Brgys. Salaza and Cauyan, Palauig, Zambales.	TBD
Sta. Barbara Solar Power Project	15	Sta. Barbara, Pangasinan	TBD
Cardona Solar Power Project	1200	Cardona, Binangonan and Laguna de Bay	TBD
Naga Solar Power Plant	1200	Naga Camarines Sur	TBD
Sub-Total Solar	**13,173.49**		
HYDRO			
Man-Asok	3	Buguias, Benguet	Nov 2020
Laguio Malaki 1	1.6	Mauban, Quezon	Nov 2020
Biyao	0.8	Balbalan, Kalinga	Nov 2020
Ibulao Hydroelectric Power Project*	4.5	Lagawe, Ifugao	Nov 2020
Ibulao 1	6.75	Kiangan, Ifugao	Nov 2020
ARIIS 2 Hydroelectric Power Project	0.48	San Manuel, Pangasinan	Jan 2022
ARIIS 3 Hydroelectric Power Project	0.48	San Manuel, Pangasinan	Jan 2022
ARIIS 1 Hydroelectric Power Project	0.51	San Manuel, Pangasinan	Jan 2022
ARIIS 4 Hydroelectric Power Project	0.67	San Manuel, Pangasinan	Jan 2022
Lamut Hydroelectric Power Project	6	Lamut/Asipulo, Ifugao	2022
Dupinga Hydroelectric Power Project	3	Gabaldon, Nueva Ecija	Nov 2022
Gened - 1 Hydroelectric Power Project*	150	Pudtol, Apayaw	4th Q 2022
Didipio 1	2.1	Kasibu, Nueva Vizcaya	Nov 2024
Kibungan 2 Hydroelectric Power Project	40	Kibungan, Benguet	2023
Kabayan 2 (Natalang HEP)	38	Kabayan, Benguet	Nov 2024
Ilaguen 3*	11	Echague, Isabela	Nov 2024
Kapangan*	60	Kapangan & Kibungan, Benguet	Nov 2025
Tumauini (Lower Cascade)	7.8	Tumauini, Isabela	Nov 2025
Abdao HEP	2	Tabaan Sur, Tuba, Benguet	Nov 2025
Barit (Irrigation Discharge) Hydroelectric Power Project	0.4	Buhi, Camarines Sur	Nov 2025
Talubin Hydropower Project	4.9	Bontoc, Mountain Province	Nov 2025
Ilaguen 4*	10	Echague	Nov 2025
Matuno 1*	7.4	Ambaguio, Nueva Vizcaya	Nov 2025
Hungduan	4.04	Kiangan, Ifugao	Nov 2025
Asin	7.04	Kiangan, Ifugao	Nov 2025
Ilaguen*	19	San Mariano & San Guillermo	Nov 2025
Piapi*	3.30	Mauban, Quezon	Nov 2025
Lower Labayat*	1.40	Real, Quezon	Nov 2026
Ilaguen 2*	14	Dinapique, Isabela	Nov 2026
Colasi	1	Mercedes, Camarines Norte	Nov 2019
Labayat River (Upper Cascade)*	3	Real, Quezon	Nov 2019
Matuno	8	Bambang, Nueva Ecija	Nov 2020
Tubao	1.5	Tubao, La Union	Nov 2021
Rangas	1.5	Goa & Tigaon, Camarines Sur	Nov 2021

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Lalawinan Mini-Hydro Power Project*	3	Real, Quezon	Nov 2019
Pinacanauan	6	Peñablanca, Cagayan	TBD
Matibuey	16	Matibuey, Ilocos Sur	TBD
Tibag*	4.40	Real, Quezon	TBD
Tignoan River (Upper Cascade) HEP*	1.5	Real, Quezon	TBD
Ibulao 2	7.40	Municipalities of Kiangan, Lamut and Lagawe , Province of Ifugao	TBD
Tinoc 1	4.1	Tinoc, Ifugao	TBD
Tinoc 4	5	Tinoc, Ifugao	TBD
Tinoc 2	11	Tinoc, Ifugao	TBD
Tinoc 3	8	Tinoc, Ifugao	TBD
Tumauini (Upper Cascade)	14	Tumauini, Isabela	TBD
Kabayan 1	20	Kabayan, Benguet	TBD
Kabayan 3	27	Kabayan, Benguet	TBD
Tignoan HEP	20	Real, Quezon	TBD
Ibulao I Hydroelectric Power Project	6	Kiangan, Ifugao	TBD
Maris Main Canal2 HEP	1.75	Alfonso Lista, Ifugao	TBD
100 MW Alimit*	100	Lagawe, Ifugao	TBD
240 MW Alimit	240	Lagawe, Ifugao	TBD
Olilicon HEPP*	10	Lagawe, Ifugao	TBD
Cervantes-Mankayan-Bakun HEPP	27	Benguet	TBD
Chico Hydroelectric Power Project*	150	Tabuk, Kalinga	TBD
Kibungan Pumped-Storage HEPP*	500	Kibungan, Benguet	TBD
Ilaguen 4 Hydropower Project	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
Ilaguen HEPP	19	San Mariano and San Guillermo, Isabela	TBD
Matuno 2 HEPP*	7.9	Bambang, Nueva Vizcaya	TBD
Sablan 1 Hydroelectric Power Project*	20	Sablan, Benguet	TBD
Sablan 2 Hydroelectric Power Project	30	Sablan, Benguet	TBD
Santol-Sugpon Hydroelectric Power Project	52	Sugpon, Ilocos Sur / Kibungan Benguet	TBD
Pasil B Hydroelectric Power Project	15.684	Pasil, Kalinga	TBD
Pasil C Hydroelectric Power Project	9.754	Pasil, Kalinga	TBD
Calanan Hydropower Project*	60	Tabuk, Kalinga	TBD
Dalimuno Hydropower Project*	58	Tabuk, Kalinga	TBD
Pampang Hydroelectric Power Plant	26	Sta. Fe Nueva Vizcaya & San Nicolas Pangasinan	TBD
Colasi Mini-Hydroelectric Power Plant Project	4	Mercedes, Camarines Norte	TBD
Boga Hydroelectric Power Projects	1	Bauko, Mountain Province	TBD
Upper Chico Hydroelectric Power Projects	2.1	Bauko, Mountain Province	TBD

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Kadipo Bauko Hydropower Corporation	3.4	Bauko and Sadanga, Mountain Province	TBD
Cupis Hydroelectric Power Project	10	Brgy. Nabuangan, Conner, Apayao	TBD
Rizal Hydroelectric	10	Brgy. Rizal San Guillermo, Isabela	TBD
Coto 1 Hydroelectric Power Plant	9	Masinloc, Zambales	TBD
Coto 2 Hydroelectric Power Plant	3.5	Masinloc, Zambales	TBD
Baua 1 Hydroelectric Power Project	4.44	Gonzaga, Cagayan	TBD
Tinglayan Hydroelectric Power Project	4.32	Tinglayan, Kalinga	TBD
Aoan Hydroelectric Power Project	50	Calanasan, Apayao	TBD
Sub-Total Hydro	**3577.418**		
WIND			
Matnog 1 Wind Power Project*	153	Matnog, Sorsogon	Jul 2020
Matnog 2 Wind Power Project	206	Matnog, Sorsogon	Jul 2020
Matnog 3 Wind Power Project	206	Matnog, Sorsogon	Jul 2020
Tanay Wind Power Project	100	Antipolo and Tanay, Rizal	Q2 2022
Presentacion Wind Power Plant	42	Presentacion and Garchitorena Camarines Sur	2024
Aguilar Wind Power Project	99	Bugallon and Aguilar Pangasinan	2024
Bugallon Wind Power Plant	63	Bugallon, Pangasinan	2026
Pagudpud Wind Power Project	84	Brgy. Balaoi and Caunayan, Pagudpud, Ilocos Norte	Nov 2019
Burgos 2 Wind Power Project	183	Burgos, Ilocos Norte	Nov 2019
Sembrano Wind Power Project (Formerly: Phase 2: Mabitac Wind Power Project)	80.4	Mt. Sembrano, Mabitac, Laguna	Dec 2019
Phase 1: Pasuquin East Wind Power Project	48	Pasuquin, Ilocos Norte	TBD
Balaoi Wind Power Project	45	Brgy. Balaoi, Pagudpud, Ilocos Norte	TBD
Talim Wind Power Project	140	Rizal	TBD
Calatagan Wind Power Project	80	Batangas	TBD
Rizal Wind Power Project	603	Antipolo and Tanay, Rizal	TBD
Camarines Sur Wind Power Project	99	Camarines Sur	TBD
Alabat Wind Power Project	50	Alabat, Perez and Quezon, Quezon	TBD
Presentacion Wind Power Project	54	Presentacion Camarines Sur	TBD
Quezon Wind Power Project	100	Pagbilao and Atimonan, Quezon	TBD
Sison Wind Power Plant	73	Tuba, Benguet and Sison, Pangasinan	TBD
Wind Farm Power Project	250	Real, Quezon	TBD
Sub-Total Wind	**2,758.4**		
BIOMASS			
FQBC Biogas Power Plant Project	1.2	Quezon	TBD
NREDC Biomass Power Plant Project	24	Cagayan	Jun 2020
Polillo Biomass Power Plant Project	1.5	Quezon	Nov 2020
EcoMarket Solutions Coconut Waste- Fired Biomass Power Project	2.5	Aurora	Nov 2020
CJ Global Waste-to-Energy Power Project	20	Camarines Sur	Nov 2020
Green Atom Pampanga Waste to Energy Project	6	Mabalacat City, Pampanga	Nov 2020
Green Atom Pangasinan Waste to Energy Project	6	Laoac, Pangasinan	Nov 2020

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Green Atom Batangas Waste to Energy Project	6	Brgy. Aya, San Jose, Batangas	Nov 2020
Santa Biomass Power Project*	10	Brgy. Nagpanaoan, Santa, Ilocos Sur	Jun 2020
Bataan 2020 Multi-Feedstock Cogeneration Power Plant*	25	Mariveles, Bataan	TBD
Biomass Power Plant Project	15	Brgy. Raniag, Burgos, Isabela	TBD
Sub-Total Biomass	**117.2**		
BATTERY			
Mexico Battery Energy Project*	40	Mexico, Pampanga	TBD
SN Aboitiz Battery Energy Storage System	20	Isabela	TBD
ISOC San Manuel Energy Storage, Inc.	40	San Manuel, Pangasinan	TBD
ISOC Iridium Energy Storage, Inc.	40	Lumban, Laguna	TBD
ISOC Paladium Energy Storage, Inc.	40	Concepcion, Tarlac	TBD
ISOC Cadmium Energy Storage, Inc.	40	Mexico, Pampanga	TBD
Bauang BESS Project	40	Bauang, La Union	TBD
Hermosa BESS Project	40	Hermosa, Bataan	TBD
Labrador BESS Project	40	Labrador, Pangasinan	TBD
San Manuel BESS Project	40	San Manuel, Pangasinan	TBD
Cabanatuan BESS Project	40	Cabanatuan, Nueva Ecija	TBD
Bayombong BESS Project	40	Bayombong, nueva Vizcaya	TBD
Nagsaag Battery Energy Storage	20	Nagsaag, Pangasinan	TBD
Lumban Battery Energy Storage*	20	Lumban, Laguna	TBD
Laoag Battery Energy Storage*	20	Laoag, Ilocos Norte	TBD
Concepcion Battery Energy Storage*	20	Concepcion, Tarlac	TBD
Labrador Battery Energy Storage	20	Labrador, Pangasinan	TBD
Pililla Energy Storage Project	50	Pililia, Rizal	TBD
Currimao Energy Storage Project	50	Currimao, Ilocos Norte	TBD
Alaminos Battery Energy Storage	20	Alaminos, Pangasinan	TBD
Bay Energy Storage Project	20	Bay, Laguna	TBD
Labo Energy Storage Project	20	Labo, Camarines Norte	TBD
Sub-Total Battery	**720**		
TOTAL INDICATIVE	**38,796.5**		
TOTAL INDICATIVE W/O BATTERY	**38,076.5**		

* - with SIS

Table A3.2: Private Sector Initiated Power Projects in Visayas as of 31 August 2020

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
COMMITTED POWER PLANTS			
COAL			
Palm Concepcion Coal-Fired Power Project*	135	Brgy. Nipa, Concepcion, Iloilo	Dec 2021
Sub-Total Coal	**135**		
OIL-BASED			
Isabel Modular Diesel Ancillary Service Power Project *	70	Isabel, Leyte	Nov 2020
TPVI Diesel-Fired Power Plant*	44.58	Brgy. Colon, Naga City, Cebu	Diesel Engine 1: Nov 4W Diesel Engine 2: Done Diesel Engine 3: Nov 4W Diesel Engine 4: Nov 4W Diesel Engine 5: Nov 4W

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
			Diesel Engine 6: Done
Sub-Total Oil-Based	**114.58**		
BIOMASS			
HDJ Biomass Power Plant Project*	3	Himamaylan City, Negros Occidental	Sep 2019
SNBI Cane trash-Fired Biomass Power Plant Project*	25	Negros Occidental	Oct 2019
NNBI Biomass Power Plant Project*	25	Manapla, Negros Occidental	Nov 2019
SCBI Multi-Feedstock Biomass Power Plant Project*	20	Negros Occidental	Nov 2019
HPC Cogeneration Power Plant Project*	20.58	Negros Occidental	2020
VMC Biomass Expansion Project*	60	Victoria, Negros Occidental	Jan 2021
Sub-Total Biomass	**153.58**		
BATTERY			
Ormoc Battery Energy Storage	20	Ormoc, Leyte	Jan 2021
Toledo Battery Energy Storage*	20	Toledo, Cebu	Jan 2021
Caticlan Battery Energy Storage	20	Caticlan	Jan 2021
Iloilo Battery Energy Storage*	20	Iloilo	Jan 2021
Mactan Battery Energy Storage	20	Mactan, Cebu	Jan 2021
Bohol Battery Energy Storage System	20	Bohol	Jan 2021
Cebu Battery Energy Storage System*	20	Compostela, Cebu	Jan 2021
Samboan Battery Energy Storage System*	20	Samboan, Cebu	Jan 2021
Tabango Battery Energy Storage System*	20	Tabango, Leyte	Jan 2021
Mactan Battery Energy Storage	20	Mactan, Cebu	Jan 2021
San Carlos Battery Energy Storage	20	San Carlos City, Negros Occidental	Jan 2021
Naga Battery Energy Storage	20	Naga, Cebu	Jan 2021
Kabankalan Integrated Renewable Power Hub Facility (R-Hub)	10	Kabankalan, Negros Occidental	TBD
Bais Battery Energy Storage	10	Negros Oriental	TBD
Sub-Total BESS	**270**		
TOTAL COMMITTED	**673.2**		
TOTAL COMMITTED W/O BESS	**403.16**		
INDICATIVE POWER PLANTS			
COAL			
SMC Loboc Malabuyoc Coal-Fired Power Plant Project*	300	Mactan, Cebu	TBD
SMC Global Negros Coal-Fired Power Plant Project	300	San Carlos, Negros Occidental	TBD
Sub-Total Coal	**600**		
NATURAL GAS			
Argao Floating CCGT Power Plant	138	Brgy. Bulasa, Argao, Cebu	TBD
Sub-Total Natural Gas	**138**		
OIL			
Bohol Diesel Power Plant Capacity Expansion*	30	Tagbilaran, Bohol	Aug 2020
Alsons Energy Bunker C Fired Power Plant*	55	Calbayog, Samar	TBD
GT Energy Bunker Fired Power Plant*	18	Calbayog, Samar	TBD
SPC Diesel Power Plant*	7.2	Brgy. Imelda, Ubay, Bohol	TBD
Sub-Total Oil	**110.2**		
GEOTHERMAL			

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Biliran Geothermal Plant Project*	50	Biliran, Biliran	Unit 1 (3.5 MW) - 2022 Unit 2 (4.5 MW) - 2024 Unit 3 (10 MW) - 2025 Unit 4 (10MW) - 2026 Unit 5 (22 MW) - 2027 Unit 6 (10 MW) - TBD
Dauin Geothermal Project	40	Dauin, Negros Oriental	Nov 2025
Mahanagdong Geothermal Brine Optimization Plant*	36	Barangay Tongonan, Ormoc City, Leyte	TBD
Sub-Total Geothermal	**126**		
SOLAR			
Sanpalo Solar Power Plant*	100	San Miguel, Leyte	Aug 2020
Ceko Solar PV Project (Daanbantayan Solar PV Power Project)*	100	Brgy. Tominjao, Daan Bantayan, Cebu	TBD
Silay Phase II Solar Power Project	10	Silay City, Negros Occidental	TBD
Victorias Solar Power Project*	30.63	Brgy. XII, Victorias City, Negros Occidental	TBD
Grid Tied Solar Farm	25	Biliran, Biliran	TBD
Tigbauan Solar Power Project	34.3	Brgy. Cordova Norte and Bantud, Tigbauan, Iloilo	TBD
Medellin Solar Power Plant*	300	Medellin, Cebu	TBD
Puente Al Sol Solar Power Plant*	70	Cadiz City, Negros Occidental	TBD
Roxas City Solar Power Project	0.7	Roxas City , Capiz	TBD
Sub-Total Solar	**670.63**		
WIND			
Iloilo 1 Wind Power Project	213	Batad & San Dionisio, Iloilo	Jul 2020
Nabas Wind Power Project Phase II*	14	Brgy. Pawa, Nabas, Aklan	Phase 2 (14 MW) - Aug 2021
Iloilo 2 Wind Power Project	500	Concepcion, Iloilo	TBD
Negros Wind Power Project	262	Manapla & Cadiz, Negros Occidental	TBD
Pulupandan Wind Power Project*	50	Pulupandan, Negros Occidental	TBD
Aklan I Wind Power Project Phase 1-3*	75	Nabas-Malay, Aklan	TBD
Anda Wind Power Project*	50	Anda, Candijay & Guindalman, Bohol	TBD
Bohol I (Ubay) Wind Power Project*	100	Ubay, Alicia, Mabini, Bohol	TBD
Tanjay Wind Power Project*	50	Bais, Negros Oriental	TBD
San Isidro Wind Power Project*	150	San Isidro, Northern Samar and Calbayog City, Samar	TBD
Guimaras Strait Wind Power Project	600	Guimaras, Negros Occidental	TBD
Sub-Total Wind	**2,064**		
HYDRO			
Igbulo (Bais) Hydroelectric Power Project*	5.1	Igbaras, Iloilo	2020
Timbaban*	18.0	Madalag, Aklan	2020
Loboc Hydroelectric Power Project*	1.2	Loboc, Bohol	Nov 2020
Aklan Pumped-Storage Hydropower*	300	Malay, Aklan	Jan 2024
Amlan (Plant A)*	50.7	Amlan, Negros Oriental	Nov 2025
Malago*	6	Silay City, Negros	Nov 2025
Amlan (Plant C)*	0.8	Amlan, Negros Oriental	Nov 2026
Main Aklan River Hydroelectric Power Project	15	Libacao, Aklan	Nov 2026

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Lower Himogaan	4	Sagay, Negros Occidental	Nov 2026
Amlan (Plant B)*	1.5	Amlan, Negros Oriental	Nov 2026
Cantakoy	8	Danao, Bohol	TBD
Hilabangan (Lower Cascade)	3	Kabankalan, Negros Occidental	TBD
Hilabangan (Upper Cascade)	4.8	Kabankalan, Negros Occidental	TBD
Maninila (Lower Cascade)	4.5	San Remigio, Antique	TBD
Maninila (Upper Cascade)	3.1	San Remigio, Antique	TBD
Sibalom (Upper Cascade)	4.2	San Remigio, Antique	TBD
Sibalom (Middle Cascade)	4	San Remigio, Antique	TBD
Sibalom (Lower Cascade)	3.3	San Remigio, Antique	TBD
Bolusao Pumped Storage	300	Lawaan, Eastern Samar	TBD
Ilog Hydroelectric Power Plant*	21.6	Mabinay, Negros Occidental	TBD
Maslog Hydroelectric Power Project*	40	Maslog, Eastern Samar	TBD
Sub-Total Hydro	**798.8**		
BIOMASS			
MCEI Multi-Feedstock Biomass Power Plant Project*	12	Negros Occidental	Nov 2020
UGEP Rice Husk-Fired Biomass Power Plant Project	2.5	Leyte	Nov 2020
Bagasse-Fired Cogeneration Power Plant Project*	8	Brgy Cadilang, Passi, Iloilo	Sep 2021
Green Power Biomass Power Plant Project	17.5	Mina, Iloilo	Nov 2022
Sub-total Biomass	**40**		
BATTERY			
Toledo Battery Energy Storage System	6	Toledo City, Cebu	TBD
Daanbantayan Battery Energy Storage System	10	Barangay Talisay, Daanbantayan, Cebu	TBD
Toledo Battery Energy Storage System	7.5	Toledo City, Cebu	TBD
Tabango Battery Energy Storage System	7.5	Tabango City, Cebu	TBD
Compostela Battery Energy Storage System	7.5	Compostela, Cebu	TBD
Dingle Battery Energy Storage System	7.5	Dingle City, Cebu	TBD
Ubay Battery Energy Storage System	7.5	Ubay City, Cebu	TBD
Ormoc Energy Storage Project	50	Ormoc, Leyte	TBD
Tinampa-an Energy Storage Project*	50	Cadiz, Negros Occidental	TBD
Cadiz Energy Storage Project	50	Cadiz, Negros Occidental	TBD
Kabankalan Integrated Renewable Power Hub Facility (R-Hub)*	20	Kabankalan, Negros Occidental	TBD
Sub-Total Battery	**223.5**		
TOTAL INDICATIVE	**4,771.13**		
TOTAL INDICATIVE W/O BATTERY	**4,547.63**		

* - with SIS

Table A3.3: Private Sector Initiated Power Projects in Mindanao as of 31 August 2020

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
COMMITTED POWER PLANTS			
COAL			
GNPower Kauswagan Clean Coal-Fired Power Plant*	150	Kauswagan, Lanao del Norte	2020
FDC-MPC CFB Coal-Fired Power Plant*	270	Misamis Oriental	2024

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Sub-Total Coal	**420**		
BIOMASS			
PTCI Rice Husk-Fired Biomass Cogeneration Facility	3	Sultan Kudarat, Maguindanao	Jun 2019 (On-going Testing and Commissioning)
SPGI Biomass Power Plant Project*	6	Surallah, South Cotabato	Nov 2019
Sub-Total Biomass	**9**		
BESS			
TMI Hybrid BESS	49	Maco, Compostela Valley	TBD
Surigao / Butuan Battery Energy Storage	20	Surigao / Butuan	TBD
Zamboanga Battery Energy Storage	200	Zamboanga	TBD
Maco Battery Energy Storage*	20	Maco, Compostela Valley	TBD
Sub-Total BESS	**289**		
TOTAL COMMITTED	**718**		
TOTAL COMMITTED W/O BESS	**429**		
INDICATIVE POWER PLANTS			
COAL			
Ozamiz Coal Fired Power Plant*	300	Brgy. Pulot,Ozamiz City,Misamis Occidental	TBD
SMC Malita Coal Power Project Phase II*	300	Brgy. Culaman, Malita, Davao Occidental	TBD
SMC Global Power Coal-Fired Power Plant*	328	Brgy. Darong, Santa Cruz, Davao del Sur	TBD
Sub-Total Coal	**928**		
OIL-BASED			
TPI Diesel Power Plant*	5.883	Mati, Davao Oriental	Jun 2020
Sub-Total Oil-Based	**5.883**		
GEOTHERMAL			
EDC Mindanao 3 Geothermal Power Plant*	30	Kidapawan, North Cotabato	Nov 2021
Sub-Total Geothermal	**30**		
HYDRO			
Lake Mainit*	25	Jabonga, Agusan del Norte	Nov 2020
Bubunawan Hydroelectric Power Project	23	Baungon and Libona, Bukidnon	Nov 2021
Pulanai	10.6	Valencia, Bukidnon	Nov 2022
Tagum	2.60	Maco, Compostela Valley	Nov 2024
Tagoloan	39	Impasugong & Sumilao, Bukidnon	Nov 2025
Culaman Hydroelectric Power Project*	10	Manolo Fortich, Bukidnon	Nov 2025
Katipunan River Mini Hydro Power Project	6.2	Cabanglasan, Bukidnon	Nov 2025
Cabadbaran Hydroelectric Power Project*	9.75	Cabadbaran, Agusan del Norte	Nov 2025
Lower Maladugao River Mini-Hydropower Project	15.7	Kalilangan and Wao, Bukidnon	Nov 2025
Maladugao (Upper Cascade) Hydroelectric Power Project	8.4	Kalilangan, Bukidnon	Nov 2026
Sawaga River Mini Hydro Power Project	4.5	Malaybalay, Bukidnon	Nov 2026
Liangan Hydropower Project*	11.9	Bacolod, Lanao del Norte	Nov 2026
Malitbog*	3.4	Malitbog, Bukidnon	TBD
Clarin*	5	Clarin, Misamis Occidental	TBD
Mat-i-I*	4.85	Claveria, Cagayan de Oro	TBD
Silo-o*	3.29	Malitbog, Bukidnon	TBD
Agus III	225	Pantar & Balo-I, Lanao del Sur & Lanao del Norte	TBD

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Kitaotao 1	70	Bukidnon	TBD
10 MW Cabulig-2 Hydroelectric Power Plant Project	10	Jasaan, Misamis Oriental	TBD
Davao Hydroelectric Power Project	140	Davao City	TBD
South Pulangi Hydroelectric Power Project*	250	Damulos, Bukidnon	TBD
Mangima Hydro Electric Corp	12	Manolo Fortich, Bukidnon	TBD
Sub-Total Hydro	**890.19**		
SOLAR			
Greenlight Solar Power Project*	50	Datu Odin, Sinsuat, Maguindanao	Q3 2020
Sarangani Solar PV Power Plant	100	Alabel, Sarangani	Sep 2020
Laguindingan Solar Power Project	20	Laguindingan, Misamis Oriental	Mar 2021
Banale Solar Power Project	13	Brgy. Banale, Pagadian, Zamboanga del Norte	Dec 2020
Conel Solar Power Project	16	General Santos City, South Cotabato	Mar 2021
Mabuhay Solar Power Project	44	General Santos City, South Cotabato	Mar 2021
Sumilao Solar Power Project	2	San Vicente, Sumilao, Bukidnon	TBD
GenSan Solar Power Project Phase I*	48	Brgy. Conel, General Santos City, South Cotabato	TBD
GenSan Solar Power Project Phase II*	48	Brgy. Tambler, General Santos City, South Cotabato	TBD
60 MW General Santos City Solar Power Project	60	General Santos City, South Cotabato	TBD
San Francisco Solar Power Project	10	San Francisco, Agusan del Sur	TBD
Jasaan Solar Power Project	60	Jasaan, Misamis Oriental	TBD
Lal-lo Solar PV Power Plant*	100	Maasim, Sarangani	TBD
Ecoglobal 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
Tantangan Solar Power Project	65	Tantangan, South Cotabato	TBD
Claveria Solar Power Project	60	Claveria, Misamis Oriental	TBD
Sub-Total Solar	**778**		
BIOMASS			
10MW Malay-balay Bio-Energy Corporation Multi Feedstock Generating Facility	10	Bukidnon	Nov 2020
NAREDCO Biogas Power Plant	24	Lal-lo, Cagayan	Nov 2020
Napier Grass-Fired Biomass Power Plant Project	5	Bukidnon	Nov 2020
Biogas Power Plant Project	24	Maasim, Sarangani	Nov 2020
23.5 MW Woody Biomass Power Plant Project	23.5	Agusan del Norte	2022
12 MW Napier Grass-Fired Biomass Power Plant Project	12	Bukidnon	Nov 2020
Bagasse-Fired Co-generation Power Plant*	14.9	Maramag, Bukidnon	TBD
Sub-Total Biomass	**113.4**		
BESS			
3 x 20 Pitogo Battery Energy Storage Solution	60	Brgy. Sinunuc, Pitogo, Zamboanga City, Zamboanga del Sur	TBD
2 x 20 Sangali Battery Energy Storage Solution	40	Sangali, Zamboanga City, Zamboanga del Sur	TBD
2 x 20 Aurora (Pagadian) Battery Energy Storage Solution	40	Aurora, Zamboanga del Norte	TBD
Kibawe Energy Storage Project	50	Kibawe, Bukidno	TBD
Toril Energy Storage System	20	Toril, Davao	TBD

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Sub-Total Battery	**210**		
TOTAL INDICATIVE	**2,955.5**		
TOTAL INDICATIVE W/O BESS	**2,745.5**		

* - with SIS

Appendix 4 – Summary of Asset Lives

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 equipment	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	
System Control		15	

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

Appendix 5 – Completed Projects (2009-2020)

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
LUZON					
Batangas Transmission Reinforcement - Calamba Tower No. 50–Biñan				36.40	Mar 2009
Tap hermosa-Balintawak (Duhat Cut-in) 230 kV Transmission Line				1.20	Nov 2009
Concepcion-Clark 230 kV Transmission Line - Clark Substation (new)		100			Nov 2009
San Jose Substation (Power Shunt Reactor)			90		Dec 2009
Biñan-Muntinlupa (Sucat) 230 kV Line 4				14.30	Jun 2010
Replacement Program for San Jose		3000			Feb 2010
Taytay (Dolores) Substation		300			May 2010
Doña Imelda (Araneta) Substation		300			Sep 2010
Santiago-Alicia 69 kV Transmission Line				20	Jan 2011
Relocation of Hermosa-Balintawak 230 kV Transmission Line				11.41	Mar 2011
Kadampat Substation (Power Shunt Reactor)				90	Jan 2011
Luzon Substation Expansion Project 1 - Mexico Substation Expansion - Binan Substation Expansion		 600 300			 Sep 2011 Dec 2011
Dasmariñas Substation Upgrading		300			Oct 2011
Mariveles Coal Transmission Reinforcement - Reconductoring of Limay-Hermosa 230 kV Transmission Line (Line 2) - Mariveles-Limay B 230 kV Transmission Line (Line 2)				 89.9 35.8	 Oct 2012 Dec 2012
Luzon Substation Expansion Project 1 - Cruz-na-Daan S/S Expansion - Bantay S/S Expansion - Laoag S/S Expansion - Cabanatuan S/S Expansion - Bauang S/S Expansion - Naga S/S Expansion		 100 50 50 300 100 100			 May 2012 Jun 2012 Jul 2012 Aug 2012 Sep 2012 Dec 2012
Mariveles Coal Transmission Reinforcement Project - Reconductoring of Limay-Hermosa 230 kV Transmission Line (Line 1)				89.9	Jan 2013

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
- Mariveles-Limay B 230 kV Transmission line (Line 1)				35.8	Jan 2013
Tayabas S/S Expansion Project 1		600			Jan 2013
Luzon S/S Expansion Project 3 - Batangas S/S Expansion (TO4)		300			Sep 2013
Dasmariñas EHV Substation Expansion		300			Nov 2013
Luzon Voltage Improvement Project 1 - Cabanatuan Substation - Muntinlupa (Sucat) S/S			 100 50		 Apr 2013 Apr 2013
Magapit Capacitor			15		May 2013
Luzon S/S Expansion Project 2 - Mexico Substation - Concepcion Substation - La Trinidad Substation - Ambukalo Substation		 300 100 300 50			
San Esteban-Laoag 230 kV Transmission Line, Stage 2 - Laoag Substation (T03) - Laoag S/S (T04)		 300 300			 May 2014 Jun 2014
Damariñas EHV Substation Expansion		600			Oct 2014
Luzon Substation Expansion Project 3 - Batangas Substation		 300			 Nov 2014
Luzon S/S Expansion Project 4 - Limay Substation		 100			 Dec 2014
Lumban EHV-Bay 230 kV Transmission Line - Line 2 - Line 1				85.2	 Mar 2015 Mar 2015
San Esteban-Laoag 230 kV Transmission Line - Line 2 - Line 1				218	 Sep 2015 Dec 2015
Luzon Substation Expansion Project 4 - Muntinlupa Substation - Bayombong Substation		 300 75			 Mar 2015 Aug 2015
Luzon Substation Expansion Project 2 - Mexico Substation		100			Jun 2015
Binga-San Manuel 230 kV Transmission Line, Stage 1 - Binga Substation		50			Dec 2015
Luzon Voltage Improvement Project 2 - Dasmariñas Substation Capacitors 1 & 2 - Biñan Substation Capacitors 1 & 2 - Mexico Substation Capacitors 1 & 2			 200 200 200		 Oct 2015 Jul 2015 Sep 2015
Bacnotan Tap-Bacnotan Transmission Line - Bacnotan-San Esteban 230 kV Line 1				6	 Mar 2016 Mar 2016

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
- Bauang-Bacnotan 230 kV Line 2					
Luzon Substation Expansion Project 3 - Bay Substation		 100			 Feb 2016
Balingueo (Sta. Barbara) 230 kV Substation (New)		100			Mar 2016
Luzon Substation Expansion Project 4 - Tuguegarao Substation - Santiago S/S (T02) - Santiago S/S (T01) - Nagsaag S/S - Gumaca DS/S		 100 100 100 100 50			 Apr 2016 Jun 2016 Oct 2016 Sep 2016 Dec 2016
Luzon Substation Reliability Project 1 - San Esteban Substation - Botolan Substation		 50 50			 Apr 2016 Oct 2016
Luzon Voltage Improvement Project 1 - Doña Imelda Substation Capacitor Bank 1			 100		 Feb 2016
Santiago-Tuguegarao 230kV Transmission Line				118	Sep 2017
Eastern Albay 69 kV Transmission Line, Stage 1				18	Dec 2017
Luzon Substation Expansion Project 4 - Daraga Substation - Gamu Substation		 100 50			 May 2017 Jul 2017
Las Pinas Substation Expansion		300			Jun 2017
Luzon Voltage Improvement Project 3 - Laoag Substation			 35		 Sep 2017
Bataan 230kV Reinforcement - Reconductoring of Mexico-Hermosa T/L & Mexico-Cabanatuan "Cut-in" Cruz na Daan - Reconductoring of Hermosa-Limay Transmission Line				 76 70	 Mar 2018 Jun 2018
Luzon Substation Reliability Project 1 - Labo Substation		 50			 Jun 2018
Hermosa–Floridablanca 69 kV Transmission Line		-	-	17	Feb 2019
San Jose 500 kV Substation (4th Bank)		750	-	-	Apr 2019
North Luzon Substation Upgrading Project 1 – Malaya Substation		300	-	-	Oct 2019
Luzon Voltage Improvement Project 3, Stage 1 - Cabanatuan Substation (Capacitor Bank 2) - Cabanatuan Substation (Capacitor Bank 1) - Tuguegarao Substation (Capacitor Bank 1) - San Jose Substation (Capacitors Banks 5 & 6)		 -	 50 50 25 200	 -	 Mar 2019 Oct 2019 Mar 2019 Mar 2019

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
- Mexico Substation (Capacitor Banks 3 & 7) - Tuguegarao Substation (Power Shunt Reactor) - Nagsaag Substation (Shunt Reactor) -Bantay Substation (Capacitor Bank) - Laoag Susbtation (Shunt Reactor) - Laoag Substation (Capacitor Banks)			200 25 90 7.5 25 50		Apr 2019 Aug 2019 Aug 2019 Sep 2019 Sep 2019 Sep 2019
Luzon Voltage Improvement Project 4, Stage 1 - Biñan Substation (Capacitor Bank 3 & 4) Dasmariñas Substation (Capacitor Bank 3 & 4)		-	200 200	-	Apr 2019 Apr 2019
Tower Structure Upgrading of Bicol Transmission Facilities (formerly Permanent Restoration Works of Toppled Towers by Typhoon Nina) - Naga–Tiwi C Transmission Line 2 (36 Towers)		-	-	-	Apr 2019
Luzon Voltage Improvement Project 3 - Mexico Substation			100		Mar 2020
Luzon Voltage Improvement Project 3 - Taytay Substation			200		Aug 2020
San Jose–Quezon 230 kV Line 3				19.50	Nov 2020
San Manuel–Nagsaag 230 kV Substation and Tie Line		600		0.60	Dec 2020
VISAYAS					
Northern Panay Backbone 139 kV Transmission Line				95	Jan 2011
New Naga Substation and Associated Tie Line - Old Naga-New Naga Tie Line - New Naga-Banilad Tie Line - New Naga-Sigpit Tie Line - New Naga-Suba Tie Line				9.92	 Mar 2011 Mar 2011 Jun 2011 Jun 2011
Paranas (Wright)-Carayman (Calbayog) 138 kV Transmission Project - Paranas-Carayman Transmission Line				123.64	Nov 2011
Negros-Panay Interconnection Project - San Juan-Dingle Transmission Line				33.8	Dec 2011
Northern Panay Backbone 139 kV Substation - Nabas Substation (new)		100			Jan 2011
New Naga Substation and Associated Tie Line		50			Feb 2011

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
Paranas (Wright)-Carayman (Calbayog) 138 kV Transmission Project - Carayman (Calbayog) Substation (new)		50			Nov 2011
Negros-Panay Interconnection Project - San Juan Substation (new)		50			Nov 2012
Visayas Substation Expansion Project 1 - Ormoc Substation Expansion		100			Dec 2012
Compostela Substation Expansion		150			Oct 2013
Bohol Backbone 138 kV T/L - Ubay-Corella T/L				92.27	Jun 2014
Bohol Backbone 138 kV T/L - Corella Substation (New)		100			Jun 2014
Visayas Substation Expansion project 1 - Kabankalan Substation Expansion - Calong Calong Substation		50 50			Mar 2014 Sep 2014
Southern Panay Backbone 138 kV Transmission Line				104	Dec 2015
Visayas Substation Reliability Project 1 - Babatngon Substation		50			Jul 2015
Visayas Substation Reliability Project 2 - Babatngon Substation		50			Nov 2015
Culasi-San Jose 69 kV Transmission Line - Schedule 1A & 1B				31.5	Mar 2016
Calong Calong-Toledo-Colon 138 kV Transmission Line - Line 1 - Line 2				54	 Aug 2016 Aug 2016
Colon-Cebu 138 kV Transmission Line - Line 2 - Line 3				54	 Sep 2016 Sep 2016
Cebu-Negros-Panay 230 kV Backbone, Stage 1 - Submarine Cable				18.9	 Oct 2016
Ormoc-Maasin 138 kV Transmission Line				114	Dec 2016
Visayas S/S Reliability Project 1 - Cadiz Substation - Ormoc Substation		50 150			Jan 2016 Nov 2016
Southern Panay Backbone - San Jose Substation (new)		50			Mar 2016
Visayas Substation Reliability Project 2 - Sta. Barbara Substation (T01) - Sta. Barbara Substation (T02) - Ormoc Substation		50 50 100			Oct 2016 Dec 2016 Nov 2016

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
Culasi-San Jose 69kV Transmission Line - Schedule 2A & 2B				31.50	Jan 2017
Visayas Substation Reliability Project 1 - Samboan Substation - Bacolod Substation - Amlan Substation		 50 100 50			 Mar 2017 Apr 2017 Dec 2017
Ormoc-Babatngon 138kV Transmission Line				81	Dec 2018
Visayas Voltage Improvement Project, Stage 1 - Compostela Substation - Corella Substation		 - -	 40 15	 - -	 Dec 2019 Dec 2019
Visayas Substation Reliablity Project 1 - Maasin Substation		 50			 Feb 2020
Bagolibas Substation		50			Mar 2020
Visayas Voltage Improvement Project - Cebu Substation			40		Mar 2020
San Carlos-Guihulngan Transmission Line				58	Aug 2020
New Naga Substation (Colon Substation)		100			Dec 2020
MINDANAO					
Maramag-Bunawan 230 kV Substation - Bunawan Substation - Tagoloan Substation		 50 100			 Sep 2009 Oct 2009
Maramag-Bunawan 230 kV Transmission Line				212.76	Oct 2010
Maramag-Bunawan 230 kV Substation - Maramag Substation (new)		75			Feb 2010
Mindanao Substation Expansion - Maco Substation - New Loon Substation		 100 150			 Nov 2010 Dec 2010
Sangali-Zamboanga (Pitogo) 138 kV Transmission Line				64	Jan 2011
Gen. Santos-Tacurong 138 kV Transmission Line - Gen. Santos-Tacurong Transmission Line				152.55	Dec 2011
Mindanao Substation Expansion Project - Matanao - Butuan Substation Expansion - Sta. Clara Substation Expansion		 50 100 50			 Jan 2011 Oct 2011 Nov 2011
Gen. Santos-Tacurong 138 kV Transmission Project - Gen Santos Substation Expansion - Tacurong		 100 100			 Dec 2011 Dec 2011
Mindanao Reliability Compliance Project 1			22		Mar 2012

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
- Bislig Substation Expansion - Naga (Sta. Clara) Substation Expansion			45		Jul 2012
Mindanao Substation Reliability Project 1 - Nabunturan (Tindalo) Substation Expansion - Sultan Kudarat (Nuling) S/S Expansion		100 75			Mar 2013 Apr 2013
Kirahon-Maramag 230 kV T/L				213.33	Aug 2014
Mindanao Substation Reliability Project 1 - Aurora Substation		100			Feb 2014
Abaga-Kirahon 230 kV Transmission Line				244	Jan 2015
Mindanao Substation Reliability Project 1 - Jasaan Substation		100			Dec 2015
Matanao-Culaman 230 kV Transmission Line - Line 1 - Line 2				120	Mar 2016 Apr 2016
Maramag-Kibawe 138 kV Transmission Line				20.9	Apr 2016
Matanao-Klinan (Gen. Santos) 138 kV Transmission Line - Line 2				68.7	Jun 2016
Matanao-Culaman 230 kV Transmission Line - Culaman Substation (new)		50			Mar 2016
Opol 138kV Substation & Associated. Cut-in Lines - Opol Substation (new)		75			Aug 2016
Mindanao S/S Expansion Project 2 - Gen.Santos Substation - Kidapawan Substation		100 50			Aug 2016 Nov 2016
Aurora-Polanco 138kV Transmission Line - Line 1 - Line 2				158	Jun 2018 Jul 2018
Aurora-Polanco 138kV Transmission Line - Polanco Substation (new)		75			Jun 2018
Matanao–Toril–Bunawan 230kV Transmission Line		-	-	38	Dec 2019
Mindanao 230 kV Backbone, Stage 1 - Bunawan Substation - Toril Substation - Culaman Substation		600 600 50	- - -	- - -	Oct 2019 Nov 2019 Dec 2019
Balo-i–Kauswagan–Aurora 230 kV Substation Phase 1		300	-	-	Jun 2019
Mindanao 230 kV Backbone, Stage 2		600	-	-	Nov 2019

Project Name / Components	Purpose	MVA	MVAR	CKT-KM	Date of Completion / Energization
- Villanueva Substation - Villanueva Subststation (Shunt Reactor)		-	70	-	Sep 2019
Mindanao Substation Reliability Project 1 - Maco Substation (Capacitor Bank 3) - Nabunturan (Capacitor Bank 5)		 - -	 7.5 7.5	 - -	 Oct 2019 Oct 2019
Mindanao Substation Upgrading Project 1 - Pitogo Substation (Capacitor Banks 3 & 4) - Butuan Substation (Capacitor Banks 4 & 5) - Placer Substation (Capacitor Banks 2 & 3) - San Francisco Substation (Capacitor Banks 1, 2, & 3) - Gen. Santos Substation (Capacitor Bank 4) - Tacurong Substation (Capacitor Bank 4)		 - - - - -	 15 22.5 15 22.5 7.5 7.5	 - - - - - -	 Dec 2019 Oct 2019 Oct 2019 Oct 2019 Oct 2019 Nov 2019
Matanao-Toril 230 kV Transmission Line				38	Jan 2020
Sultan Kudarat (Nuling) Substation Capacitor			15		Jul 2020
Butuan–Placer Transmission Line Project Schedule I & II				96.40	Oct 2020
Toril–Bunawan Transmission Line Project				84	Nov 2020
Mindanao Substation Upgrading Project - Placer Substation		100			Dec 2020
	TOTAL	21,209	2,855	3,375	

A. On-going Projects

	LUZON	ETC		VISAYAS	ETC		MINDANAO	ETC
1.	**Bataan–Cavite Transmission Line FS**	Dec 2020	1.	**Cebu–Negros–Panay 230 kV Backbone Project - Stage 1**	Apr 2021	1.	**Kauswagan–Lala 230 kV Transmission Line Project** **(Formerly Balo-i–Kauswagan–Aurora 230 kV Transmission Line Project (Phase 2)**	Sep 2021
2.	**Luzon PCB Replacement**	Mar 2021	2.	**Panitan–Nabas 138 kV Transmission Line 2 Project**	May 2021	2.	**Agus 2 Switchyard Upgrading Project**	Feb 2022
3.	**Luzon Voltage Improvement Project 3**	Mar 2021	3.	**Visayas Substation Reliability Project II**	Jun 2021	3.	**Mindanao Substation Upgrading Project (MSUP)**	Jun 2022
4.	**Calamba 230 kV Substation**	Mar 2021	4.	**Sta. Rita–Quinapondan 69 kV Transmission Line**	Jun 2021	4.	**Mindanao Substation Rehabilitation Project (MSRP)**	Jun 2022
5.	**North Luzon 230 kV Substation Upgrading Project**	Mar 2021	5.	**Tagbilaran 69 kV Substation Project**	Sep 2021	5.	**Tacurong–Kalamansig 69 kV Transmission Line**	Jun 2023
6.	**Tower Structure Upgrading of Bicol Transmission Facilities**	May 2021	6.	**New Naga (Colon) Substation Project (Remaining Works)**	Dec 2021	6.	**Mindanao–Visayas Interconnection Project**	Dec 2021
7.	**San Jose–Angat 115 kV Line Upgrading**	Jun 2021	7.	**Naga (Visayas) Substation Upgrading Project**	Dec 2021			
8.	**Relocation of Steel Poles along Hermosa–Duhat 230 kV Transmission Line**	Jun 2021	8.	**Cebu–Negros–Panay 230 kV Backbone Project - Stage 3**	Dec 2022			

LUZON		ETC	VISAYAS		ETC	MINDANAO		ETC
9.	**Western Luzon 500 kV Backbone (Stage 1)**	Jun 2021	**9.**	**Visayas Voltage Improvement Project**	Dec 2022			
10.	**South Luzon 230 kV Substation Upgrading Project**	Sep 2021	**10.**	**Cebu–Lapu-Lapu 230 kV Transmission Line Project**	Dec 2023			
11.	**Mariveles–Hermosa 500 kV Transmission Line**	Oct 2021						
12.	**Tiwi Substation Upgrading**	Dec 2021						
13.	**Clark–Mabiga 69 kV Transmission Line**	Dec 2021						
14.	**Hermosa–San Jose 500 kV Transmission Line**	Dec 2021						
15.	**Luzon Voltage Improvement Project 4**	Dec 2021						
16.	**Pagbilao 500 kV Substation**	Mar 2022						
17.	**Tuguegarao– Lal-lo 230 kV Transmission Line**	Mar 2022						
18.	**Antipolo 230 kV Substation**	Apr 2022						
19.	**Ambuklao–Binga 230 kV Transmission Line Upgrading**	Dec 2023						
20.	**Binga–San Manuel 230 kV Transmission Line Stage 1 & 2**	Dec 2023						

LUZON		ETC	VISAYAS		ETC	MINDANAO		ETC
21.	**Navotas 230 kV Substation**	Dec 2023						
22.	**Taguig 500 kV Substation**	Dec 2023						
23.	**Tuy 500/230 kV Substation Project (Stage 1)**	Mar 2023						
24.	**Eastern Albay 69 kV Line Stage 2**	Oct 2023						
25.	**La Trinidad–Calot 69 kV Transmission Line**	Nov 2025						
26.	**Pasay 230 kV Substation**	Dec 2025						
27.	**Navotas–Doña Imelda 230 kV Transmission Line**	Jan 2028						

B. Proposed Transmission Projects

LUZON		ETC	VISAYAS		ETC	MINDANAO		ETC
1.	**Santiago–Magat 230 kV Transmission Line Recoductoring Project**	Dec 2022	**1.**	**Cebu–Negros–Panay 230 kV Backbone Project – Stage 2**	Dec 2021	**1.**	**Laguindingan 230kV SS Project**	Jun 2023
2.	**Malaya 230 kV Collector Station Project**	Dec 2022	**2.**	**Panay–Guimaras 138 kV Interconnection Project**	Oct 2022	**2.**	**Mindanao Substation Expansion 4 Project**	Jun 2023
3.	**Pinamucan 500 kV Substation**	Jun 2024	**3.**	**Negros–Panay 230 kV Interconnection Line 2 Project**	Mar 2023	**3.**	**Mindanao Substation Expansion 3 Project**	Jul 2025
4.	**Pagbilao–Tayabas 500 kV Transmission Line**	Mar 2025	**4.**	**Nabas–Caticlan–Boracay Transmission Project**	Jun 2022	**4.**	**Zamboanga Peninsula Voltage Improvement Project**	Capacitors – 2021 STATCOM – 2022
5.	**Marilao 500 kV Substation**	Jul 2023	**5.**	**Cebu–Bohol 230 kV Interconnection Project**	Sep 2022	**5.**	**Nasipit Substation Bus-In Project**	Jun 2023

LUZON		ETC	VISAYAS		ETC	MINDANAO		ETC
6.	**Concepcion–Sta. Ignacia 69 kV Transmission Line**	Aug 2022	**6.**	**Banga 138 kV Substation Project**	Dec 2024	**6.**	**Kabacan 138 kV Substation Project**	S/S - Jun 2023; T/L to Kidapawan – Sep 2025
7.	**Nagsaag–Tumana 69 kV Transmission Line**	Aug 2022	**7.**	**Amlan–Dumaguete 138 kV Transmission Project**	Feb 2025	**7.**	**Mindanao Substation Upgrading 2 Project (MSU2P)**	Jun 2023
8.	**North Luzon Substation Upgrading 2**	Oct 2022	**8.**	**Babatngon–Palo 230 kV Transmission Line Project (Initially energized at 138 kV)**	Oct 2025	**8.**	**Sultan Kudarat – Pinaring 69 kV Line Upgrading Project**	Dec 2023
9.	**Pinili 230 kV Substation**	May 2023	**9.**	**Permanent Restoration of Panit-an–Nabas 138 kV Line affected by Typhoon Ursula**	May 2021	**9.**	**San Francisco–Tago 138 kV Transmission Line Project**	Dec 2023
10.	**San Simon 230 kV Substation**	May 2023	**10.**	**Permanent Restoration of Colon–Samboan 138 kV Lines 1 and 2 affected by Landslide**	Jun 2021	**10.**	**Polanco – Oroquieta 138 kV Transmission Line Project (Initially energized at 69 kV)**	Capacitors– Sep 2024 T/L– Apr 2028
11.	**Abuyog 230 kV Substation**	Feb 2024	**11.**	**Visayas Substation Upgrading Project 1**	Nov 2021	**11.**	**Maco–Mati 138 kV Transmission Line Project**	Aug 2025
12.	**South Luzon Substation Upgrading Project 2**	Dec 2023	**12.**	**Lapu-lapu 230 kV Substation Project**	Dec 2022	**12.**	**Eastern Mindanao Voltage Improvement Project**	Dec 2025
13.	**Tanauan 230 kV Substation**	Aug 2025	**13.**	**Visayas Substation Upgrading Project 2**	Mar 2023	**13.**	**Nasipit – Butuan 69 kV Transmission Line Project**	Jan 2026
14.	**Tuguegarao–Enrile 69 kV Line**	Oct 2024	**14.**	**Barotac Viejo–Natividad 69 kV Transmission Line Project**	Oct 2023	**14.**	**Placer – Luna 69 kV Transmission Line Project**	Dec 2026
15.	**Sampaloc 230 kV Substation**	Dec 2025	**15.**	**Upgrading of acquired Transmission Assets**	Dec 2023	**15.**	**Opol – Carmen 69 kV Transmission Line Project**	Dec 2026
16.	**Luzon Voltage Improvement Project 5**	Dec 2025	**16.**	**Calbayog–Allen 138 kV Transmission Line Project**	Nov 2025	**16.**	**Davao – Toril 69 kV Transmission Line 2 Project**	Dec 2026
17.	**Castillejos 230 kV Substation**	Feb 2024	**17.**	**Laray 230 kV Substation Project (Initially energized at 138 kV)**	Nov 2026	**17.**	**Villanueva– Kinamlutan 230 kV Transmission Line**	Jan 2027

LUZON		ETC	VISAYAS		ETC	MINDANAO		ETC
18.	**Capas 230 kV Substation**	Oct 2025	**18.**	**Sumangga 138 kV Substation Project**	May 2027	**18.**	**Koronadal 138 kV Substation Project**	Aug 2027
19.	**Porac 230 kV Substation**	Dec 2023	**19.**	**Granada 230 kV Substation Project**	Sep 2027	**19.**	**Agus 6–Kiwalan–Lugait 69 kV Transmission Line Project**	Oct 2027
20.	**Tower Resiliency of Bicol Transmission Facilities**	Dec 2025	**20.**	**Tigbauan 138 kV Substation Project**	Sep 2027	**20.**	**Tigbao 138 kV Substation Bus-in**	Dec 2027
21.	**Western Luzon 500 kV Backbone – Stage 2**	Dec 2025	**21.**	**Carmen 230 kV Substation Project**	Sep 2028	**21.**	**Maco–Tagum 69 kV Transmission Line Project**	Dec 2027
22.	**Taguig–Taytay 230 kV Transmission Line**	Dec 2026	**22.**	**La Carlota 138 kV Substation Project**	Oct 2028	**22.**	**Naga Min – Pangi 69 kV Transmission Line Project**	Dec 2027
23.	**Nagsaag–Santiago 500 kV Transmission Line**	Aug 2027	**23.**	**San Isidro–Catarman 138 kV Transmission Line Project**	Dec 2028	**23.**	**Marawi – Malabang 69 kV Transmission Line Project**	Dec 2027
24.	**Tuy 500/230 kV Substation (Stage 2)**	Oct 2027	**24.**	**Bool 138 kV Substation Project**	Jun 2029	**24.**	**Tumaga 138 kV Substation Project**	May 2028
25.	**Northern Luzon 230 kV Loop**	Dec 2027	**25.**	**Laray–Cordova 230 kV Interconnection Project**	Jun 2029	**25.**	**Naga Mindanao–Salug 138 kV Transmission Line Project (Energized at 69 kV)**	Jul 2028
26.	**La Trinidad–Sagada 230 kV Transmission Line**	Dec 2027	**26.**	**Sipalay 138 kV Substation Project**	Dec 2029	**26.**	**Midsayap 138 kV Substation Project**	Dec 2028
27.	**Palauig 500 kV Substation**	Dec 2027	**27.**	**Laray–Alpaco 230 kV Energization Project**	Dec 2030	**27.**	**Nabunturan – Monkayo 69 kV Transmission Line Project**	Dec 2029
28.	**Cabanatuan–Sampaloc–Nagsaag 230 kV Transmission Line**	Feb 2028	**28.**	**Luzon–Visayas HVDC Bipolar Operation Project**	Apr 2028	**28.**	**Matanao 230/138 kV Transformer Project**	Dec 2030

LUZON		ETC	VISAYAS		ETC	MINDANAO		ETC
29.	**Luzon–Visayas HVDC Bipolar Operation**	Apr 2028	**29.**	**Corella–Ubay 138 kV Line 2 Stringing Project**	Sep 2028	**29.**	**Placer – Madrid 69 kV Transmission Line Project**	Dec 2030
30.	**Bolo–Balaoan 500 kV Transmission Line**	Apr 2028	**30.**	**Barotac Viejo–Unidos 230 kV Transmission Line Project**	Nov 2028	**30.**	**Mindanao Substation Expansion 5 Project (MSE5P)**	Dec 2030
31.	**Balaoan–Laoag 500 kV Transmission Line**	Apr 2028	**31.**	**Panay–Guimaras 138 kV Interconnection Line 2 Project**	Sep 2026	**31.**	**Sultan Kudarat –Tacurong 230 kV Transmission Line Project (Initially energized at 138 kV)**	Oct 2026
32.	**Bolo 5th Bank**	Dec 2028	**32.**	**Nivel Hills 230 kV Substation Project**	Apr 2027	**32.**	**Eastern Mindanao 230 kV Transmission Line Project**	Aug 2027
33.	**Pinamucan–Tuy 500 kV Line**	Jan 2029	**33.**	**Tabango–Biliran 69 kV Transmission Line Project**	Jun 2027	**33.**	**Opol Substation Bus-in Project**	Sep 2027
34.	**Tagkawayan 500 kV Substation**	Dec 2028	**34.**	**Siaton–Bayawan 138 kV Transmission Line (Initially energized at 69 kV)**	Dec 2027	**34.**	**Lala – Naga Min – Zamboanga 230 kV Transmission Line Project**	Jul 2029
35.	**North Luzon 69 kV Transmission Line Upgrading 1**	Mar 2021	**35.**	**Visayas Substation Upgrading Project 3**	Dec 2027	**35.**	**Lala – Malabang – Sultan Kudarat 230 kV Transmission Line Project**	Dec 2030
36.	**South Luzon 69 kV Transmission Line Upgrading 1**	Jun 2021	**36.**	**Taft–Bobolosan 138 kV Transmission Line Project (Initially energized at 69 kV)**	Dec 2028	**36.**	**Siom – Sindangan – Salug 69 kV Transmission Line Project**	Dec 2030
37.	**Marilao 500 kV Substation Expansion**	Dec 2026	**37.**	**Cebu–Leyte 230 kV Interconnection Lines 3 and 4 Project**	May 2029	**37.**	**Davao – Samal 69 kV Interconnection**	Dec 2030
38.	**Taguig EHV Substation Expansion**	Dec 2027	**38.**	**Babatngon–Sta. Rita 138 kV Transmission Line Upgrading**	Jun 2029	**38.**	**Zamboanga – Basilan 69 kV Interconnection**	Dec 2030
39.	**Plaridel 230 kV Substation**	Feb 2026	**39.**	**Kananga–Babatngon 230 kV Transmission Line Project**	Nov 2029	**39.**	**Southwestern Mindanao 230 kV Transmission Backbone**	Dec 2030

	LUZON	ETC		VISAYAS	ETC		MINDANAO	ETC
40.	**Luzon Voltage Improvement Project 6**	Mar 2026	**40.**	**Bayawan–Sipalay 138 kV Transmission Line (Initially energized at 69 kV)**	Dec 2030	**40.**	**San Francisco –Barobo 69 kV Transmission Line 2 Project**	2031-2035
41.	**Kawit 230 kV Substation**	May 2026	**41.**	**Visayas Voltage Improvement Project 2**	Jun 2027	**41.**	**Bislig – Baganga 138 kV Transmission Line Project**	2031-2035
42.	**Silang 500 kV Substation**	Feb 2027	**42.**	**Visayas Voltage Improvement Project 3**	Dec 2027	**42.**	**Bunawan – Bukal 230 kV Transmission Line**	2031-2035
43.	**Daraga–Bitano 69 kV Transmission Line**	Jun 2027	**43.**	**Mandurriao 138 kV Substation Project**	2031-2035	**43.**	**Mindanao Substation Expansion 6 Project (MSE6P)**	2031-2035
44.	**Dasol 230 kV Substation**	Dec 2027	**44.**	**Bacolod–Kabankalan 230 kV Transmission Line Project (Initially energized at 138 kV)**	2031-2035	**44.**	**Maco – Mati 69 kV Transmission Line Project**	2036-2040
45.	**Magalang 230 kV Substation**	Dec 2027	**45.**	**Visayas Substation Upgrading Project 4**	2031-2035	**45.**	**San Francisco –Tandag 69 kV Transmission Line Project**	2036-2040
46.	**San Agustin 230 kV Substation**	Dec 2027	**46.**	**Bohol–Leyte 230 kV Interconnection Project**	2031-2035	**46.**	**Naga Min – Malangas 69 kV Transmission Line Project**	2036-2040
47.	**Apalit 230 kV Substation**	Dec 2027	**47.**	**San Jose–Nabas 138 kV Transmission Line Project**	2031-2035	**47.**	**Aurora – Kapatagan 69 kV Transmission Line Project**	2036-2040
48.	**Valenzuela 230 kV Substation**	Dec 2030	**48.**	**Palo–Javier 230 kV Transmission Line Project**	2031-2035	**48.**	**Sultan Kudarat –Midsayap 69 kV Transmission Line Project**	2036-2040
49.	**San Fabian 230 kV Substation**	Mar 2028	**49.**	**Visayas Voltage Improvement Project 4**	2031-2035	**49.**	**Baganga – Mati 138 kV Transmission Line Project**	2036-2040
50.	**Iriga 230 kV Substation**	Dec 2028	**50.**	**Cebu–Negros 230 kV Interconnection Line 3 and 4 Project**	2036-2040	**50.**	**Bislig – Barobo 69 kV Transmission Line Project**	2036-2040

LUZON		ETC	VISAYAS		ETC	MINDANAO		ETC
51.	**Malvar 230 kV Substation**	Dec 2028	**51.**	**Babatngon–Borongan 138 kV Transmission Line Project**	2036-2040	**51.**	**Tumaga – Pitogo 69 kV Transmission Line Project**	2036-2040
52.	**Balanga 230 kV Substation**	Dec 2028	**52.**	**Visayas Substation Upgrading Project 5**	2036-2040	**52.**	**Culaman – Gen. Santos 230 kV Transmission Line**	2036-2040
53.	**San Isidro 230 kV Substation**	Dec 2028	**53.**	**Lapu-lapu–Cordova 230 kV Interconnection Project**	2036-2040	**53.**	**Ipil 138 kV Substation Project**	2036-2040
54.	**FBGC 230 kV Substation**	Dec 2028	**54.**	**Borongan–Catarman 138 kV Transmission Line Project**	2036-2040	**54.**	**Mindanao Substation Expansion 7 Project (MSE7P)**	2036-2040
55.	**Baler 230 kV Substation Project**	Feb 2029						
56.	**Guagua 230 kV Substation**	Dec 2029						
57.	**San Antonio 500 kV Substation**	Dec 2030						
58.	**Alaminos EHV Substation**	Dec 2030						
59.	**Nuvali 230 kV Substation**	Dec 2030						
60.	**Cabatuan 230 kV Substation**	Dec 2030						
61.	**Minuyan 115 kV Switching Station**	Feb 2026						
62.	**Taguig–Silang 500 kV Transmission Line**	Dec 2027						
63.	**Marilao–Mexico 230 kV Transmission Line**	Aug 2027						
64.	**San Jose–San Rafael 230 kV Transmission Line Upgrading**	Oct 2027						
65.	**Bauang–La Trinidad 230 kV Transmission Line Upgrading**	Dec 2027						
66.	**Olongapo 230 kV Substation Upgrading**	Mar 2028						
67.	**Mexico–Clark 69 kV Transmission Line Upgrading**	Apr 2028						

LUZON		ETC	VISAYAS		ETC	MINDANAO		ETC
68.	**Cabanatuan–San Rafael–Mexico 230 kV Transmission Line Upgrading**	Apr 2028						
69.	**Bauang–Balaoan 230 kV Transmission Line Upgrading**	Dec 2028						
70.	**Hermosa–Mexico 230 kV Transmission Line Upgrading**	Dec 2028						
71.	**Calaca–Salong 230 kV Transmission Line 2**	Dec 2028						
72.	**Baras 500 kV Substation**	Feb 2029						
73.	**Pasay–Taguig 230 kV Transmission Line**	Dec 2030						
74.	**Navotas–Pasay 230 kV Transmission Line**	Dec 2030						
75.	**Naga–Presentacion 230 kV Transmission Line**	Dec 2030						
76.	**Baras–San Antonio 500 kV Transmission Line**	Dec 2030						
77.	**Baras–Pinamucan 500 kV Transmission Line**	Dec 2030						
78.	**Limay–Pasay 230 kV Transmission Line**	Dec 2030						
79.	**Luzon Voltage Improvement Project 7**	Dec 2027						
80.	**Batangas–Mindoro Interconnection Project**	Feb 2026						
81.	**Palawan–Mindoro Interconnection Project**	Feb 2028						
82.	**Santiago–Kabugao 500 kV Transmission Line**	2031-2035						
83.	**North Luzon Substation Upgrading 3**	2031-2035						
84.	**South Luzon Substation Upgrading 3**	2031-2035						
85.	**North Luzon 69 kV Transmission Line Upgrading 2**	2031-2035						
86.	**South Luzon 69 kV Transmission Line Upgrading 2**	2031-2035						

LUZON		ETC	VISAYAS		ETC	MINDANAO		ETC
87.	**San Mateo 230 kV Substation**	2031-2035						
88.	**Bustos 230 kV Substation**	2031-2035						
89.	**Sariaya 230 kV Substation**	2031-2035						
90.	**Presentacion 230 kV Substation**	2031-2035						
91.	**Bacolor 500 kV Substation**	2031-2035						
92.	**Dasmariñas 500 kV Substation**	2031-2035						
93.	**Taguig–Muntinlupa 230 kV Transmission Line 2**	2031-2035						
94.	**Matnog 230 kV Substation**	2036-2040						
95.	**Kalinga 500 kV Substation**	2036-2040						
96.	**North Luzon Substation Upgrading 4**	2036-2040						
97.	**South Luzon Substation Upgrading 4**	2036-2040						
98.	**Sagada–San Esteban 230 kV Transmission Line**	2036-2040						
99.	**Dinadiawan–Santiago 230 kV Transmission Line**	2036-2040						
100.	**Baler–Dinadiawan 230 kV Transmission Line**	2036-2040						
101.	**Capas–Kadampat 230 kV Transmission Line**	2036-2040						
102.	**Bataan–Cavite 500 kV Transmission Line**	2036-2040						
103.	**Upgrading of Bicol Transmission Facilities**	2036-2040						

Appendix 7 – Changes from TDP 2020 – 2040 to TDP 2021 – 2040

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
LUZON PROJECTS			
Hermosa–Floridablanca 69 kV Transmission Line	**ETC: Mar 2019**	**Completed**	Completed
Bataan 230 kV Grid Reinforcement	**ETC: Aug 2019**	**Completed**	Completed
Bataan–Cavite Transmission Line Feasibility Study	**ETC: Dec 2018**	**ETC: Dec 2020**	Updated ETC based on latest project timeline considering actual implementation
San Jose–Quezon 230 kV Line 3	**ETC: Jan 2020** Status: The Project is 89.72% complete	**Completed**	**Completed**
San Jose–Angat 115 kV Line Upgrading	**ETC: Dec 2019**	**ETC: Jun 2021** Status: Turnkey (T/L): 84.27% complete	Updated ETC based on latest project timeline considering actual implementation
Tiwi Substation Upgrading	**ETC: Mar 2021**	**ETC: Dec 2021** **Status:** Turnkey (Secondary Equipment): 75.80% Erection (Primary Equipment): 24.35%	Updated ETC based on latest project timeline considering actual implementation
Calamba 230 kV Substation	**ETC: July 2019**	**ETC: Mar 2021** Status: Transmission Line: 34.78% Calamba S/S: 67.58%	Updated ETC based on latest project timeline considering actual implementation
Pasay 230 kV Substation	**ETC: Jan 2022** ▪ 11-230 kV PCBs (GIS) and associated equipment Bulk Cost Estimate: 13,018 Million Pesos	**ETC: Dec 2025** ▪ 9-230 kV PCBs (GIS) and associated equipment Bulk Cost Estimate: 12,871 Million Pesos	Updated ETC based on latest project timeline considering actual implementation Updated project cost
Tower Structure Upgrading of Bicol Transmission Facilities	**ETC: Jun 2019**	**ETC: May 2021** Status: 88.30% Complete	Updated ETC based on latest project timeline considering actual implementation

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Mariveles–Hermosa 500 kV Transmission Line	Project name: Mariveles–Balsik (Hermosa) 500 kV Transmission Line Status: Project erection is 1.53% complete	**ETC: Oct 2021** Project name: Mariveles–Hermosa 500 kV Transmission Line Status: Transmission Line: 29.24% Substation: 2.34%	Updated ETC based on latest project timeline considering actual implementation Updated Project Status
North Luzon Substation Upgrading Project	**ETC Stage 1: May 2020** **ETC Stage 2: Mar 2020**	**ETC: Mar 2021** Bauang 230 kV Substation ETC: Mar 2020 Gamu 230 kV Substation ETC: Mar 2020 Bayombong 230 kV Substation ETC: Jun 2020 Hermosa 69 kV Substation ETC: Mar 2020 Malaya 230 kV Substation ETC: Nov 2020 Quezon 230 kV Substation ETC: Nov 2020 San Jose 230 kV Substation ETC: Mar 2020 Doña Imelda Substation Mar 2020 Concepcion 230 kV Substation ETC: Nov 2020	Updated ETC based on latest project timeline considering actual implementation
Luzon PCB Replacement	**ETC: Dec 2019** Ongoing: San Jose 115 kV Substation Labo 230 kV Substation Malaya 230 kV Substation Gumaca 230 kV Substation	**ETC: Mar 2021** Status: San Jose S/S: 87.06% Malaya S/S: 89.42%	Updated ETC based on latest project timeline considering actual implementation

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	Status: Malaya 230 kV Substation is 80% complete		
Luzon Voltage Improvement Project – 3	**ETC Stage 1: Aug 2020** **ETC Stage 2: Mar 2021**	**ETC: Mar 2021** Completed: - Bantay 115 kV Substation - Tuguegarao 230 kV Substation - Mexico 230 kV Substation - San Jose 230 kV Substation - Laoag 115 kV Substation - Cabanatuan 230 kV Substation - Nagsaag 230 kV Substation Baler Load-End 69kV Substation ETC: Dec 2020 Pantabangan Load-end 69kV Substation ETC: Dec 2020 Umingan 69 kV Substation ETC: Dec 2020 Camiling 69 kV Substation ETC: Dec 2020 San Esteban 230 kV Substation ETC: Aug 2020 Botolan 230 kV Substation ETC: Dec 2020 Itogon 69 kV Substation ETC: Dec 2020 Antipolo 230 kV Substation ETC: Aug 2020 Taytay 230 kV Substation ETC: Apr 2020 Quezon 230 kV Substation ETC: Apr 2020	Updated ETC based on latest project timeline considering actual implementation Updated Project components

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
		Bautista Load-end 69kV Substation ETC: Dec 2020 Status for Stage 1: Mexico S/S: 60.50% Status for Stage 2: Lal-lo S/S: 42.17%; San Esteban S/S: 30.87%	
Clark–Mabiga 69 kV Transmission Line	**ETC: Apr 2020** Status: The Substation portion of the project is 90.10% complete	**ETC: Dec 2021** Status: Transmission Line: For re-rerouting of line; Clark S/S: 93.76%	Updated ETC based on latest project timeline considering actual implementation
Hermosa–San Jose 500 kV Transmission Line	**ETC: Oct 2020** Project name: Balsik (Hermosa)–San Jose 500 kV Transmission Line Status: Transmission Line is 8.78% complete Substation is 2.23% complete	**ETC: Dec 2021** Project name: Hermosa–San Jose 500 kV Transmission Line Substation ETC: Mar 2020 Transmission Line ETC: May 2021 Status: Transmission Line: 12.65% Substation: 63.64%	Updated ETC based on latest project timeline considering actual implementation
Pagbilao 500 kV Substation	**ETC: Dec 2020**	**ETC: Mar 2022** Status: Transmission Line: 29.24% Substation: 2.72%	Updated ETC based on latest project timeline considering actual implementation
Navotas 230 kV Substation	**ETC: May 2021** Status: The project is 40.24% complete	**ETC: Dec 2023** Substation ETC: Jun 2020 Status: The project is 83.65% complete	Updated ETC based on latest project timeline considering actual implementation
Navotas–Doña Imelda 230 kV Transmission Line	**ETC: May 2022**	**ETC: Jan 2028**	Updated ETC based on latest project timeline considering actual implementation

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Tuguegarao–Lal-lo 230 kV Transmission Line	**ETC: Oct 2020** Status: Transmission Line is 37.64% complete Substation is 71.31% complete	**ETC: Mar 2022** Substation ETC: Mar 2020 Status: Transmission Line: 47.16% Substation: 80.90%	Updated ETC based on latest project timeline considering actual implementation
Relocation of Steel Poles along Hermosa–Duhat 230 kV Transmission Line	**ETC: Dec 2019**	**ETC: Jun 2021** Status: 53.51% complete	Updated ETC based on latest project timeline considering actual implementation
Western 500 kV Backbone (Stage 1)	**ETC: Jun 2020** Status: Project erection is 41.28% complete	**ETC: Jun 2021** Status: Transmission Line: 59.51%	Updated ETC based on latest project timeline considering actual implementation
Taguig 500 kV Substation	**ETC: Dec 2020**	**ETC: Dec 2023** Status: Taguig–Baras T/L: 7.02%; Substation Site Development: 88.09%; Taguig 500 kV S/S: 26.17%	Updated ETC based on latest project timeline considering actual implementation
Antipolo 230 kV Substation	**ETC: Dec 2021**	**ETC: Apr 2022** Status: Site Development (S/S): 8.64% Turnkey (Secondary Equipment): 54.52% Erection (Primary Equipment): Securing of LGU Permits	Updated ETC based on latest project timeline considering actual implementation
Ambuklao–Binga 230 kV Transmission Line Upgrading	**ETC: Oct 2021**	**ETC: Dec 2023** Status: Turnkey (T/L): Preparation of bid documents	Updated ETC based on latest project timeline considering actual implementation
Binga–San Manuel 230 kV Transmission Line Stage 1 & 2	**ETC: Oct 2021**	**ETC: Dec 2023** Status for Stage 1: Turnkey (S/S): 91.70% complete	Updated ETC based on latest project timeline considering actual implementation

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
		Status for Stage 2: Turnkey (T/L): Preparation of bid documents	
Tuy 500/230 kV Substation Project (Stage 1)	**ETC: Oct 2020** Status: Tendering Stage (Awaiting ERC decision)	**ETC: Mar 2023** Status: Tuy S/S: 14.70%	Updated ETC based on latest project timeline considering actual implementation
South Luzon 230 kV Substation Upgrading Project	**Stage 1 ETC: Sep 2021**	**ETC: Sep 2021** Las Piñas 230 kV Substation ETC Sep 2021 Lumban 230 kV Substation ETC: Sep 2021 San Juan 230 kV Substation ETC: Sep 2021 Naga 230 kV Substation ETC: Sep 2021 Daraga 230 kV Substation ETC: Dec 2021 Gumaca 230 kV Substation ETC: Dec 2021 Labo 230 kV Substation ETC: Dec 2021 Status for Stage 1: Las Pinas S/S: 23.21% Status for Stage 2: Pre-construction activity	Updated ETC based on latest project timeline considering actual implementation
Eastern Albay 69 kV Line Stage 2	**ETC: Sep 2020**	**ETC: Oct 2023** Status: Sto. Domingo S/S: Notice of Award	Updated ETC based on latest project timeline considering actual implementation
La Trinidad–Calot 69 kV Transmission Line	**ETC: Jun 2019**	**ETC: Nov 2025** Status: Pre-construction activity	Updated ETC based on latest project timeline considering actual implementation
Luzon Voltage Improvement Project 4	**Stage 1 ETC: Mar 2022** **Stage 2 ETC: Jun 2022**	**ETC: Dec 2021** Ligao Switchyard ETC: Feb 2023	Updated ETC based on latest project timeline considering actual implementation

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
		Iriga 230 kV Substation ETC: Feb 2023 Sorosogon 230 kV ETC: Feb 2023 Dasmariñas 230 kV Substation ETC: Feb 2023 Biñan 230 kV Substaion ETC: Feb 2023 Status for Stage 1: Turnkey (S/S): Notice of Award Status for Stage 2: Pre-construction activity	
Pagbilao–Tayabas 500 kV Transmission Line	**ETC: Jul 2023** Pagbilao 500 kV Substation, 4-500 kV PCBs and associated equipment 4-230 kV PCBs and associated equipment Bulk Cost Estimate: 3,934 Million Pesos	**ETC: Mar 2025** Pagbilao 500 kV Substation, 4-500 kV PCBs and associated equipment 4-230 kV PCBs and associated equipment, 1x30 MVAR, 500 kV Line Reactor Bulk Cost Estimate: 3,375 Million Pesos	Updated ETC based on latest project timeline considering actual implementation Updated Project Components Updated Bulk Cost Estimate
Santiago–Magat 230 kV Transmission Line Recoductoring Project			New Project under TDP 2021-2040
Malaya 230 kV Collector Station Project			New Project under TDP 2021-2040
Pinamucan 500 kV Substation	Bulk Cost Estimate: 4,669 Million Pesos	**ETC: Jun 2024** Bulk Cost Estimate: 4,117 Million Pesos	Updated ETC Updated Bulk Cost Estimate
Northern Luzon 230 kV Loop	Bulk Cost Estimate: 18,102 Million Pesos	**ETC: Dec 2027** Bulk Cost Estimate: 16,928 Million Pesos	Updated Bulk Cost Estimate

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Cabanatuan–Sampaloc–Nagsaag 230 kV Transmission Line	Bulk Cost Estimate: 7,136.65 Million Pesos	**ETC: Feb 2028** Bulk Cost Estimate: 6,834.42 Million Pesos	Updated Bulk Cost Estimate
Tagkawayan 500 kV Substation	Bulk Cost Estimate: 4,621 Million Pesos	**ETC: Dec 2028** Tayabas 230 kV Substation, 14-230 kV PCBs and associated equipment. Bulk Cost Estimate: 5,128 Million Pesos	Updated ETC Additional Project components Updated Bulk Cost Estimate
North Luzon Substation Upgrading 2	**ETC: Dec 2021** Nagsaag 230 kV Substation, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; 1-230 kV PCBs and Associated Equipment; 1-69 kV PCBs and Associated Equipment Laoag 115 kV Substation (Replacement), 1x100 MVA 115/69-13.8 kV Power Transformer and associated equipment; 1-115 kV PCBs and Associated Equipment Concepcion 230 kV Substation (Replacement), 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; 6-69 kV PCBs and Associated Equipment Subic 230 kV Substation, 4-230 kV PCBs and Associated Equipment San Manuel 69 kV Substation, 1-69 kV PCBs and Associated Equipment Bayombong 230 kV Substation, 2x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; 2-230 kV PCBs and Associated Equipment; 1-	**ETC: Oct 2022** Nagsaag 230 kV Substation, 2-69 kV PCBs and Associated Equipment Laoag 115 kV Substation (Replacement), 1x100 MVA 115/69-13.8 kV Power Transformer and associated equipment; 1-115 kV PCBs and Associated Equipment; 8-69 kV PCBs and Associated Equipment Concepcion 230 kV Substation (Replacement), 2x300 MVA 230/69-13.8 kV Power Transformer and associated equipment; 22-69 kV PCBs and Associated Equipment Subic 230 kV Substation, 1-230 kV PCBs and Associated Equipment San Manuel 230 kV Substation, 2x300 MVA, 230/69-13.8 kV Power Transformer and associated equipment; 13-69 kV PCBs and Associated Equipment Bayombong 230 kV Substation, 2x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; 5-230 kV PCBs and Associated Equipment; 8-	Updated Project Components

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	69 kV PCBs and Associated Equipment Santiago 230 kV Substation, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; 2-230 kV PCBs and Associated Equipment; 2-69 kV PCBs and Associated Equipment San Esteban 115 kV Substation, 2x100 MVA 115/69-13.8 kV Power Transformer and associated equipment; Bulk Cost Estimate: 4,680 Million Peso	69 kV PCBs and Associated Equipment Santiago 230 kV Substation, 1x100 MVA 230/69-13.8 kV Power Transformer and associated equipment; 5-69 kV PCBs and Associated Equipment San Esteban 115 kV Substation, 2x100 MVA 115/69-13.8 kV Power Transformer and associated equipment; 1-115 kV PCB and Associated equipment; 1-69 kV PCB and associated equipment. Hermosa 230 kV Substation, 21-230 kV PCBs and Associated equipment; San Jose 230 kV Substation, 28-230 kV PCBs and Associated equipment; 11-115 kV PCBs and associated equipment. Bulk Cost Estimate: 9,929 Million Pesos	Updated Bulk Cost Estimates Updated ETC based on latest project timeline considering actual implementation
Pinili 230 kV Substation	**ETC: Mar 2022** Pinili 230 kV Substation (New), 2x100 MVA 230/69-13.8 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 5-69 kV PCBs and associated equipment. Bulk Cost Estimate: 1,632 Million Pesos	**ETC: May 2023** Pinili 230 kV Substation (New), 2x100 MVA 230/69-13.8 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 8-69 kV PCBs and associated equipment. Bulk Cost Estimate: 1,692 Million Pesos	Updated ETC based on latest project timeline considering actual implementation Updated Project Component Updated Bulk Cost Estimate
Concepcion–Sta. Ignacia 69 kV Transmission Line	**ETC: Apr 2022** Concepcion–Sta. Ignacia 69 kV Transmission Line,	**ETC: Aug 2022** Concepcion–Sta. Ignacia 69 kV Transmission Line,	Updated Project Component Updated Bulk Cost Estimate

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	69 kV, SP-DC, 1-795 MCM ACSR, 27 km. Bulk Cost Estimate: 672 Million Pesos	69 kV, SP-DC, 1-795 MCM ACSR, 33 km. Bulk Cost Estimate: 896 Million Pesos	Updated ETC based on latest project timeline considering actual implementation
Nagsaag–Tumana 69 kV Transmission Line	**ETC: Apr 2022** Bulk Cost Estimate: 686 Million Pesos	**ETC: Aug 2022** Bulk Cost Estimate: 588 Million Pesos	Updated ETC based on latest project timeline considering actual implementation Updated Bulk Cost Estimate
San Simon 230 kV Substation	**ETC: Jul 2022** San Simon 230 kV Substation, 2x300 MVA 230/69 kV Power Transformer and accessories, 3x100 MVAR 230 kV capacitor, 8-230 kV PCBs, 4-69 kV PCBs and associated equipment; San Simon–Real Steel 69 kV Line, SP-SC, 1-410 mm2 TACSR/AS, 3.27 km; San Simon–Melters 69 kV Line, SP-SC, 1-410 mm2 TACSR/AS, 6.10 km. Bulk Cost Estimate: 2,318 Million Pesos	**ETC: May 2023** San Simon 230 kV Substation, 2x300 MVA 230/69 kV Power Transformer and accessories, 2x100 MVAR 230 kV capacitor, 14-230 kV PCBs, 10-69 kV PCBs and associated equipment; San Simon–SKK 69 kV Line, SP-SC, 1-410 mm2 TACSR/AS, 7.56 km; San Simon–Melters 69 kV Line, SP-SC, 1-410 mm2 TACSR/AS, 4.75 km. San SImon–Wan Chiong 69 kV Line, SP-SC, 1-795 MCM ACSR/AS, 6.8 km Bulk Cost Estimate: 3,812 Million Pesos	Updated Project Component Updated Bulk Cost Estimate Updated ETC based on latest project timeline considering actual implementation
Marilao 500 kV Substation	**ETC: Oct 2022** Bulk Cost Estimate: 7,393 Million Pesos	**ETC: Jul 2023** Bulk Cost Estimate: 6,060 Million Pesos	Updated ETC based on latest project timeline considering actual implementation Updated Bulk Cost Estimate
Taguig EHV Substation Expansion			No Change
Luzon Voltage Improvement Project 5	**ETC: Nov 2022** Bulk Cost Estimate: 2,735 Million Pesos	**ETC: Dec 2025** Bulk Cost Estimate: 2,599 Million Pesos	Updated ETC based on latest project timeline considering actual implementation Updated Bulk Cost Estimate

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Luzon Voltage Improvement Project 6	**ETC: Dec 2030** **Substation Components:** Taguig 230 kV Substation, 1x100 MVAR, 230 kV Capacitor Banks and accessories; Marilao 230 kV Substation, 2x100 MVAR, 230 kV Capacitor Banks and accessories; Calamba 230 kV Substation, 2x100 MVAR, 230 kV Capacitor Banks and accessories; Clark 230 kV Substation, 1x100 MVAR, 230 kV Capacitor Banks and accessories;	**ETC: Mar 2026** **Substation Components:** Bautista Load-end Substation, 3x5 MVAR, 69 kV Capacitor Banks and accessories; 4-69 kV PCBs and associated equipment San Jacinto Load-end Substation, 4x5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment Malasiqui Load-end Substation, 4x5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment Tabuk Load-end Substation, 4x2.5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment San Miguel Load-end Substation, 3x2.5 MVAR, 69 kV Capacitor Banks and accessories; 4-69 kV PCBs and associated equipment Libmanan Load-end Substation, 4x2.5 MVAR, 69 kV Capacitor Banks and accessories; 5-69 kV PCBs and associated equipment San Rafael 230 kV Substation, 2x100 MVAR, 230 kV Capacitor Banks and accessories; 2-230 kV PCBs and associated equipment Calamba 230 kV Substation, 2x100 MVAR, 230 kV Capacitor Banks and accessories; 2-230 kV PCBs and associated equipment Bulk Cost Estimate: 3,049 Million Pesos	Updated ETC based on latest project timeline considering actual implementation Updated Project Components
Capas 230 kV Substation	Capas 230 kV Substation, 2x300 MVA 230/69-13.8 kV Power Transformers and accessories, 3x100 MVAR 230 kV Shunt	**ETC: Oct 2025** Capas 230 kV Substation, 2x300 MVA 230/69-13.8 kV Power Transformers and accessories, 3x100 MVAR 230 kV Shunt	Updated Project components

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	Capacitor and accessories; 9-230 kV PCBs and associated equipment, 5-69 kV PCBs and associated equipment; Bulk Cost Estimate: 2,619 Million Pesos	Capacitor and accessories; 11-230 kV PCBs and associated equipment, 14-69 kV PCBs and associated equipment; Bulk Cost Estimate: 2,605 Million Pesos	Updated Bulk Cost Estimate
Abuyog 230 kV Substation	Abuyog 230 kV Substation, 2x100 MVA 230/69-13.8 kV Power Transformer and accessories, 3x25 MVAR, 230 kV Shunt Capacitor and accessories, 3x25 MVAR, 230 kV Shunt Reactor and accessories, 12-230 kV PCBs and associated equipment, 6-69 kV PCBs and associated equipment. Bulk Cost Estimate: 3,483.780 Million Pesos	**ETC: Feb 2024** Abuyog 230 kV Substation, 2x100 MVA 230/69-13.8 kV Power Transformer and accessories, 3x25 MVAR, 230 kV Shunt Capacitor and accessories, 3x25 MVAR, 230 kV Shunt Reactor and accessories, 12-230 kV PCBs and associated equipment, 5-69 kV PCBs and associated equipment. Bulk Cost Estimate: 3,326.197 Million Pesos	Updated Project components Updated Bulk Cost Estimate
Porac 230 kV Substation	**ETC: Oct 2023** Bulk Cost Estimate: 6,655 Million Pesos	**ETC: Dec 2023** Bulk Cost Estimate: 6,384 Million Pesos	Updated ETC based on latest project timeline considering actual implementation Updated Bulk Cost Estimate
Plaridel 230 kV Substation	Bulk Cost Estimate: 1,155 Million Pesos	**ETC: Feb 2026** Bulk Cost Estimate: 1,078 Million Pesos	Updated Bulk Cost Estimate
Tanauan 230 kV Substation	Tanauan 230 kV Substation, 2x100 MVA, 230/69 kV Power Transformers and accessories, 8-230 kV PCBs and associated equipment; 5-69 PCBs and associated equipment; FITUI Malvar Load-end 69 kV Substation, 2x5 MVAR, 69 kV Capacitor Banks and accessories, 3-69 kV PCBs and associated equipment.	**ETC: Aug 2025** Tanauan 230 kV Substation, 2x100 MVA, 230/69 kV Power Transformers and accessories, 8-230 kV PCBs and associated equipment; 4-69 PCBs and associated equipment;	Updated ETC Updated Project Components

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	Bulk Cost Estimate: 2,493 Million Pesos	Bulk Cost Estimate: 2,435 Million Pesos	Updated Bulk Cost Estimate
Sampaloc 230 kV Substation	Bulk Cost Estimate: 1,529.42 Million Pesos	**ETC: Dec 2025** Bulk Cost Estimate: 1,717.99 Million Pesos	Updated Bulk Cost Estimate
Daraga–Bitano 69 kV Line	Bulk Estimate: 211 Million Pesos	**ETC: Jun 2027** Bulk Estimate: 201 Million Pesos	Updated Bulk Cost Estimate
Castillejos 230 kV Substation	Castillejos 69 kV Line Extension, 1-410 mm2 TACSR/AS, SP/ST-DC, 1 km. Bulk Cost Estimate: 1,566 Million Pesos	**ETC: Feb 2024** Hermosa–Castillejos 500 kV Line Extension, 4-410 mm2 TACSR/AS, ST-DC, 5.5 km Hanjin 230 kV Line Extension, 1-795 MCM ACSR, ST-DC, 7 km RP Energy 230 kV Line Extension, 2-795 MCM ACSR, ST-DC, 7 km Castillejos 69 kV Line Extension, 1-410 mm2 TACSR/AS, SP/ST-DC, 3 km. Bulk Cost Estimate: 3,068 Million Pesos	Updated ETC Additional Components Updated Project Component Updated Bulk Cost Estimate
Tuguegarao–Enrile 69 kV Line	Bulk Cost Estimate: 772 Million Pesos	**ETC: Oct 2024** Bulk Cost Estimate: 734 Million Pesos	Updated Bulk Cost Estimate
Silang 500 kV Substation	Biñan 230 kV Substation, 6-230 kV PCBs and associated equipment. Bulk Cost Estimate: 4,477 Million Pesos	**ETC: Feb 2027** Bulk Cost Estimate: 4,148 Million Pesos	Remove component as it is transferred to SLSUP II Updated Bulk Cost Estimate
Kawit 230 kV Substation	Bulk Cost Estimate: 9,260 Million Pesos	**ETC: May 2026** Bulk Cost Estimate: 8,807 Million Pesos	Updated Bulk Cost Estimate
Dasol 230 kV Substation	Bulk Cost Estimate: 2,194 Million Pesos	**ETC: Dec 2027** Bulk Cost Estimate: 2,116 Million Pesos	Updated Bulk Cost Estimate

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
San Manuel–Nagsaag 230 kV Transmission Line	**ETC: Mar 2021**	**Completed**	
Taguig–Taytay 230 kV Transmission Line	Bulk Cost Estimate: 3,823 Million Pesos	**ETC: Dec 2026** Bulk Cost Estimate: 3,256 Million Pesos	Updated Bulk Cost Estimate
Olongapo 230 kV Substation Upgrading	Olongapo 230 kV Substation, 1x100 MVA, 230/69 kV Power Transformers and accessories; 8-230 kV PCB (GIS) and associated equipment, 1-69 kV PCB and associated equipment, Primary and Secondary Devices Bulk Cost Estimate: 1,190 Million Pesos	**ETC: Mar 2028** Olongapo 230 kV Substation, 1x100 MVA, 230/69 kV Power Transformers and accessories; 8-230 kV PCB (GIS) and associated equipment, 9-69 kV PCB and associated equipment, Primary and Secondary Devices Bulk Cost Estimate: 2,957 Million Pesos	Updated Project components Updated Bulk Cost Estimate
Tower Resiliency of Bicol Transmission Facilities		**Transmission Components:** Naga–Tiwi A–Daraga 230 kV Transmission Line, 2-795 MCM ACSR/AS, ST-DC, 105 km. Naga–Tiwi C 230 kV Transmission Line, 2-795 MCM ACSR/AS, ST-DC, 60 km. Daraga–Tublijon 230 kV Transmission Line, 2-795 MCM ACSR/AS, ST-DC, 35 km. Bulk Cost Estimate: 7,939 Million Pesos	New Project under TDP 2021-2040
Minuyan 115 kV Switching Station	**ETC: Oct 2023** Bulk Cost Estimate: 569 Million Pesos	**ETC: Feb 2026** Bulk Cost Estimate: 551 Million Pesos	Updated ETC Updated Bulk Cost Estimate
Western Luzon 500 kV Backbone – Stage 2	**ETC: Aug 2024** Bulk Cost Estimate: 19,823 Million Pesos	**ETC: Dec 2025** Bulk Cost Estimate: 18,965 Million Pesos	Updated ETC Updated Bulk Cost Estimate
Marilao–Mexico 230 kV Transmission Line	**ETC: Dec 2024** Bulk Cost Estimate: 2,064 Million Pesos	**ETC: Aug 2027** Bulk Cost Estimate: 2,542 Million Pesos	Updated ETC Updated Bulk Cost Estimate

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Batangas–Mindoro Interconnection Project	**ETC: Sep 2023**	**ETC: Feb 2026**	Updated ETC
Palawan–Mindoro Interconnection Project	**ETC: Dec 2024**	**ETC: Feb 2028**	Updated ETC
Nagsaag–Santiago 500 kV Transmission Line	**ETC: Aug 2024** Santiago 230 kV Substation, 5-230 kV PCBs and associated equipment; Nagsaag–Santiago 500 kV Transmission Line, ST-DC, 4-795 MCM ACSR/AS, 140.0 km; Bulk Cost Estimate: 13,642 Million Pesos.	**ETC: Aug 2027** Santiago 230 kV Substation, 4-230 kV PCBs and associated equipment; Nagsaag–Santiago 500 kV Transmission Line, ST-DC, 4-410 mm2 TACSR/AS, 140.0 km; Bulk Cost Estimate: 13,302 Million Pesos	Updated ETC Updated Project components Updated Bulk Cost Estimate
Bolo–Balaoan 500 kV Transmission Line	**ETC: Nov 2026**	**ETC: Apr 2028**	Updated ETC based on latest project timeline considering actual implementation
Balaoan–Laoag 500 kV Transmission Line	**ETC: Nov 2026** <u>*Substation Components:*</u> ▪ *Laoag 500 kV Substation (new),* 2x750 MVA, 500/230-13.8 kV Power Transformers and accessories, 11-500 kV PCBs and associated equipment, 8-230 kV PCBs and associated equipment, 3x90 MVAR, 500 kV Shunt Reactor and accessories, 2x60 MVAR, 500 kV Line Reactor and accessories;	**ETC: Apr 2028** <u>*Substation Components:*</u> ▪ *Laoag 500 kV Substation (new),* 2x750 MVA, 500/230-13.8 kV Power Transformers and accessories, 9-500 kV PCBs and associated equipment, 8-230 kV PCBs and associated equipment, 3x90 MVAR, 500 kV Shunt Reactor and accessories, 2x60 MVAR, 500 kV Line Reactor and accessories;	Updated ETC based on latest project timeline considering actual implementation Updated Project components
La Trinidad–Sagada 230 kV Transmission Line			No Change
Palauig 500 kV Substation		**ETC: Dec 2027**	New Project under TDP 2021-2040
Bolo 5th Bank			No Change

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Pinamucan–Tuy 500 kV Line	**ETC: Oct 2029**	**ETC: Jan 2029**	Updated ETC based on latest project timeline considering actual implementation
Tuy 500/230 kV Substation (Stage 2)	**ETC: Dec 202** Bulk Cost Estimate: 4,309 Million Pesos	**ETC: Oct 2027** Bulk Cost Estimate: 4,298 Million Pesos	Updated ETC based on latest project timeline considering actual implementation Updated Bulk Cost Estimate
North Luzon 69 kV Transmission Line Upgrading 1	**ETC: Dec 2026**	**ETC: Mar 2021**	Updated ETC based on latest project timeline considering actual implementation
South Luzon 69 kV Transmission Line Upgrading 1	**ETC: Dec 2026**	**ETC: Jun 2021**	Updated ETC based on latest project timeline considering actual implementation
Marilao 500 kV Substation Expansion			No change
Taguig EHV Substation Expansion			No change

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
South Luzon Substation Upgrading Project 2	**ETC: Dec 2022** Tuy 230 kV Substation, 1x100 MVA, 230/69-13.8 kV Power Transformer and associated equipment, 2-230 kV PCBs and associated equipment, 2-69 kV PCBs and associated equipment; Daraga 230 kV Substation (Replacement), 2x100 MVA, 230/69-13.8 kV Power Transformer and associated equipment; ▪ Tanauan 230 kV Substation, 1x100 MVA, 230/69-13.8 kV Power Transformer and associated equipment; 2-230 kV PCBs and associated equipment, 4-69 kV PCBs and associated equipment;	**ETC: Dec 2023** Tuy 230 kV Substation, 1x300 MVA, 230/69-13.8 kV Power Transformer and associated equipment, 2-230 kV PCBs and associated equipment 1-69 kV PCBs and associated equipment; Daraga 230 kV Substation, 4-230 kV PCBs and associated equipment Calaca 230 kV Substation (Replacement), 2x300 MVA, 230/69-13.8 kV Power Transformer and associated equipment; 6-230 kV PCBs and associated equipment; 7-69 kV PCBs and associated equipment Biñan 230 kV Substation, 6-230 kV PCBs and associated equipment, 6-115 kV PCBs and associated equipment. Dasmariñas 115 kV Substation, 3-115 kV PCBs and associated equipment. Naga 69 kV Substation, 1-69 kV PCB and associated equipment Muntinlupa 115 kV Substation, 10-115 kV PCBs and associated equipment. Bulk Cost Estimate: 3,092 Million Pesos	Updated ETC Updated Project components Removed component. Additional Component
Sampaloc–Baler 230 kV Transmission Line	**ETC: Dec 2026**	**Removed**	Included in Baler 230 kV Substation Project
Magalang 230 kV Substation			No Change
San Agustin 230 kV Substation			No Change

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
San Fabian 230 kV Substation	**ETC: Dec 2027**	**ETC: Mar 2028**	Updated ETC based on latest project timeline considering actual implementation
Apalit 230 kV Substation			No Change
Valenzuela 230 kV Substation			No Change
Iriga 230 kV Substation			No Change
Malvar 230 kV Substation			No Change
Balanga 230 kV Substation			No Change
San Isidro 230 kV Substation			No Change
FBGC 230 kV Substation			No Change
Baler 230 kV Substation	**ETC: Dec 2026** Bulk Cost Estimate: 4,852 Million Pesos	**ETC: Feb 2029** Bulk Cost Estimate: 4,607 Million Pesos	Updated ETC based on latest project timeline considering actual implementation Updated Bulk Cost Estimate
Guagua 230 kV Substation			No Change
San Antonio 500 kV Substation		**ETC: Dec 2030**	New Project
Alaminos EHV Substation			No Change
Nuvali 230 kV Substation			No Change
Cabatuan 230 kV Substation			No Change

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Taguig–Silang 500 kV Transmission Line			No Change
Bauang–La Trinidad 230 kV Transmission Line Upgrading	**ETC: Jun 2027**	**ETC: Dec 2027** *Substation Components:* ▪ *La Trinidad 230 kV Substation, 9-230 kV PCBs and associated equipment; 3-69 kV PCBs and associated equipment.*	Updated ETC based on latest project timeline considering actual implementation Updated Project components
Mexico–Clark 69 kV Transmission Line Upgrading			No Change
Cabanatuan–San Rafael–Mexico 230 kV Transmission Line Upgrading			No Change
Bauang–Balaoan 230 kV Transmission Line Upgrading		**ETC: Dec 2028**	New Project
Hermosa–Mexico 230 kV Transmission Line Upgrading			No Change
Calaca–Salong 230 kV Transmission Line 2	**ETC: Dec 2025**	**ETC: Dec 2028**	Updated ETC based on latest project timeline considering actual implementation
Baras 500 kV Substation	**ETC: Dec 2038**	**ETC: Feb 2029**	Updated ETC based on latest project timeline considering actual implementation
Pasay–Taguig 230 kV Transmission Line			No Change
Navotas–Pasay 230 kV Transmission Line			No Change
Naga–Presentacion 230 kV Transmission Line			No Change
Baras–San Antonio 500 kV Transmission Line		**ETC: Dec 2030**	New Project

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Baras–Pinamucan 500 kV Transmission Line		**ETC: Dec 2030**	New Project
Limay–Pasay 230 kV Transmission Line			No Change
Luzon Voltage Improvement Project 6		**Luzon Voltage Improvement Project 7**	Project Name Change
Santiago–Kabugao 500 kV Transmission Line		**ETC: 2031-2035**	Updated ETC
Pasay–Taguig 230 kV Transmission Line	**ETC: Dec 2026**	**ETC: Dec 2030**	Updated ETC based on latest project timeline considering actual implementation
Presentacion 230 kV Substation	<u>*Substation Components:*</u> ▪ *Naga 230 kV Substation, 4-230 kV PCBs and associated equipment;* ▪ *Presentacion 230 kV Substation, 2x50 MVA 230/69 kV Power Transformers and accessories, 6-230 kV PCBs and associated equipment, 3-69 kV PCBs and associated equipment.*	**ETC: 2031-2035** <u>*Substation Components:*</u> ▪ *Naga 230 kV Substation, 4-230 kV PCBs and associated equipment;* ▪ *Presentacion 230 kV Substation, 2x50 MVA 230/69 kV Power Transformers and accessories, 3x25 MVAR, 230 kV Shunt Capacitor and accessories, 9-230 kV PCBs and associated equipment, 3-69 kV PCBs and associated equipment.*	Updated ETC Additional capacitor component based on updated TDP Forecast
San Rafael–San Jose 230 kV Line Upgrading	San Jose 230 kV Substation, 2-230 kV PCBs and associated equipment; San Rafael 230 kV Substation, 4-230 kV PCBs and associated equipment. San Rafael–San Jose 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR, 31 km. ETC: Dec 2035	**ETC: Oct 2027** San Jose 230 kV Substation, 2-230 kV PCBs and associated equipment; San Rafael 230 kV Substation, 2-230 kV PCBs and associated equipment. San Jose–San Rafael 230 kV Transmission Line, ST-DC, 4-795 MCM ACSR, 31 km. ETC: Dec 2025	Updated ETC Updated Project Components Updated ETC based on latest project

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	Project Name: San Rafael-San Jose 230 kV Transmission Line Upgrading	Project Name: San Jose-San Rafael 230 kV Transmission Line Upgrading	timeline considering actual implementation Updated Project Name
Taguig–Muntinlupa 230 kV Transmission Line 2		**ETC: 2031-2035**	Updated ETC
Matnog 230 kV Substation	-	**ETC: 2036-2040**	Updated ETC
Kalinga 500 kV Substation	**-**	**ETC: 2036-2040**	Updated ETC
Sagada–San Esteban 230 kV Transmission Line	**-**	**ETC: 2036-2040**	Updated ETC
Dinadiawan–Santiago 230 kV Transmission Line	**-**	**ETC: 2036-2040**	Updated ETC
Baler–Dinadiawan 230 kV Transmission Line	**-**	**ETC: 2036-2040**	Updated ETC
Capas–Kadampat 230 kV Transmission Line	**-**	**ETC: 2036-2040**	Updated ETC
Bataan–Cavite 500 kV Transmission Line	**-**	**ETC: 2036-2040**	Updated ETC
Upgrading of Bicol Transmission Facilities	**-**	**ETC: 2036-2040**	Updated ETC
North Luzon Substation Upgrading 4	**-**	**ETC: 2036-2040**	Updated ETC
South Luzon Substation Upgrading 3	**-**	**ETC: 2031-2035**	Updated ETC
Sariaya 230 kV Substation	**-**	**ETC: 2031-2035**	Updated ETC
North Luzon Substation Upgrading 3	**-**	**ETC: 2031-2035**	Updated ETC
North Luzon 69 kV Transmission Line Upgrading 2	*Transmission Components:*	**ETC: 2031-2035** *Transmission Components:*	Concepcion–Gerona Load-End 69 kV Transmission Line

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	▪ *San Esteban–Candon Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 24.12 km. ▪ *Laoag–San Nicolas Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 6.85 km. ▪ *Hermosa–Calaguiman Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 13.95 km. ▪ *Limay–Alas-asin Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 11.34 km. ▪ *Olongapo–Subic Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 5.06 km. ▪ *Botolan–Iba Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 5.04 km. ▪ *Concepcion–Gerona Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 23.04 km.	▪ *San Esteban–Candon Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 24.12 km. ▪ *Laoag–San Nicolas Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 6.85 km. ▪ *Hermosa–Calaguiman Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 13.95 km. ▪ *Limay–Alas-asin Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 11.34 km. ▪ *Olongapo–Subic Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 5.06 km. ▪ *Botolan–Iba Load-End 69 kV Transmission Line*, SP/ST-SC, 1-160mm^2 STACIR, 5.04 km.	Upgrading is Removed
South Luzon 69 kV Transmission Line Upgrading 2	**-**	**ETC: 2031-2035**	Updated ETC
San Mateo 230 kV Substation	**-**	**ETC: 2031-2035**	Updated ETC
Bustos 230 kV Substation	**-**	**ETC: 2031-2035**	Updated ETC
South Luzon Substation Upgrading 4	**-**	**ETC: 2036-2040**	Updated ETC

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Bacolor 500 kV Substation	**-**	**ETC: Dec 2035**	New project under TDP 2021-2040
Dasmariñas 500 kV Substation Upgrading	**-**	**ETC: Dec 2035**	New project under TDP 2021-2040
Luzon Voltage Improvement Project 8	**-**	**ETC: Dec 2035**	New project under TDP 2021-2040

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
VISAYAS PROJECTS			
Cebu–Negros–Panay 230 kV Backbone Stage 1	**ETC: Dec 2020**	**ETC: Apr 2021**	Updated ETC based on latest project timeline considering actual implementation
Panitan–Nabas 138 kV Transmission Line 2 Project	**ETC: Dec 2020**	**ETC: May 2021**	Updated ETC based on latest project timeline considering actual implementation
Visayas Substation Reliability Project II	**ETC: Jun 2020**	**ETC: Jun 2021**	Updated ETC based on latest project timeline considering actual implementation
San Carlos–Guihulngan 69 kV Transmission Line	**ETC: Jun 2020**	Completed	Project already energized
Sta. Rita–Quinapondan 69 kV Transmission Line	**ETC: Dec 2020** This project involves the construction of a 97 km 69 kV line connecting Sta. Rita and Quinapondan Substation.	**ETC: Jun 2021** This project involves the construction of a 95 km 69 kV line connecting Sta. Rita and Quinapondan Substation.	Updated ETC based on latest project timeline considering actual implementation Updated transmission line length based on actual implementation
Tagbilaran 69 kV Substation Project	**ETC: Dec 2020**	**ETC: Sept 2021**	Updated ETC based on latest project timeline considering actual implementation
New Naga (Colon) Substation Project	**ETC: Dec 2020**	**ETC: Dec 2021**	Updated ETC based on latest project timeline considering actual implementation

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Naga (Visayas) Substation Upgrading Project	**ETC: Dec 2020**	**ETC: Dec 2021**	Updated ETC based on latest project timeline considering actual implementation
Cebu–Negros–Panay 230 kV Backbone Project - Stage 3	**ETC: Dec 2021** ▪ Magdugo 230 kV S/S, 2x70 MVAR 230 kV Reactor;	**ETC: Dec 2022** ▪ Magdugo 230 kV Substation, 2x70 MVAR 230 kV Line Reactors,	Updated ETC based on latest project timeline considering actual implementation Specified as line reactor
Visayas Voltage Improvement Project	**ETC:** **Stage 1 – Jan 2021** **Stage 2 – Jan 2022** Stage 1 ▪ Lapu-lapu 138 kV S/S, 2x20 MVAR, 138 kV Capacitor Banks and accessories, 2-138 kV PCBs and associated equipment;	**ETC: Dec 2022** Stage 1 ▪ Cebu 138 kV S/S, 2x20 MVAR, 138 kV Capacitor Banks and accessories, 2-138 kV PCBs and associated equipment;	Stage 1 already energized. Updated ETC for Stage 2 based on latest project timeline considering actual implementation Capacitor Banks reverted back to its original location in Cebu S/S; Pending the direct connection of VECO's new 138 kV Line.
Cebu–Lapu-Lapu 230 kV Transmission Line Project	**ETC: Dec 2021**	**ETC: Dec 2023**	Updated ETC based on latest project timeline considering actual implementation
Cebu–Negros–Panay 230 kV Backbone Project – Stage 2	**ETC: Dec 2020**	**ETC: Dec 2021**	Updated ETC based on latest project timeline considering actual implementation
Panay–Guimaras 138 kV Interconnection Project	**ETC: Nov 2021** ▪ Iloilo S/S, 2x100 MVA, 138/69-13.8 kV Power	**ETC: Oct 2022** ▪ Iloilo S/S, 3x100 MVA, 138/69-13.8 kV Power	Updated ETC based on latest project timeline considering actual implementation Iloilo S/S capacity upgraded to 3x100

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	Transformers and accessories, 2-138 kV PCBs, 10-69 kV PCBs (GIS) and associated equipment; ▪ Buenavista S/S, 2x100 MVA, 138/69-13.8 kV Power Transformers and accessories, 6-138 kV PCBs (GIS), 4-69 kV PCBs and associated equipment;	Transformers and accessories, 2-138 kV PCBs, 10-69 kV PCBs (GIS) and associated equipment; ▪ Buenavista S/S, 1x100 MVA, 138/69-13.8 kV Power Transformers and accessories, 6-138 kV PCBs (GIS), 4-69 kV PCBs and associated equipment; ▪ Transfer of existing 1x100 MVA 138/69-13.8 kV Power Transformer from Iloilo S/S to Buenavista S/S;	MVA PTRs due to issue in parallel operation between the existing 100 MVA PTR and the proposed 2x100 MVA PTRs. The existing 100 MVA PTR will be transferred to Buenavista S/S and will operate in parallel with new 1x100 MVA PTR.
Negros–Panay 230 kV Interconnection Line 2 Project	**ETC: Feb 2022**	**ETC: Mar 2023**	Updated ETC based on latest project timeline considering actual implementation
Nabas–Caticlan–Boracay Transmission Line Project	**ETC: May 2021** ▪ Boracay 138 kV GIS S/S (New), 2x100 MVA 138/69-13.2 kV Power Transformer and accessories, 5-138 kV PCBs, 6-69 kV PCBs and associated equipment; ▪ Unidos–Caticlan 138 kV U/G, Double circuit, 138 kV Underground Cable System of 180 MW capacity per circuit, 4.5 km. ▪ Unidos–Caticlan 138 kV T/L, ST/SP-DC, 138 kV, 1-795 MCM ACSR, 2.5 km;	**ETC: Jun 2022** ▪ Boracay 138 kV GIS S/S (New), 2x100 MVA 138/69-13.8 kV Power Transformer and accessories, 5-138 kV PCBs (GIS), 6-69 kV PCBs (GIS) and associated equipment; ▪ Caticlan 138 kV U/G, Double circuit, 138 kV Underground Cable System of 180 MW capacity per circuit, 4.5 km. ▪ Unidos–Caticlan 138 kV T/L, ST/DC, 138 kV, 1-795 MCM ACSR, 1.4 km;	Updated ETC based on latest project timeline considering actual implementation Updated components based on actual implementation Underground cable will traverse only in Barangay Caticlan Updated transmission line length based on actual implementation

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	▪ Nabas–Unidos 230 kV Transmission Line (Initially energized at 138 kV), 230 kV, ST/SP-DC, 4-795 MCM ACSR, 14 km. ▪ Caticlan–Boracay S/C, Submarine Cable System, Double circuit of 100 MW capacity at 138 kV, 2 km;	▪ Nabas–Unidos 230 kV Transmission Line (Initially energized at 138 kV), 230 kV, ST/SP-DC, 4-795 MCM ACSR, 15.9 km. ▪ Caticlan–Boracay S/C, Submarine Cable System, Double circuit of 100 MW capacity at 138 kV, 2.1 km;	
Cebu–Bohol 230 kV Interconnection Project	**ETC: Dec 2021** ▪ Dumanjug–Argao T/L, 230 kV, ST-DC, 4-795 MCM ACSR, 29 km ▪ Loon–Corella T/L, 230 kV, ST-DC, 4-795 MCM ACSR, 26 km ▪ Argao–Loon 230 kV S/C, Double circuit submarine cable system with transfer capacity of 600 MW at 230 kV, 30 km. (with provision for 3rd circuit) ▪ Loon CTS (with provision to be SWS)	**ETC: Sep 2022** ▪ Dumanjug–Argao T/L, 230 kV, ST-DC, 4-795 MCM ACSR, 28 km ▪ Maribojoc–Corella T/L, 230 kV, ST-DC, 4-795 MCM ACSR, 22 km ▪ Argao–Maribojoc 230 kV S/C, Double circuit submarine cable system with transfer capacity of 600 MW at 230 kV, 30 km. (with provision for 3rd circuit) ▪ Maribojoc CTS (with provision to be SWS)	Updated ETC based on latest project timeline considering actual implementation. Updated transmission line length based on actual implementation CTS Site changed from Loon to Maribojoc based on latest site survey
Banga 138 kV Substation Project	▪ Kalibo S/S, 3x100 MVA, 138/69 kV Power Transformer and accessories, 12-138 kV PCBs, 8-69 kV PCBs and associated equipment. ▪ Bus-in of Kalibo Substation to Panitan–Nabas T/L, 138 kV Transmission Line, ST-DC, 1-795 MCM ACSR, 1 km	▪ Banga S/S, 2x100 MVA, 138/69 kV Power Transformer and accessories, 10-138 kV PCBs, 5-69 kV PCBs and associated equipment. ▪ Bus-in of Banga Substation to Panitan–Nabas T/L, 138 kV Transmission Line, ST-DC, 1-795 MCM ACSR, 1 km ▪ Banga Cut-in 69 kV Cut-in Line, SP-DC, 1-336.4 MCM ACSR, 1 km	Implementation of 3rd Transformer will be under a different project. Decrease in PCB due to decrease in number of Transformers Site of Substation changed from Kalibo to Banga according to SEIL Inclusion of 69 kV cut-in Line

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Amlan–Dumaguete 138 kV Transmission Project	**ETC: Nov 2022**	**ETC: Feb 2025**	Updated ETC based on latest project timeline considering actual implementation.
Babatngon–Palo 230 kV Transmission Line Project (Initially energized at 138 kV)	**ETC: Feb 2023**	**ETC: Oct 2025**	Updated ETC based on latest project timeline considering actual implementation.
Permanent Restoration of Panit-an–Nabas 138 kV Line affected by Typhoon Ursula	**ETC: Dec 2020**	**ETC: May 2021**	Updated ETC based on latest project timeline considering actual implementation
Permanent Restoration of Colon–Samboan 138 kV Lines 1 and 2 affected by Landslide	**ETC: Oct 2020** ▪ Panit-an-Nabas Transmission Line, 1-795 MCM ACSR, 138 kV, ST-DC1, toppled towers;	**ETC: Jun 2021** Stage 1: Permanent Restoration of Toppled Towers ▪ Panit-an-Nabas Transmission Line, 1-795 MCM ACSR, 138 kV, ST-DC1, 14 toppled towers; Stage 2: Replacement/Upgrading of 4 Tower Adjacent to the Toppled Towers ▪ Panit-an-Nabas Transmission Line, 1-795 MCM ACSR, 138 kV, ST-DC1, 4 toppled towers;	Updated ETC based on latest project timeline considering actual implementation Introduced staging for clarity 4 adjacent towers also need replacement to further strengthen the line
Visayas Substation Upgrading Project - 1			No change
Lapu-lapu 230 kV Substation Project	**ETC: Aug 2022** ▪ Ibo 230 kV GIS S/S (New), 2x300 MVA 230/69-13.8 kV Power Transformers and accessories, 8-230 kV PCB (GIS), 10-69 kV	**ETC: Dec 2022** ▪ Pusok 230 kV GIS S/S (New), 2x300 MVA 230/69-13.8 kV Power Transformers and accessories, 8-230 kV PCB (GIS), 10-69 kV	Updated ETC based on latest project timeline considering actual implementation Substation site changed from Ibo to

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	PCB (GIS) and associated equipment. ▪ Umapad–Ibo 230 kV S/C, 600 MW per circuit, Double circuit, 2.1 km.	PCB (GIS) and associated equipment. ▪ Umapad–Pusok 230 kV S/C, 600 MW per circuit, Double circuit, 2.1 km.	Pusok based on latest actual implementation data
Visayas Substation Upgrading Project 2	**ETC: Jul 2022** ▪ Calong-calong S/S, 3x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 2x50 MVA transformers), 2-138 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ Compostela S/S, 1x150 230/138-13.8 kV Power Transformer 1-69 kV PCB and associated equipment; ▪ Kabankalan S/S, 2x100 MVA 138/69-13.8 kV Power Transformer and accessories, 2-69 kV PCBs and associated equipment;	**ETC: Mar 2023** ▪ Calong-calong S/S, 3x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 2x50 MVA transformers), 3-138 kV PCBs, 12-69 kV PCBs and associated equipment, Transfer of 2x50 MVA transformers to Isabel and San Isidro S/S, Full upgrading of secondary devices, Dismantling of existing 69 kV Switchyard, and Calong-calong 69 kV feeder line extensions. ▪ Compostela S/S, 2x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 2x50 MVA transformers), 2-230 kV PCBs, 3-69 kV PCBs and associated equipment, and Relocation of Warehouse; ▪ Kabankalan S/S, 2x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 30 and 50 MVA Transformers), 2-138 kV PCBs, 2-69 kV PCBs and associated equipment, Centralized Control Building and Telecom Shelter,	Updated ETC based on latest project timeline considering actual implementation. Inclusion of upgrading of necessary secondary devices on all substations Updated components based on latest lay-out/configuration in order to provide reliability on the substation

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
		Kabankalan–Overflow 69 kV Line Extension, and Full upgrading of secondary devices;	
	▪ Mabinay 138 kV Substation, 2-138 kV PCBs and 2-69 kV PCB	▪ Mabinay S/S, 2-138 kV PCBs, 4-69 kV PCBs and associated equipment, Centralized Control Building, and Full upgrading of secondary devices;	
	▪ Panitan S/S, 3x100 MVA 138/69-13.8 kV Power Transformer and accessories, 11-69 kV PCBs and associated equipment. Rehabilitation of the Control Center and other facilities;	▪ Panitan S/S, 3x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 2x30 and 50 MVA transformers), 4-138 kV PCBs, 13-69 kV PCBs and associated equipment, Centralized Control Building and Container Van and Dismantling of existing 69 kV Switchyard;	
	▪ Dingle S/S, 2x100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-69 kV PCB and associated equipment;	▪ Dingle S/S, 2x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 2x50 MVA Transformers), 3-138 kV PCBs, 3-69 kV PCBs and associated equipment, Centralized Control Building and Telecom Shelter, and Full upgrading of secondary devices;	
	▪ Tabango S/S, 1x50 MVA 230/69-13.8 kV Power Transformer and accessories, 2-230 kV PCBs and associated equipment;	▪ Tabango S/S, 1x50 MVA 230/69-13.8 kV Power Transformer and accessories, 2-230 kV PCBs, 4-69 kV PCBs and associated equipment, Centralized Control Building, Full upgrading of secondary devices;	
		▪ Daanbantayan S/S, 3-69 kV PCB and	

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	▪ Daanbantayan 230 kV Substation, 1-69 kV PCB and associated equipment; ▪ Calbayog S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 4-138 kV PCB, 7-69 kV PCBs and associated equipment. ▪ Isabel S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories (1x50 MVA transformer transferred from Calong-calong Substation), 1-138 kV PCBs, 2-69 kV PCBs and associated equipment. (Additional), 9-138 kV PCBs, 2-69 kV PCBs and associated equipment. (Replacement), Upgrading of existing SCADA system and Control Room; ▪ Paranas S/S, 2x100 MVA 138/69-13.8 kV Power Transformer and accessories, 2-69 kV PCBs and associated equipment, Transfer of termination of various transmission lines and Transfer of 50 MVA Transformer to San Isidro S/S; ▪ Samboan S/S, 3-138 kV PCB and Associated equipment, 69 kV Tie Breaker and Associated equipments;	associated equipment, Centralized Control Building; ▪ Calbayog S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 5-138 kV PCB, 8-69 kV PCBs and associated equipment, Full upgrading of secondary devices. ▪ Isabel S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories (1x50 MVA transformer transferred from Calong-calong Substation), 3-138 kV PCBs, 2-69 kV PCBs and associated equipment. (Additional), 10-138 kV PCBs, 2-69 kV PCBs and associated equipment. (Replacement), Centralized Control Building, Full upgrading of secondary devices; ▪ Paranas S/S, 2x100 MVA 138/69-13.8 kV Power Transformer and accessories (Replacement of 30 MVA and 50 MVA transformers), 7-69 kV PCBs and associated equipment, Centralized Control Building, Full upgrading of secondary devices, and Transfer of 50 MVA Transformer to San Isidro S/S; ▪ Samboan S/S, 4-138 kV PCB, 3-69 kV PCBs and Associated equipment, Centralized Control Building, and Full upgrading of secondary devices;	

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	▪ Toledo S/S, 3x100 MVA 138/34.5-13.8 kV Power Transformer and accessories, 2-34.5 kV PCBs and associated equipment (Replacement), Transfer of termination of various transmission lines; ▪ Ubay S/S, 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 4-138 kV PCBs, 10-69 kV PCBs and associated equipment, Construction of new control building; ▪ Corella S/S, 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs, 8-69 kV PCBs and associated equipment. ▪ Barotac Viejo S/S, 50 MVA 138/69-13.8 kV Power Transformer and accessories (50 MVA Transformer transferred from Iloilo Substation), 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ Sta. Barbara S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories. (50 MVA Transformer transferred from Dingle Substation), 3-138 kV PCBs, 2-69 kV PCBs and associated equipment.	▪ Toledo S/S, 3x100 MVA 138/34.5-13.8 kV Power Transformer and accessories (Replacement of 3x40 MVA transformers), 1-138 kV PCBs and associated equipment (Replacement), Transfer of termination of various transmission lines, and Centralized Control Building; ▪ Ubay S/S, 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 7-138 kV PCBs, 13-69 kV PCBs and associated equipment, Centralized Control Building, and transfer of Capacitor Bank from Trinidad 69 kV LES; ▪ Corella S/S, 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 2-138 kV PCBs, 4-69 kV PCBs and associated equipment (Transfer from Ubay Substation); ▪ Barotac Viejo S/S, 50 MVA 138/69-13.8 kV Power Transformer and accessories (50 MVA Transformer transferred from Iloilo Substation), 2-138 kV PCBs, 1-69 kV PCBs and associated equipment; ▪ Sta. Barbara S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories. (50 MVA Transformer transferred from Dingle Substation), 2-138 kV PCBs, 1-69 kV PCBs and associated equipment.	

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Barotac Viejo–Natividad 69 kV Transmission Line Project	**ETC: Jul 2022**	**ETC: Oct 2023**	Updated ETC based on latest project timeline considering actual implementation.
Upgrading of Acquired Transmission Assets			No change
Calbayog–Allen 138 kV Transmission Line Project	**ETC: Apr 2022** **Calbayog–San Isidro 138 kV Transmission Line Project** ▪ San Isidro S/S, 2x50 MVA 138/69 kV Power Transformer and accessories (1x50 MVA transformer from Paranas S/S), 11-138 kV PCBs, 5-69 kV PCBs and associated equipment;	**ETC: Nov 2025** **Calbayog–Allen 138 kV Transmission Line Project** ▪ San Isidro S/S, 2x50 MVA 138/69 kV Power Transformer and accessories (2x50 MVA transformer from Paranas S/S and Calong-calong S/S), 11-138 kV PCBs, 5-69 kV PCBs and associated equipment;	Updated ETC based on latest project timeline considering actual implementation Transformers from Paranas and Calong-calong will be utilized in San Isidro S/S
Laray 230 kV Substation Project (Initially energized at 138 kV)	**ETC: Apr 2022**	**ETC: Nov 2026**	Updated ETC based on latest project timeline considering actual implementation.
Sumangga 138 kV Substation Project	**ETC: Dec 2024** ▪ Sumangga S/S, 2x100 MVA, 138/69 kV Power Transformer and accessories, 4-69 kV PCBs and associated equipment; ▪ Ormoc S/S, 4-69 kV PCBs and associated equipment. ▪ Sumangga 69 kV Cut-in Line, SP-DC, 1-336.4 MCM ACSR, 2 km. ▪ Reconductoring of Ormoc–Simangan, 69 kV, 1-160 mm2 STACIR, 6 km.	**ETC: May 2027** ▪ Sumangga S/S, 2x100 MVA, 138/69-13.8 kV Power Transformer and accessories, 5-69 kV PCBs and associated equipment; ▪ Ormoc S/S, 6-69 kV PCBs and associated equipment. ▪ Sumangga 69 kV Cut-in Line, SP-DC, 1-336.4 MCM ACSR, 2 km. ▪ Sumangga–Talisayan T/L, 69 kV, SP-SC, 1-336.4 MCM ACSR, 4 km	Updated ETC based on latest project timeline considering actual implementation Additional PCB due to inclusion of 69 kV line to Talisayan LES New 69 kV line to Talisayan LES is considered in lieu of reconductoring

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Granada 230 kV Substation Project	**ETC: Oct 2024**	**ETC: Sep 2027**	Updated ETC based on latest project timeline considering actual implementation
Tigbauan 138 kV Substation Project	**ETC: Dec 2023** ▪ Sta. Barbara S/S, 1-138 kV PCB and associated equipment; ▪ Tigbauan 69 kV Cut-in Line, SP-DC, 1-160 mm2 STACIR, 1 km.	**ETC: Sep 2027** ▪ Sta. Barbara S/S, 1-138 kV PCB, 2-69 kV PCBs and associated equipment; ▪ Tigbauan 69 kV Cut-in Line, SP-DC, 1-160 mm2 STACIR/1-336.4 MCM ACSR, 0.5 km;	Updated ETC based on latest project timeline considering actual implementation Additional 2-69 kV PCBs to be used for Stage 1 of the project Change in conductor for cut-in line to match the conductors of the associated feeders
Carmen 230 kV Substation Project	**ETC: Jun 2025** ▪ Carmen 230 kV Bus-in Line, ST-DC, 772 mm2 (796 MVA), 2x0.50 km;	**ETC: Sep 2028** ▪ Carmen 230 kV Bus-in Line, ST-DC, 4-795 MCM ACSR, 2x0.50 km;	Updated ETC based on latest project timeline considering actual implementation Change in conductor to match the capacity of the transmission line where Carmen S/S will bus-in to.
La Carlota 138 kV Substation Project	**ETC: Dec 2024** .	**ETC: Oct 2028** ▪ La Carlota 69 kV Cut-in Line, ST-DC, 1-160 mm2 STACIR/336.4 MCM ACSR, 1.5 km	Updated ETC based on latest project timeline considering actual implementation Inclusion of 69 kV cut-in Line
San Isidro–Catarman 138 kV Transmission Line Project	**ETC: Dec 2028** **Calbayog–San Isidro–Catarman 138 kV Transmission Line Project** ▪ Catarman S/S, 2x100 MVA 138/69 kV Power Transformer and accessories, 10-138 kV PCBs, 6-69 kV PCBs	**ETC: Dec 2030** **San Isidro–Catarman 138 kV Transmission Line Project** ▪ Catarman S/S, 2x100 MVA 138/69 kV Power Transformer and accessories (2x100 MVA transferred from Mandaue and Lapu-	Updated ETC based on latest project timeline considering actual implementation 2x100 MVA Transformers from Mandaue and Lapu-lapu will be utilized in Catarman Substation

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	and associated equipment.	lapu S/S), 10-138 kV PCBs, 6-69 kV PCBs and associated equipment.	
Bool 138 kV Substation Project	**ETC: Nov 2023** <u>Stage 1 (Nov 2019–Dec 2024)</u> ▪ Bool S/S, 2-69 kV Air Break Switch (ABS); ▪ Corella S/S (Expansion): 1x100 MVA 138/69 kV Power Transformer and accessories, 4-69 kV PCB and associated equipment; ▪ Corella–Bool 138 kV T/L (69 kV energized), ST-DC, 1-795 MCM ACSR, 6 km; <u>Stage 2 (Aug 2027–Dec 2029)</u> ▪ Bool S/S, 2x100 MVA 138/69 kV Power Transformer and accessories, 8-138 kV PCBs, 11-69 kV PCBs and associated equipment; ▪ Transfer of 1x100 MVA 138/69 kV Power Transformer and accessories to Bool Substation;	**ETC: Jun 2029** <u>Stage 1 (Nov 2019–Dec 2024)</u> ▪ Bool SWS, 4-69 kV PCB and associated equipment; ▪ Corella S/S (Expansion): 1x100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV PCB, 4-69 kV PCB and associated equipment; ▪ Corella–Bool 138 kV T/L (69 kV energized), ST-DC, 1-795 MCM ACSR, 6 km; <u>Stage 2 (Aug 2027–Dec 2029)</u> ▪ Bool S/S, 2x100 MVA 138/69-13.8 kV Power Transformer and accessories, 8-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ Transfer of 1x100 MVA 138/69-13.8 kV Power Transformer and accessories 3-69 kV PCBs to Bool Substation;	Updated ETC based on latest project timeline considering actual implementation Components updated based on updated lay-out/configuration in order to provide reliability
Laray–Cordova 230 kV Transmission Line Project	**ETC: Dec 2030**	**ETC: Jun 2029**	Updated ETC based on latest project timeline considering actual implementation
Sipalay 138 kV Substation Project			No change
Laray–Alpaco 230 kV Energization Project	Energization of Laray to 230 kV, 2x300 MVA, 230/69-13.8 kV Power Transformer and accessories;	Energization of Laray to 230 kV, 3x300 MVA, 230/69-13.8 kV Power Transformer and accessories;	Additional 300 MVA Transformer will be needed in order to provide N-1 contingency

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Luzon–Visayas HVDC Bipolar Operation	**ETC: Jan 2025**	**ETC: Apr 2028**	Updated ETC based on latest project timeline considering actual implementation
Corella–Ubay 138 kV Line 2 Stringing Project	**ETC: Dec 2026** ▪ Ubay S/S, 1-138 kV PCBs and associated equipment;	**ETC: Sep 2028** ▪ Ubay S/S, 3-138 kV PCBs and associated equipment;	Updated ETC based on latest project timeline considering actual implementation Increase in number of PCB based on latest configuration.
Barotac Viejo–Unidos 230 kV Transmission Line Project	**ETC: Dec 2024** ▪ Barotac Viejo–Unidos 230 kV Transmission Line (Extension up to Nabas), ST-DC, 4-795 MCM ACSR, 140 km; ▪ Bus-in of Unidos S/S to Nabas–Caticlan T/L (Going to Nabas), 230 kV T/L, ST-DC, 4-795 MCM ACSR, 1 km.	**ETC: Nov 2028** ▪ Barotac Viejo–Unidos 230 kV Transmission Line (Extension up to Barotac Viejo), ST-DC, 4-795 MCM ACSR, 140 km; ▪ Bus-in of Unidos S/S to Nabas–Caticlan T/L (Going to Barotac Viejo), 230 kV T/L, ST-DC, 4-795 MCM ACSR, 1 km.	Updated ETC based on latest project timeline considering actual implementation Clarified the scope of 230 kV T/L and bus-in line
Panay–Guimaras 138 kV Interconnection Line 2 Project	**ETC: Dec 2026**	**ETC: Sep 2026**	Updated ETC based on latest project timeline considering actual implementation
Nivel Hills 230 kV Substation Project	**ETC: Dec 2023**	**ETC: Apr 2027**	Updated ETC based on latest project timeline considering actual implementation
Tabango–Biliran 69 kV Transmission Line Project	**ETC: Jun 2025** ▪ Tabango–Biliran 69 kV T/L, ST-DC, 1-795 MCM ACSR, 35 km	**ETC: Jun 2027** ▪ Tabango–Biliran 69 kV T/L, SP-SC, 1-795 MCM ACSR, 35 km	Updated ETC based on latest project timeline considering actual implementation Updated component based on actual implementation data
Siaton–Bayawan 138 kV Transmission Line			No change

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
(Initially energized at 69 kV)			
Visayas Substation Upgrading Project 3		▪ Cadiz S/S, 2x100 MVA 138/69-13.8 kV Power Transformer and accessories. (Replacement of existing 2x50 MVA transformer).	Inclusion of Cadiz Substation upgrading to provide N-1 contingency
Taft–Bobolosan 138 kV Transmission Line Project (Initially energized at 69 kV)			No change
Cebu–Leyte 230 kV Interconnection Lines 3 and 4 Project	**Cebu–Leyte 230 kV Interconnection Line 3 and 4 Project** **ETC: Mar 2025** ▪ Daanbantayan–Tabango S/C, Submarine Cable, 600 MW capacity per ckt, Double Circuit, 32.49 km; ▪ Daanbantayan S/S (Expansion), 2x70 MVAR, 230 kV Line Reactor, 9-230 kV PCBs and associated equipment; ▪ Tabango S/S (Expansion), 2x70 MVAR, 230 kV Line Reactor, 4-230 kV PCBs and associated equipment; ▪ Ormoc S/S (Expansion), 2-230 kV PCBs and associated equipment; ▪ Tabango S/S (Expansion), 4-230 kV PCBs and associated equipment. ▪ Bobon SWS–Daanbantayan T/L, 4-	**Cebu–Leyte 230 kV Interconnection Lines 3 and 4 Project** **ETC: May 2029** ▪ Daanbantayan–Tabango S/C, Submarine Cable, 600 MW capacity per ckt, Double Circuit, 33 km; ▪ Daanbantayan SWS, 4x70 MVAR, 230 kV Line Reactors, 11-230 kV PCBs and associated equipment; ▪ Tabango SWS, 4x70 MVAR, 230 kV Line Reactors, 11-230 kV PCBs and associated equipment; ▪ Bobon SWS (Expansion), 2-230 kV PCBs and associated equipment; ▪ Kananga SWS, 6-230 kV PCBs and associated equipment; ▪ Marshalling SWS (Expansion), 2-230 kV PCBs and associated equipment;	Updated ETC based on latest project timeline considering actual implementation Updated length of the submarine cable due to change in its termination location New switching stations will be built for the termination of the proposed submarine cables Inclusion of new Kananga SWS in the project The project will be connected to the grid via Bobon SWS in Cebu and Marshalling SWS in Leyte (originally in Ormoc S/S) Inclusion of series line reactors to optimize the power flow between the existing and proposed submarine cables

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	795 MCM ACSR, 120 km**;** ▪ Ormoc–Kananga T/L, 4-795 MCM ACSR, 7 km; ▪ Tabango–Kananga T/L, 4-795 MCM ACSR, 38 km.	▪ Tabango S/S, series line reactor along Tabango–Marshalling 230 kV T/L; ▪ Bobon SWS–Daanbantayan SWS T/L, 4-795 MCM ACSR, 120 km**;** ▪ Tabango SWS–Kananga SWS T/L, 4-795 MCM ACSR, 33 km; ▪ Kananga SWS–Marshalling SWS T/L, 4-795 MCM ACSR, 10 km	
Babatngon–Sta. Rita 138 kV Transmission Line Upgrading	**ETC: Dec 2026** ▪ Sta. Rita S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories, 10-138 kV PCBs, 4-69 kV PCBs and associated equipment;	**ETC: Jun 2029** ▪ Sta. Rita S/S, 1x50 MVA 138/69-13.8 kV Power Transformer and accessories (50 MVA transformer will be transferred from Cadiz Substation), 10-138 kV PCBs, 4-69 kV PCBs and associated equipment;	Updated ETC based on latest project timeline considering actual implementation 50 MVA Transformer will be utilized in Cadiz Substation
Kananga–Babatngon 230 kV Transmission Line Project	**ETC: Mar 2025** **Kananga 230 kV Switching Station Project** ▪ Kananga SWS, 10-230 kV PCBs and associated equipment;	**ETC: Nov 2029** **Kananga–Babatngon 230 kV Transmission Line Project** ▪ Kananga SWS (Expansion), 4-230 kV PCBs and associated equipment;	Updated ETC based on latest project timeline considering actual implementation Construction of Kananga SWS included under Cebu–Leyte 230 kV Interconnection Lines 3 and 4 Project Updated components cover only the expansion of Kananga SWS
Bayawan–Sipalay 138 kV Transmission Line (Initially energized at 69 kV)			No change

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Visayas Voltage Improvement Project 2	**ETC: Dec 2022** ▪ Bacolod 138 kV S/S, 4x50 MVAR Capacitor Bank, 4-138 kV PCBs and associated equipment; ▪ Maasin 138 kV S/S, 4x20 MVAR Capacitor Bank, 4-138 kV PCBs and associated equipment; ▪ Panitan 138 kV S/S, 2x20 MVAR Capacitor Bank, 2-138 kV PCBs and associated equipment.	**ETC: Jun 2027** ▪ Paranas 138 kV S/S, ±20 MVAR 138 kV STATCOM, 1-138 kV PCB and associated equipment; ▪ Quinapondan 69 kV LES, 5 MVAR 69 kV Capacitor Bank, 1-69 kV PCB and associated equipment; ▪ Baybay 69 kV LES, 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment; ▪ Dalaguete 69 kV LES, 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment; ▪ Colon 138 kV S/S, ±80 MVAR 138 kV STATCOM, 4-138 kV PCBs and associated equipment; ▪ Asturias 69 kV LES, 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment; ▪ Garcia Hernandez 69 kV LES, 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment; ▪ Carmen 69 kV LES, 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment; ▪ La Castellana 69 kV LES, 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment;	Updated ETC based on latest project timeline considering actual implementation Updated project components based on latest simulation result

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
		▪ Siaton 69 kV LES, 5 MVAR 69 kV Capacitor Bank, 1-69 kV PCB and associated equipment; ▪ Panitan 138 kV S/S, ±20 MVAR 138 kV STATCOM, 1-138 kV PCB and associated equipment; ▪ Roxas 69 kV LES, 5 MVAR 69 kV Capacitor Bank, 1-69 kV PCB and associated equipment; ▪ San Jose 69 kV LES, 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment; ▪ Estancia 69 kV LES, 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment; ▪ Dumangas 69 kV LES, 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCBs and associated equipment.	
Visayas Voltage Improvement 3	▪ Sumangga 138 kV S/S, 1x50 MVAR Capacitor Bank, 1-138 kV PCBs and associated equipment.	▪ Tigbauan 69 kV LES, 3x5 MVAR Capacitor Bank, 3-69 kV PCBs and associated equipment; ▪ Dingle 138 kV S/S, 20 MVAR Capacitor Bank, 1-138 kV PCB and associated equipment; ▪ Bayawan 69 kV LES, 2x5 MVAR Capacitor Bank, 2-69 kV PCBs and associated equipment; ▪ Granada 69 kV S/S, 3x5 MVAR Capacitor Bank, 3-69 kV PCBs and associated equipment;	Updated components based on latest simulation results

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
		▪ Lagasan 69 kV LES, 3x5 MVAR Capacitor Bank, 3-69 kV PCBs and associated equipment; ▪ DUCOM 69 kV LES, 3x5 MVAR Capacitor Bank, 3-69 kV PCBs and associated equipment; ▪ Dayhagon 69 kV LES, 2x5 MVAR Capacitor Bank, 2-69 kV PCBs and associated equipment; ▪ Umapad 69 kV S/S, 4x5 MVAR Capacitor Bank, 4-69 kV PCBs and associated equipment; ▪ Maasin 138 kV S/S, 4x20 MVAR Capacitor Bank, 4-138 kV PCB and associated equipment; ▪ Himayangan 69 kV LES, 5 MVAR Capacitor Bank, 1-69 kV PCBs and associated equipment; ▪ Calbayog 69 kV S/S, 3x5 MVAR Capacitor Bank, 3-69 kV PCBs and associated equipment.	
Mandurriao 138 kV Substation Project	**Jaro 230 kV Substation Project** **ETC: Jun 2025**	**Mandurriao 138 kV Substation** **ETC: 2031-2035**	New substation in Mandurriao is considered due to its strategic location to support load growth in western part of Iloilo City Updated ETC
Bacolod–Kabankalan 230 kV Transmission Line	**ETC: Sep 2033**	**ETC: 2031-2035**	Updated ETC

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Project (Initially energized at 138 kV)			
Visayas Substation Upgrading Project 4	**ETC: Dec 2031** ▪ Jaro S/S (Expansion), 1x300 MVA 230/69 kV Power Transformer and accessories, 2-230 kV PCB, 1-69 kV PCB and associated equipment; ▪ Sumangga S/S (Expansion), 1x100 MVA 138/69 kV Power Transformer and accessories (Transferred from Palo 138 kV Substation), 2-138 kV PCB, 2-69 kV PCB and associated equipment; ▪ Dingle S/S (Expansion), 1x100 MVA 138/69-13.8 kV Power Transformer and accessories (Transferred from Palo 138 kV Substation), 2-138 kV PCBs, 1-69 kV PCBs and associated equipment.	**ETC: 2031-2035** ▪ Sumangga S/S (Expansion), 1x100 MVA 138/69 kV Power Transformer and accessories (Transferred from Palo 138 kV Substation), 1-138 kV PCB, 2-69 kV PCB and associated equipment; ▪ Dingle S/S (Expansion), 1x100 MVA 138/69-13.8 kV Power Transformer and accessories (Transferred from Palo 138 kV Substation), 1-138 kV PCBs, 1-69 kV PCBs and associated equipment.	Updated ETC Jaro 230 kV Substation Project replaced with Mandurriao 138 kV Substation Project from TDP Updated components based on latest configuration
Bohol–Leyte 230 kV Interconnection	**ETC: Dec 2031** ▪ Tugas–Guadalupe S/C, 2 ckts XLPE submarine cable of 600 MW capacity per ckt, 17.6 km. ▪ Ubay S/S (Expansion), 2x300 MVA 230/138 kV Transformers, 4-230 kV PCBs and associated equipment;	**ETC: 2031-2035** ▪ Maasin S/S (Expansion), 2x300 MVA 230/138-13.8 kV Transformers, 2x70 MVAR Line Reactors and accessories, 8-230 kV PCBs, 2-138 kV PCBs and associated equipment; ▪ Ubay S/S (Expansion), 2x300 MVA 230/138-13.8 kV Transformers, 2x70 MVAR Line Reactors and accessories, 8-230 kV PCBs and associated equipment;	Updated ETC Updated components based on latest configuration

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	▪ Ubay–Tugas T/L, 4-795 MCM ACSR, ST-DC, 20 km;	▪ C.P. Garcia 230 kV CTS; ▪ Guadalupe 230 kV CTS. ▪ Ubay–C.P. Garcia 230 kV T/L, 4-795 MCM ACSR, ST-DC, 19 km; ▪ Maasin–Javier 230 kV T/L, ST-DC, 4-795 MCM ACSR, 120 km; ▪ Guadalupe–Maasin 230 kV T/L, ST-DC, 4-795 MCM ACSR, 4.5 km. ▪ C.P. Garcia–Guadalupe 230 kV S/C, Double Circuit Submarine Cable, 600 MW per circuit, 17.6 km.	C.P. Garcia and Guadalupe will be initially CTS but will be developed to SWS upon implementation of the 3rd Circuit.
San Jose–Nabas 138 kV Transmission Line Project	**ETC: Dec 2033**	**ETC: 2031-2035**	Updated ETC
Palo–Javier 230 kV Transmission Line Project	**ETC: Sep 2034**	**ETC: 2031-2035**	Updated ETC
Visayas Voltage Improvement Project 4		**ETC: 2031-2035** ▪ Granada 230 kV S/S, 5x20 MVAR Capacitor Bank, 5-230 kV PCBs and associated equipment. ▪ La Carlota 138 kV S/S, 20 MVAR Capacitor Bank, 1-138 kV PCB and associated equipment; ▪ Cordova 69 kV S/S, 4x5 MVAR Capacitor Bank, 4-69 kV PCBs and associated equipment;	New Project under TDP 2021-2040

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Cebu–Negros 230 kV Interconnection Line 3 and 4 Project	**ETC: Dec 2040**	**ETC: 2036-2040**	Updated ETC
Babatngon–Borongan 138 kV Transmission Line Project	**ETC: Dec 2038**	**ETC: 2036-2040**	Updated ETC
Visayas Substation Upgrading Project 5	**ETC: Dec 2026**	**ETC: 2036-2040** ▪ Daanbantayan S/S (Expansion), 150 MVA 138/69-13.8 kV Power Transformer and accessories, 1-230 kV PCB, 1-69 kV PCB and associated equipment; ▪ Calatrava S/S (Expansion), 100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV PCB, 2-69 kV PCB and associated equipment; ▪ La Carlota S/S (Expansion), 100 MVA 138/69-13.8 kV Power Transformer and accessories, 1-138 kV PCB, 2-69 kV PCB and associated equipment.	Updated ETC Expansion of the following substation in order to provide N-1 contingency
Lapu-lapu–Cordova 230 kV Interconnection Project	**ETC: Dec 2038** ▪ Ibo–Cordova S/C S/C, 2 ckts XLPE submarine cable of 600 MW per ckt capacity, 6 km;	**ETC: 2036-2040** ▪ Pusok–Cordova S/C S/C, 2 ckts XLPE submarine cable of 600 MW per ckt capacity, 6 km;	Updated ETC Substation site changed from Ibo to Pusok based on latest actual implementation data
Borongan–Catarman 138 kV Transmission Line Project	**ETC: Sep 2040**	**ETC: 2036-2040**	Updated ETC
Silay 138 kV Substation Project			Project removed from TDP since 69 kV Transmission

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
			Line is not NGCP facility

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
MINDANAO PROJECTS			
Kauswagan–Lala 230 kV Transmission Line Project	**ETC: Dec 2020**	**ETC: Sep 2021**	Updated the ETC based on latest project timeline considering actual implementation
Agus 2 Switchyard Upgrading Project	**Dec 2020**	**Feb 2022**	Updated the ETC based on latest project timeline considering actual implementation
Mindanao Substation Upgrading Project (MSUP)	**ETC: Dec 2021**	**ETC: Jun 2022**	Updated the ETC based on latest project timeline considering actual implementation
Mindanao Substation Rehabilitation Project (MSRP)	**ETC: Dec 2021**	**ETC: Jun 2022**	Updated the ETC based on latest project timeline considering actual implementation
Tacurong–Kalamansig 69 kV Transmission Line Project	**ETC: Aug 2022**	**ETC: Jun 2023**	Updated the ETC based on latest project timeline considering actual implementation
Laguindingan 230 kV Substation Project	**ETC: Jul 2023** ▪ *Laguindingan 230 kV Substation: 2*-300 MVA, 230/138-13.8 kV Power Transformer and accessories, 1-100 MVA, 230/69-13.8 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 6-138 kV PCBs and associated equipment, 6-69 kV PCBs and associated equipment. ▪ *Balo-i-Villanueva 230 kV line bus-in to Laguindingan 230 kV*	**ETC: Jun 2023** ▪ *Laguindingan 230 kV Substation: 2*-300 MVA, 230/138-13.8 kV Power Transformer and accessories, 1-100 MVA, 138/69-13.8 kV Power Transformer and accessories, 10-230 kV PCBs and associated equipment, 6-138 kV PCBs and associated equipment, 3-69 kV PCBs and associated equipment. ▪ *Tagoloan 138 kV Substation:* 5-138 kV	▪ Updated the ETC based on latest project timeline considering actual implementation ▪ Changes in the number of PCBs in Laguindingan Substation; Correction of voltage level for the 100 MVA Power Transformer; Correction on the length of circuit that will bus in to the substation; Addition of PCBs

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	SS: 230 kV, ST-DC, 2x795 MCM ACSR/AS, 5.75 km **Bulk Cost Estimate**: 2,634.457 Million Pesos	PCBs and associated equipment ▪ *Balo-i-Villanueva 230 kV line bus-in to Laguindingan 230 kV SS*: 230 kV, ST-DC, 2x795 MCM ACSR/AS, 2 x 5.75 km **Bulk Cost Estimate**: 2,353.912 Million Pesos	for Tagoloan Substation. ▪ Change in bulk cost
Mindanao Substation Expansion 4 Project (MSE4P)	**ETC: Dec 2024** ▪ *Culaman 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Sultan Kudarat 138 kV Substation: 1*x100 MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; **Bulk Cost Estimate:** 3,524.761 Million Pesos	**ETC: Jun 2023** ▪ *Culaman 230 kV Substation:* 1x50 MVA 230/69 kV Power Transformers and accessories, 2-230 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Sultan Kudarat 138 kV Substation:* 2x100 MVA 138/69 kV Power Transformers and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment; **Bulk Cost Estimate:** 3,691.658 Million Pesos	▪ Updated ETC ▪ Corrected the voltage level for Culaman Substation and reduced the proposed additional capacity to 50 MVA; ▪ Addition of another 100 MVA Power Transformer in Sultan Kudarat Substation; ▪ Change in bulk cost
Mindanao Substation Expansion 3 Project (MSE3P)	**ETC: Oct 2023**	**ETC: Jul 2025**	Updated ETC
Zamboanga Peninsula Voltage Improvement Project (ZPVIP)	**ETC: Dec 2023** ▪ *Aurora 138 kV Substation:* 2x100 MVAR STATCOM, 4-138 kV PCBs and associated equipment; ▪ *Pitogo 138 kV Substation:* 2x7.5 MVAR Shunt Capacitors, 2-69 kV PCBs and associated equipment **Bulk Cost Estimate:** 920.877 Million Pesos	**ETC: Capacitors – 2021 STATCOM – 2022** ▪ *Zamboanga 138 kV Substation:* 200 MVAR STATCOM, 4-138 kV PCBs, 1-69 kV PCB and associated equipment; ▪ *Naga Min 138 kV Substation:* 4x10 MVAR Shunt Capacitors, 4-138 kV PCBs and associated equipment;	▪ Relocation of proposed STATCOM from Aurora to Zamboanga Substation; Addition of Shunt Capacitors in Pitogo and Naga Min Substation; ▪ Addition of Shunt Capacitors for Tacurong and General Santos Substation ▪ Change in bulk cost

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
		▪ *Pitogo 138 kV Substation:* 2x10 MVAR Shunt Capacitors, 6-138 kV PCBs and associated equipment; ▪ *Tacurong* 138 kV Substation: 2x30 MVAR Shunt Capacitors, 2-138 kV PCBs and associated equipment; ▪ *General Santos 138 kV Substation:* 4x30 MVAR Shunt Capacitors, 4-138 kV PCBs and associated equipment **Bulk Cost Estimate:** 920.877 Million Pesos	
Nasipit Substation Bus-In Project	**ETC: Apr 2022**	**ETC: Jun 2023**	Updated the ETC based on latest project timeline considering actual implementation
Kabacan 138 kV Substation Project	**ETC: May 2022**	**ETC:** **S/S - Jun 2023** **T/L to Kidapawan – Sep 2025**	Updated the ETC based on latest project timeline considering actual implementation
Mindanao Substation Upgrading 2 Project (MSU2P)	**ETC: Dec 2023** ▪ *General Santos 138 kV Substation,* 2x150 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ *Toril 138 kV Substation,* 2x100 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment;	**ETC: Jun 2023** ▪ *General Santos 138 kV Substation,* 2x100 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ *Toril 138 kV Substation,* 2x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 1-69 kV PCBs and associated equipment; ▪ *Balo-i 138 kV Substation, 1*x100 MVA 138/69 kV Power	▪ Updated the ETC based on latest project timeline considering actual implementation ▪ Updated the number of Power Transformers and PCBs in some substations Change in bulk cost

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	▪ *Balo-i 138 kV Substation,* 2x100 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ *Bunawan 138 kV Substation,* 2x150 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ *Butuan 138 kV Substation,* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment; ▪ *Davao 138 kV Substation,* 2x150 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment; **Bulk Cost Estimate:** 7,919.161 Million Pesos	Transformer and accessories, 3-138 kV PCBs, 6-69 kV PCBs and associated equipment; ▪ *Bunawan 138 kV Substation,* 2x100 MVA 138/69 kV Power Transformer and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment; ▪ *Butuan 138 kV Substation,* 1x100 MVA 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 1-69 kV PCBs and associated equipment; ▪ *Davao 138 kV Substation,* 2x150 MVA 138/69 kV Power Transformer and accessories, 3-138 kV PCBs, 7-69 kV PCBs and associated equipment; **Bulk Cost Estimate:** 5,556.906 Million Pesos	
Sultan Kudarat – Pinaring 69 kV Line Upgrading Project			New Project
San Francisco– Tago 138 kV Transmission Line Project	**ETC: May 2024**	**ETC: Dec 2023**	▪ Updated the ETC based on latest project timeline considering actual implementation
Polanco– Oroquieta 138 kV Transmission Line Project (Initially energized at 69 kV)	**ETC: Sep 2024** **Oroquieta 69 kV Switching Station Project**	**ETC: Capacitors – Sep 2024** **TL - Apr 2028** **Polanco–Oroquieta 138 kV Transmission Line**	▪ Updated the ETC based on latest project timeline considering actual implementation

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	Bulk Cost Estimate: 4,561.641 Million Pesos	**Project (Initially energized at 69 kV)** **Bulk Cost Estimate**: 4,039.200 Million Pesos	▪ Change in project name and bulk cost
Maco–Mati 138 kV Transmission Line Project	**ETC: May 2024**	**ETC: Aug 2025**	Updated the ETC based on latest project timeline considering actual implementation
Eastern Mindanao Voltage Improvement Project (EMVIP)	**ETC: Dec 2023** ▪ *Butuan 138 kV Substation: 3*-10 MVAR, 138 kV Shunt Capacitors and accessories; ▪ *San Francisco 138 kV Substation: 3*-10 MVAR, 138 kV Shunt Capacitors and accessories; ▪ *Nabunturan 138 kV Substation: 3*-10 MVAR, 138 kV Shunt Capacitors and accessories; ▪ *Maco 138 kV Substation: 3*-10 MVAR, 138 kV Shunt Capacitors and accessories; **Bulk Cost Estimate:** 159.687 Milliion Pesos	**ETC: Dec 2025** ▪ *Butuan 138 kV Substation: 3*-10 MVAR, 138 kV Shunt Capacitors and accessories, 3-138 kV PCBs and associated equipment; ▪ *San Francisco 138 kV Substation: 3*-10 MVAR, 138 kV Shunt Capacitors and accessories, 3-138 kV PCBs and associated equipment; ▪ *Nabunturan 138 kV Substation: 3*-10 MVAR, 138 kV Shunt Capacitors and accessories, 3-138 kV PCBs and associated equipment; ▪ *Maco 138 kV Substation: 3*-10 MVAR, 138 kV Shunt Capacitors and accessories, 3-138 kV PCBs and associated equipment; **Bulk Cost Estimate:** 868.435 Milliion Pesos	▪ Updated the ETC based on latest project timeline considering actual implementation ▪ Addition of PCBs for the Shunt Capacitors ▪ Change in bulk cost
Nasipit–Butuan 69 kV Transmission Line Project	▪ *Nasipit-Butuan 69 kV Transmission Line:* SP-SC, 1-160mm^2 STACIR/AW, 25 km	▪ *Nasipit-Butuan 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 25 km	Updated the power conductors to be used
Placer–Luna 69 kV Transmission Line Project	*Placer-Luna 69 kV Transmission Line:* SP-SC, 1-160mm^2 STACIR/AW, 18 km	*Placer-Luna 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 18 km	Updated the power conductors to be used
Opol–Carmen 69 kV Transmission Line Project	▪ *Opol-Carmen 69 kV Transmission Line:* SP-SC, 1-160mm^2 STACIR/AW, 12 km	▪ *Opol-Carmen 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 12 km	Updated the power conductors to be used

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Davao–Toril 69 kV Line 2 Transmission Line Project	▪ *Davao-Toril 69 kV Transmission Line 2:* SP-SC, 1-160mm^2 STACIR/AW, 8 km	▪ *Davao-Toril 69 kV Transmission Line 2:* SP-SC, 1-795 MCM ACSR, 8 km	Updated the power conductors to be used
Villanueva–Kinamlutan 230 kV Transmission Line Project	**Bulk Cost Estimate:** 6,944.336 Million Pesos	**Bulk Cost Estimate**: 7,873.393 Million Pesos	Change in bulk cost
Koronadal 138 kV Substation Project	**ETC: Dec 2023** ▪ *Koronadal 138 kV Substation:* 2x150 MVA 138/69 kV Power Transformers and accessories, 10-138 kV PCBs, 6-69 kV PCBs and associated equipment **Bulk Cost Estimate:** Not indicated	**ETC: Aug 2027** ▪ *Koronadal 138 kV Substation:* 2x150 MVA 138/69 kV Power Transformers and accessories, 1x7.5 MVAR Shunt Capacitor, 10-138 kV PCBs, 7-69 kV PCBs and associated equipment ▪ *Tacurong-General Santos 138 kV Transmission Line Bus-in:* ST-DC, 1-795 MCM ACSR, 0.5 km **Bulk Cost Estimate:** 1,893.649 Million Pesos	▪ Updated the ETC based on latest project timeline considering actual implementation ▪ Addition of Shunt Capacitor and Bus-in Line for Koronadal Substation ▪ The bulk cost is now indicated
Agus 6-Kiwalan-Lugait 69 kV Transmission Line Project	**ETC: Dec 2024** **Bulk Cost Estimate:** 842.794 Million Pesos	**ETC: Oct 2027** **Bulk Cost Estimate:** 610.872 Million Pesos	▪ Change in bulk cost
Tigbao 138 kV Substation Bus-in	**ETC: Dec 2023** ▪ *Tigbao 138 kV Substation:* 2x150 MVA 138/69 kV Power Transformers and accessories, 10-138 kV PCBs, 8-69 kV PCBs and associated equipment; **Bulk Cost Estimate:** Not indicated	**ETC: Dec 2027** ▪ *Tigbao 138 kV Substation:* 2x100 MVA 138/69 kV Power Transformers and accessories, 10-138 kV PCBs, 5-69 kV PCBs and associated equipment; ▪ *Tigbao-Dumalinao 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 15 km **Bulk Cost Estimate:** 1,361.995 Billion Pesos	▪ Updated the number of PCBs needed in Tigbao Substation ▪ Considred the new Tigbao-Dumalinao 69 kV feeder ▪ The bulk cost is now indicated
Maco–Tagum 69 kV Transmission Line Project	**ETC: Jun 2024** **Bulk Cost Estimate**: 1,505.236 Million Pesos	**ETC: Dec 2027** **Bulk Cost Estimate:** 1,028.688 Million Pesos	▪ Updated the ETC based on latest project timeline

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
			considering actual implementation ▪ Change in bulk cost
Naga Min–Pangi 69 kV Transmission Line Project	**Naga Mindanao–Pangi 69 kV Transmission Line Project** ▪ *Naga Min-Pangi 69 kV Transmission Line 2:* SP-SC, 1-160mm^2 STACIR/AW, 13 km	**Naga Min–Pangi 69 kV Transmission Line Project** ▪ *Naga Min-Pangi 69 kV Transmission Line 2:* SP-SC, 1-795 MCM ACSR, 13 km	▪ Standardized the Naga Substation in Mindanao as Naga Min Substation ▪ Updated the power conductors to be used ▪
Marawi–Malabang 69 kV Transmission Line Project	▪ *Marawi-Malabang 69 kV Transmission Line:* SP-SC, 1-160mm^2 STACIR/AW, 62 km	▪ *Marawi-Malabang 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 62 km	▪ Updated the power conductors to be used
Tumaga 138 kV Substation Project	**ETC: Dec 2023** ▪ *Tumaga 138 kV Substation:* 2x100 MVA 138/69 kV Power Transformers and accessories, 9-138 kV PCBs, 5-69 kV PCBs and associated equipment; ▪ *Tumaga-Zamboanga 69 kV Transmission Line:* SP-DC, 2-795 MCM ACSR, 23 km **Bulk Cost Estimate:** ▪ Not indicated	**ETC: May 2028** ▪ *Tumaga 138 kV Substation:* 2x100 MVA 138/69 kV Power Transformers and accessories; 10-138 kV PCBs, 6-69 kV PCBs and associated equipment; ▪ *Tumaga 138 kV Bus-in Line to Zamboanga:* ST-DC, 1-795 MCM ACSR, 0.5 km; ▪ *Tumaga 138 kV Bus-in Line to Pitogo:* ST-DC, 1-795 MCM ACSR, 0.5 km; ▪ *Tumaga 69 kV Cut-*Line *to Putik-Tumaga LES:* SP-DC, 1-795 MCM ACSR, 5km **Bulk Cost Estimate:** ▪ 1,502.157 Million Pesos	▪ Updated the ETC based on latest project timeline considering actual implementation ▪ Updated the number of PCBs needed in Tumaga Substation ▪ The Bus-in line of Zamboanga-Pitogo 138 kV Line to Tumaga Substation is considered ▪ New 69 kV line is considered instead of line reconductoring ▪ The bulk cost is now indicated ▪
Naga Min-Salug 138 kV Transmission Line Project (Initially energized at 69 kV)	**Naga Mindanao-Salug 138 kV Transmission Line Project (Energized at 69 kV)** **ETC: Dec 2023** ▪ *Naga Min–Salug 138 kv Transmission Line:* ST-SC, 1-795 MCM ACSR, 60 km	**Naga Min-Salug 138 kV Transmission Line Project (Initially energized at 69 kV)** **ETC: Jul 2028** ▪ *Naga Min–Salug 138 kv Transmission Line:* ST-DC, 1-795 MCM ACSR, 60 km	▪ Standardized the Naga Substation in Mindanao as Naga Min Substation ▪ Considered the outright double circuit of the Naga Min-Salug Line; ▪ The bulk cost isnow indicated

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	Bulk Cost Estimate: Not indicated	**Bulk Cost Estimate:** 3,129.437 Million Pesosf	
Midsayap 138 kV Substation Project	▪ *Midsayap 138 kV Substation:* 10-138 kV PCBs, 4-69 kV PCBs and associated equipment	▪ *Midsayap 138 kV Substation:* 2x100 MVA 138/69 kV Power Transformers and accessories, 10-138 kV PCBs, 4-69 kV PCBs and associated equipment	▪ Considered the new Power Transformers for Midsayap Substation
Nabunturan–Monkayo 69 kV Transmission Line Project	▪ *Nabunturan-Monkayo 69 kV Transmission Line:* SP-SC, 1-160mm^2 STACIR/AW, 42 km	▪ *Nabunturan-Monkayo 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 42 km	▪ Updated the power conductors to be used
Matanao 230/138 kV Transformer Project			▪ No Changes
Placer–Madrid 69 kV Transmission Line Project	▪ *Placer-Madrid 69 kV Transmission Line:* SP-SC, 1-160mm^2 STACIR/AW, 84 km	▪ *Placer-Madrid 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 84 km	▪ Updated the power conductors to be used
Mindanao Substation Expansion 5 Project (MSE5P)	▪ *Salug 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Bunawan 138 kV Substation:* 1x150 MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Culaman 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *General Santos 138 kV Substation:* 1x150	▪ *Salug 138 kV Substation:* 2x50 MVA 138/69 kV Power Transformers and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment ▪ *Bunawan 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Culaman 230 kV Substation:* 1x50 MVA 230/69 kV Power Transformers and accessories, 2-230 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *General Santos 138 kV Substation:* 1x100	▪ Updated the proposed capacity addition in Salug Substation ▪ Reduced the proposed capacity addition in Bunawan Substation ▪ Corrected the voltage level and reduced the proposed capacity addition in Culaman Substation ▪ Reduced the proposed capacity addition in General Santos Substation

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
	MVA 138/69 kV Power Transformers and accessories, 4-138 kV PCBs, 4-69 kV PCBs and associated equipment	MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 4-69 kV PCBs and associated equipment	
Sultan Kudarat–Tacurong 230 kV Transmission Line Project (Initially energized at 138 kV)	**ETC: Jan 2025** **Sultan Kudarat–Tacurong 230 kV Transmission Line Project** **Bulk Cost Estimate:** 5,232.528 Million Pesos	**ETC: Oct 2026** **Sultan Kudarat–Tacurong 230 kV Transmission Line Project (Initially energized at 138 kV)** **Bulk Cost Estimate:** 5,887.700 Million Pesos	▪ Updated the ETC based on latest project timeline considering actual implementation Change in project name and bulk cost
Eastern Mindanao 230 kV Transmission Line Project (Initially energized at 138 kV)	**ETC: Jan 2025** **Eastern Mindanao 230 kV Transmission Line Project** **Bulk Cost Estimate:** 14,180.781 Million Pesos	**ETC: Aug 2027** **Eastern Mindanao 230 kV Transmission Line Project (Initially energized at 138 kV)** **Bulk Cost Estimate**: 12,835.268 Million Pesos	▪ Updated the ETC based on latest project timeline considering actual implementation ▪ Change in project name and bulk cost
Opol Substation Bus-in Project	**ETC: Dec 2025** **Bulk Cost Estimate:** 768.433 Million Pesos	**ETC: Sep 2027** **Bulk Cost Estimate:** 885.396 Million Pesos	▪ Updated the ETC based on latest project timeline considering actual implementation ▪ Change in bulk cost
Lala–Naga Min-Zamboanga 230 kV Transmission Line Project	**Lala-Naga-Zamboanga 230 kV Transmission Line Project** **ETC: Dec 2025** **Bulk Cost Estimate**: 19,042.944 Million Pesos	**Lala-Naga Min-Zamboanga 230 kV Transmission Line Project** **ETC: Jul 2029** **Bulk Cost Estimate**: 15,061.800 Million Pesos	▪ Standardized the Naga Substation in Mindanao as Naga Min Substation ▪ Change in project name, ETC and bulk cost ▪
Lala–Malabang–Sultan Kudarat 230 kV Transmission Line Project	▪ *Malabang 230 kV Substation: 2*x50 MVA 138/69 kV Power Transformers and accessories, 8-230 kV PCBs, 3-69 kV PCBs and associated equipment	▪ *Malabang 230 kV Substation: 2*x50 MVA 230/69 kV Power Transformers and accessories, 8-230 kV PCBs, 3-69 kV PCBs and associated equipment	▪ Corrected the voltage level of the proposed Power Transformers in Malabang Substation
Siom–Sindangan–Salug	▪ *Siom–Sindangan–Salug 69 kV Transmission Line:*	▪ *Siom–Sindangan–Salug 69 kV Transmission*	▪ Updated the power conductors to be used

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
69 kV Transmission Line Project	SP-SC, 1-160 mm^2 STACIR/AW, 115 km.	*Line:* SP-SC, 1-795 MCM ACSR, 115 km.	
Davao–Samal 69 kV Interconnection Project			No Changes
Zamboanga–Basilan 69 kV Interconnection Project			No Changes
San Francisco–Barobo 69 kV Transmission Line 2 Project	**ETC: Dec 2036** **San Francisco–Barobo 69 kV Transmission Line Project** ▪ *San Francisco-Barobo 69 kV Transmission Line 2:* SP-SC, 1-795 MCM ACSR, 56.6 km	**ETC: 2031-2035** **San Francisco–Barobo 69 kV Transmission Line 2 Project** ▪ *San Francisco-Barobo 69 kV Transmission Line 2:* SP-SC, 1-795 MCM ACSR, 16.6 km	▪ Updated ETC ▪ Updated the project name ▪ Corrected the linear length of the proposed line reconductoring
Bislig–Baganga 138 kV Transmission Line Project	**ETC: Dec 2040**	**ETC: 2031-2035**	Updated ETC
Bunawan–Bukal 230 kV Transmission Line Project	**ETC: Dec 2035**	**ETC: 2031-2035**	Updated ETC
Mindanao Substation Expansion 6 Project (MSE6P)	**ETC: Dec 2035** ▪ *Naga Mindanao 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Koronadal 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment	**ETC: 2031-2035** ▪ *Naga Min 138 kV Substation:* 1x100 MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Koronadal 138 kV Substation:* 1x150 MVA 138/69 kV Power Transformers and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment	▪ Updated ETC ▪ Standardized the Naga Substation in Mindanao as Naga Min ▪ Increased the proposed capacity addition in Koronadal Substation

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
Maco–Mati 69 kV Transmission Line Project	**ETC: Dec 2036**	**ETC: 2036 - 2040**	Updated ETC
San Francisco–Tandag 69 kV Transmission Line Project	**ETC: Dec 2036** ▪ **San Francisco–Barobo–Tandag 69 kV Transmission Line Project**	**ETC: 2036 - 2040** ▪ **San Francisco–Tandag 69 kV Transmission Line Project**	▪ Updated ETC ▪ Updated the project name
Naga–Malangas 69 kV Transmission Line Project	**ETC: Dec 2036** **Naga–Malangas 69 kV Transmission Line Project** ▪ *Naga Mindanao-Malangas 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 40.94 km ▪ *Naga Mindanao 69 kV Substation:* 1-69 kV PCBs and associated equipment	**ETC: 2036 - 2040** **Naga Min–Malangas 69 kV Transmission Line Project** ▪ *Naga Min-Malangas 69 kV Transmission Line:* SP-SC, 1-795 MCM ACSR, 40.94 km ▪ *Naga Min 69 kV Substation:* 1-69 kV PCBs and associated equipment	▪ Updated ETC ▪ Standardized the Naga Substation in Mindanao as Naga Min
Aurora–Kapatagan 69 kV Transmission Line Project	**ETC: Dec 2037**	**ETC: 2036 - 2040**	Updated ETC
Sultan Kudarat–Midsayap 69 kV Transmission Line Project	**ETC: Dec 2037**	**ETC: 2036 - 2040**	Updated ETC
Baganga–Mati 138 kV Transmission Line Project	**ETC: Dec 2040**	**ETC: 2036 - 2040**	Updated ETC
Bislig–Barobo 69 kV Transmission Line Project	**ETC: Dec 2031** **San Francisco–Bislig 69 kV Transmission Line Project**	**ETC: 2036 - 2040** **Bislig–Barobo 69 kV Transmission Line Project**	▪ Updated ETC ▪ Updated the project name
Tumaga–Pitogo 69 kV Transmission Line Project	**ETC: Dec 2040**	**ETC: 2036 - 2040**	Updated ETC
Culaman-Gen. Santos	**ETC: Dec 2040**	**ETC: 2036 - 2040**	Updated ETC

Project Name	TDP 2020 – 2040	TDP 2021 – 2040	Remarks
230 kV Transmission Line Project			
Ipil 138 kV Substation Project	**ETC: Dec 2037** ▪ *Midsayap 138 kV Substation:* 10-138 kV PCBs, 4-69 kV PCBs and associated equipment	**ETC: 2036 – 2040** ▪ *Ipil 138 kV Substation:* 10-138 kV PCBs, 4-69 kV PCBs and associated equipment ▪	▪ Updated ETC ▪ Corrected the substation involved in the project
Mindanao Substation Expansion 7 Project (MSE7P)	**ETC: Dec 2040** ▪ *Salug 138 kV Substation:* 1x100 MVA, 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Tagoloan 138 kV Substation:* 1x150 MVA, 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Bunawan 138 kV Substation:* 1x150 MVA, 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment	**ETC: 2036 – 2040** ▪ *Salug 138 kV Substation:* 1x50 MVA, 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Tagoloan 138 kV Substation:* 1x100 MVA, 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment ▪ *Bunawan 138 kV Substation:* 1x100 MVA, 138/69 kV Power Transformer and accessories, 2-138 kV PCBs, 2-69 kV PCBs and associated equipment	▪ Updated ETC ▪ Reduced the proposed capacity addition in Salug Substation ▪ Reduced the proposed capacity addition in Tagoloan Substation ▪ Reduced the proposed capacity expansion in Bunawan Substation

POWER RESTORATION HIGHWAY

System blackout occurred when all generation in the grid has ceased and the entire power system has shutdown. The process of recovery from total system blackout using a generating unit with the capability to start and synchronize with the power system without an external power supply is called Black Start. Power plants which serve as Black Start Provider must have a black start capability or the ability to go from a shutdown condition to an operating condition within a specified period of time without feedback power from the grid and to start delivering power to the sections of the grid such as generating plants and critical loads.

Black start generators must be capable of starting themselves quickly without the need of external power supply from the grid, with sufficient real (MW) and reactive power (MVAR) to energize transmission lines and restart other generators. They must also be able to control frequency as well as voltage which can sustain a self-reliant operation for at least 12 hours and extend power within 30 minutes.

There are four (4) sub-grids in Luzon including Metro Manila sub-grid (LRCC), Northern Luzon sub-grid (NLACC), Central Luzon sub-grid (CLACC), and Southern Tagalog sub-grid (STACC). Both Visayas and Mindanao have five (5) sub-grids. In Visayas, these includes Panay, Negros, Cebu, Bohol, Leyte-Samar, while in Mindanao, these are Zamboanga ACC, Iligan Cagayan ACC, Butuan ACC, Davao ACC and General Santos ACC. Each sub-grid has its own designated power restoration highway and must have at least two black start service providers, in case the other fails to operate. However, at present there are sub-grids which have deficiency in Black Start Providers, hence, NGCP continuously encourages other generating units to participate as Black Start Providers for the improvement of the restoration time.

It is also crucial to monitor and ensure the health of the breakers as well as protective relays which are connected to all restoration highway (substation/power plant). Similarly, setting and proper coordination of power plant protection relays and grid protection relays could prevent any undesired tripping during occurrence of system disturbance.

Furthermore, installation of NDMEs are also necessary for real-time monitoring, recording of system disturbance and retrieving of fault data remotely particularly in these critical substations as part of the restoration highway. Similarly, installation of PQAs could be used effectively for online monitoring of power quality problems such as generating current/voltage harmonics beyond power system network limits, voltage imbalance and fluctuation and harmonic resonance in the substations and power plant which are part of the power restoration highway.

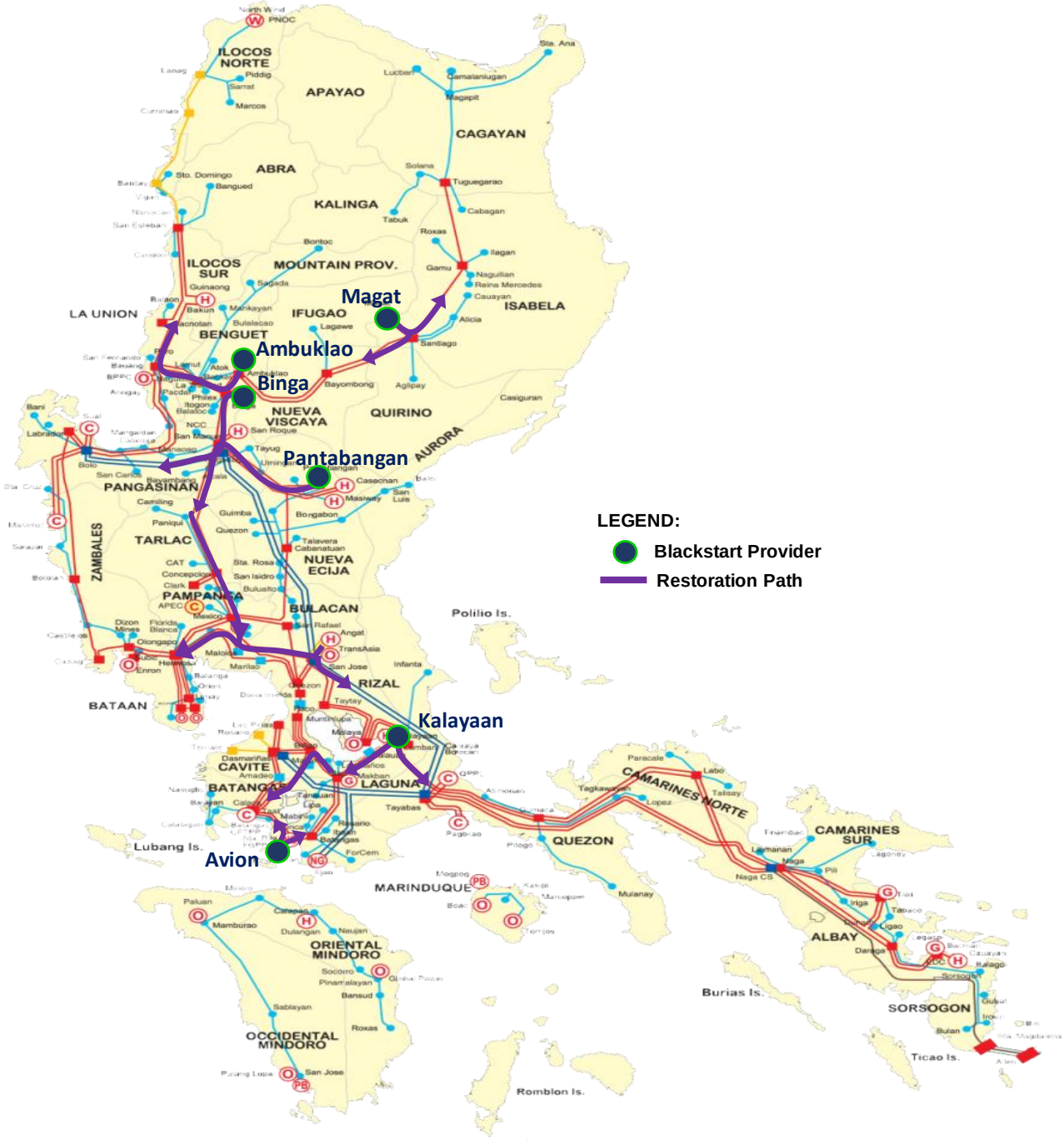


Figure 1: Luzon Power Restoration Highway

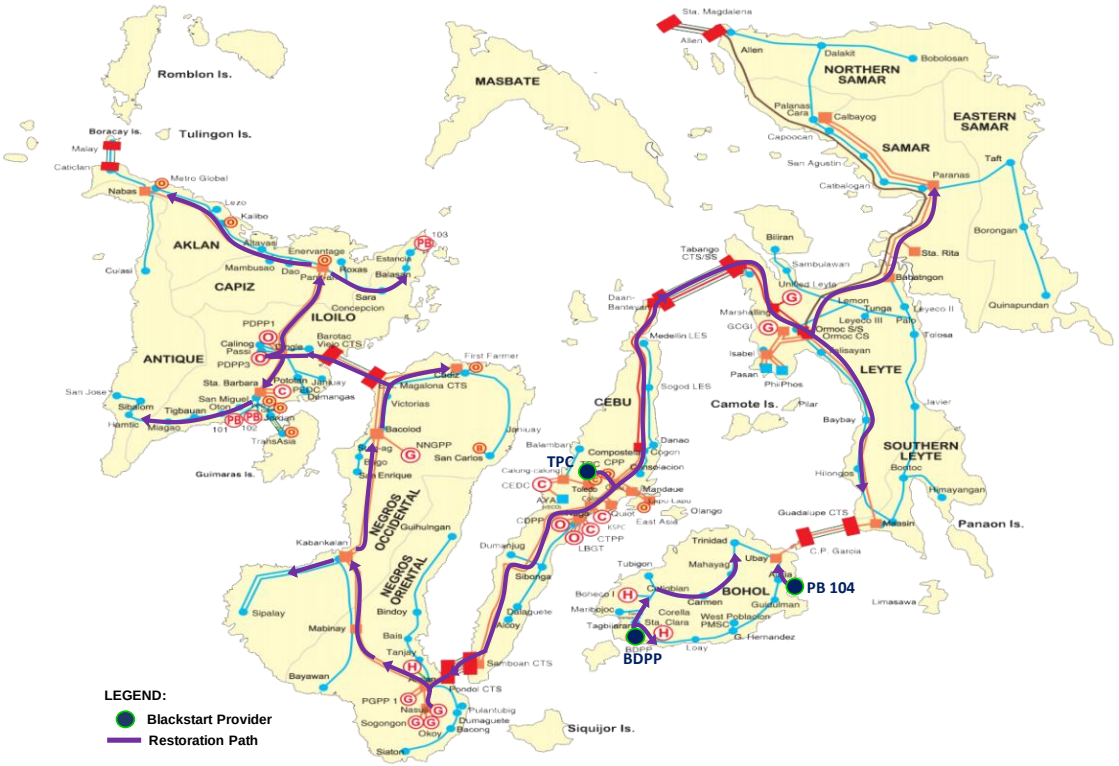


Figure 2: Visayas Power Restoration Highway

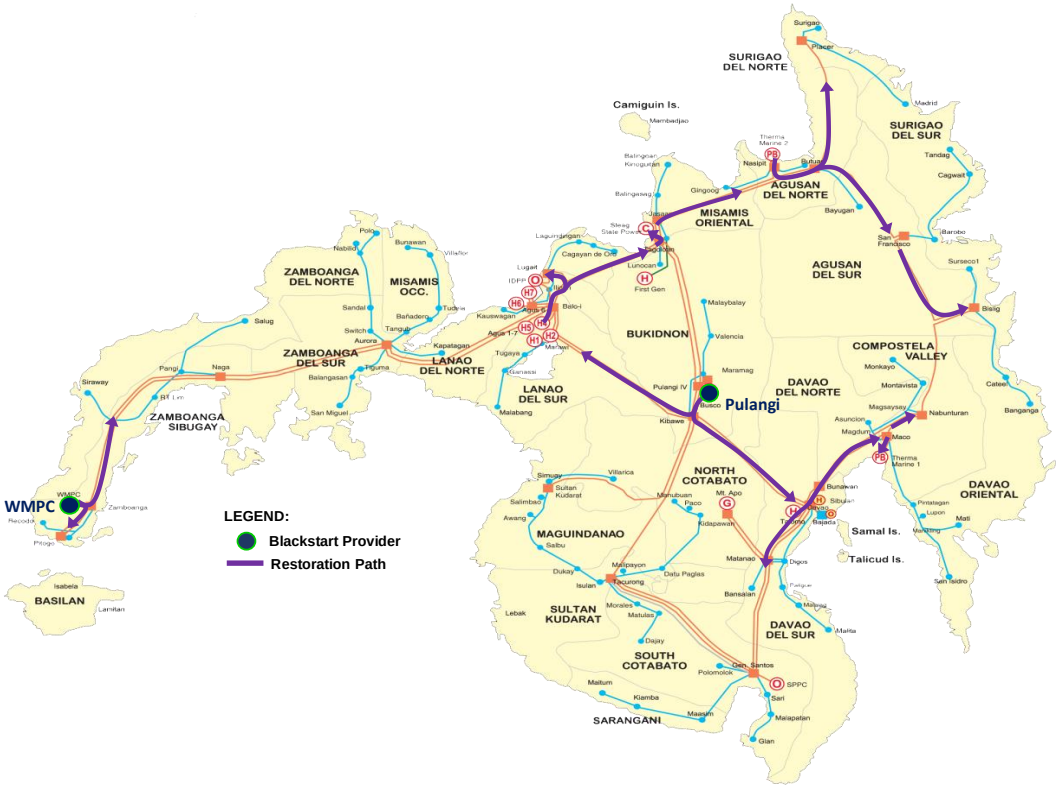


Figure 3: Mindanao Power Restoration Highway

a. Background: State of Ancillary Services in the Grid

As System Operator, NGCP determines the levels of Ancillary Services required for each grid based on the results of assessment and simulation studies. These reserve levels which are variable according to network dynamics are meant to meet PGC-prescribed grid reliability and security requirements.

To qualify as provider of Ancillary Services the prospective provider should undergo the certification process defined by the PGC. Subsequently, a certified AS provider would be subject to verification testing no more than once (1) every two (2) years except when there are reasonable grounds to surmise that the prevailing characteristics of the generating unit departs from the as-tested-and-certified values.

Table A9.1 lists the plants with existing Ancillary Service Procurement Agreement (ASPA); Table A9.2 lists prospective AS providers not yet certified by NGCP.

Table A9.1: List of Plants with Existing ASPA

Regulating Reserve		
AS Provider	**Firm (MW)**	**Non-Firm (MW)**
Luzon Grid	**237**	**575**
Panasia - Limay	60	300
SNAP - Ambuklao	22	
PSALM/NPC - KPSPP	90	90
First Gen - Pantabangan		90
MPPCL AES BESS	20	
PMPC - Avion	45	45
Visayas Grid	**0**	**50**
GCGI - Palinpinon II		30
EDC - Nasulo		20
Mindanao Grid	**0**	**165**
PSALM/NPC - Agus 1		30
PSALM/NPC - Agus 2		30
PSALM/NPC - Agus 4		40
PSALM/NPC - Pulangui 4		65

Contingency Reserve		
AS Provider	**Firm (MW)**	**Non-Firm (MW)**
Luzon Grid	**180**	**395**
Panasia - Limay		60
SNAP - Ambuklao	60	
SNAP - Binga		136
SNAP - Magat	60	60
PSALM/NPC - KPSPP		85
Therma Luzon - Pagbilao	60	
First Gen - Pantabangan		54
Visayas Grid	**71**	**30**
SIPC - PDPP3		30
CEDC	30	
PEDC	26	
PCPC	15	
Mindanao Grid	**0**	**229.5**
PSALM/NPC - Agus 1		30
PSALM/NPC - Agus 2		30
PSALM/NPC - Agus 4		30
PSALM/NPC - Agus 5		17.5
PSALM/NPC - Agus 7		20
PSALM/NPC - Pulangui 4		30
TMI (PB107)		36
TMI (PB108)		36

Dispatchable Reserve		
AS Provider	Firm (MW)	Non-Firm (MW)
Luzon Grid	**145**	**806**
Panasia - Limay		80
TAOEDC - One Subic		108
TAPGC - Bulacan DPP		48
PSALM/NPC - KPSPP		360
1590 EC		190
CIP II		20
Therma Mobile, Inc.	145	
Visayas Grid	**93.8**	**145.4**
SIPC - PDPP1	10	5
SIPC - PDPP3		50
SIPC - BDPP	16	
PHINMA (PB101)		32
PHINMA (PB102)		32
PPC - Nabas	6.8	
TPC - Carmen	40	
SIPC - PB104	21	
CENPRI		26.4
Mindanao Grid	**0**	**307.8**
TMI (PB107)		88
TMI (PB108)		88
WMPC		100
KEGI 2 - Panaon		15.6
KEGI 3 - Jimenez		16.2

Reactive Power Support
AS Provider
Luzon Grid
Panasia - Limay
SNAP - Ambuklao
SNAP - Binga
SNAP - Magat
PSALM/NPC - KPSPP
First Gen - Pantabangan
APRI - MakBan A
APRI - MakBan B
Therma Luzon - Pagbilao
Therma Mobile, Inc.
Visayas Grid
SIPC - PDPP1
SIPC - PDPP3
PPC - Nabas
TPC - Carmen
CENPRI
Mindanao Grid
PSALM/NPC - Agus 1
PSALM/NPC - Agus 2
PSALM/NPC - Agus 4
PSALM/NPC - Agus 5
PSALM/NPC - Pulangui 4
TMI (PB107)
TMI (PB108)
WMPC
KEGI 2 - Panaon
KEGI 3 - Jimenez

Black Start Provider
AS Provider
Luzon Grid
PSALM/NPC – KPSPP
First Gen – Pantabangan
SNAP – Ambuklao
SNAP – Binga
SNAP – Magat
PMPC – Avion
Visayas Grid
SIPC – BDPP
TPC – Carmen
PB104
Mindanao Grid
PSALM/NPC - Pulangui 4
WMPC

Table A9.2: List of Potential Ancillary Services Providers

Company	Power Plant	Remarks
Luzon Grid		
CE Casecnan Water & Energy Co.,Inc	Casecnan Units 1 and 2	For AS testing.
Team Pagbilao Corporation	Pagbilao Unit 3	Under negotiation.
GNPower Mariveles Co. Ltd.	Mariveles CFPP	Ongoing negotiation for CR.
Ingrid Power Holdings Inc.	Malaya Modular Diesel PP	For AS testing.
Bac-Man Geothermal Inc. (BGI)	Bacman Units 1, 2 and 3	For AS testing.
GNPower Dinginin Ltd. Co.	GNPower Dinginin	For AS Accreditation
TMO	Power Barge Unit 1	On-going ASPA hearing
Millenium	Millenium Gas Turbine PP	With AS accreditation
Visayas Grid		
Global Business Power Corporation - Toledo Power Corporation (GBPCTPC)	TPC1A	Qualified for CR. Test results under evaluation/for negotiation.
Therma Visayas, Inc. (TVI)	TVI	Qualified for CR. Test results under evaluation.
Therma Power Visayas, Inc. (TPVI)	TPVI	Qualified for DR. Other AS tests still to be conducted.

East Asia Utilities Corporation (EAUC)	EAUC	For AS testing.
Cebu Private Power Corporation (CPPC)	CPPC	For AS testing.
Green Core Geothermal Inc. (GCGI)	PGPP1	For negotiation.
Green Core Geothermal Inc. (GCGI)	TGPP	For AS testing.
Panay Power Corporation	PPC 1 and 2	For AS testing.
Isabel Ancillary Services Co. Ltd.	Isabel Modular Diesel PP	Qualified for RR. Test results under evaluation.
SMCGP Philippines Energy Storage Co. Ltd.	Kabankalan Battery Energy Storage System (BESS)	Ongoing negotiation. Test results under evaluation.
Mindanao Grid		
Therma Marine Inc. (TMI)	TMI Mobile 1 and 2	For AS testing for RPS and BSS.
GNPower Kauswagan Ltd. Co	GNPower Kauswagan	Ongoing negotiations. Qualified for CR.
Therma South Inc. (TSI)	Therma South Inc.	Ongoing negotiations. Qualified for CR.
King Energy Generation Inc. (KEGI)	KEGI Tandag	With ASPA for DR for ERC filing.

b. Plans for the Procurement of Ancillary Services

Because of the limited number of qualified AS providers, as well as restrictions from available generator capacities and response times of these providers, the Grid's reserve level requirements to sustain reliability objectives are not being met. In NGCP's view, if the existing non-firm contracts are supplemented with committed capacities through enough firm contracts, the reserve capacities would be raised to more comfortable levels.

Also, NGCP as the System Operator, conscious of its mandate, ensures that procurement of Ancillary Service is carried out in the least-cost manner. While co-optimization of offered reserves in the energy market would make for efficient energy dispatch, a secondary price cap for reserves—approved by the ERC—would be a welcome cost-control measure.

Appendix 10 – Network Synchronization Program Installation Status

Table 1: List of Substations Installed with Sync Units

Luzon	With Clock Installed
San Jose 500KV SS	Installed
Mexico SS	Installed
Nagsaag SS	Installed
Bolo SS	Installed
La Trinidad SS	Installed
Biñan SS	Installed
Dasmariñas SS	Installed
Tayabas SS	Installed
Naga SS	Installed
Bay SS	Installed
Malaya SS	Installed
Cabanatuan SS	Installed
San Manuel 230kV SS	Installed
Currimao SS	Installed
SBMA SS	Installed
Botolan SS	Installed
Olongapo SS	Installed
Subic SS	Installed
Gamu SS	Installed
Hermosa SS	Installed
San Jose 230kV SS	Installed
Bauang SS	Installed
San Esteban SS	Installed
Lumban SS	Installed
Batangas SS	Installed
Gumaca SS	Installed
Labo SS	Installed
Taytay SS	Installed
Quezon SS	Installed
Doña Imelda SS	Installed
Muntinlupa SS	Installed
Las Piñas SS	Installed
Calaca SS	Installed
Tuguegarao SS	Installed
Santiago SS	Installed
Bayombong SS	Installed
Bacnotan SS	Installed
Naga HVDC SS	Installed
Daraga SS	Installed
Labrador SS	Installed
Lamao SS	Installed
Navotas SS	Installed
Laoag SS	Installed
Bantay SS	Installed
San Rafael SS	Installed
Limay SS	Installed
Concepcion SS	Installed
Clark SS	Installed
Rosario SS	Installed
Pagbilao SS	Installed
Ambuklao SS	Installed
Binga SS	Installed
Balingueo SS	Installed
Salong SS	Installed

Visayas	With Clock Installed
Bacolod SS	Installed
Sta Barbara SS	Installed
Ormoc SS	Installed
Cebu SS	Installed
Quiot SS	Installed
Daan Bantayan SS	Installed
Colon SS	Installed
Calong-Calong SS	Installed
Tabango SS	Installed
Kabankalan SS	Installed
Mabinay SS	Installed
Cadiz SS	Installed
Ubay SS	Installed
Dingle SS	Installed
Kananga SS	Installed
Isabel SS	Installed
Panit-an SS	Installed
Compostela SS	Installed
Toledo SS	Installed
Samboan SS	Installed
Amlan SS	Installed
Corella SS	Installed
Barotac Viejo SS	Installed
San Jose SS	Installed
Nabas SS	Installed
Maasin SS	Installed
Babatngon SS	Installed
Paranas SS	Installed
Calbayog SS	Installed
Mandaue SS	Installed
Lapu-Lapu SS	Installed
Magdugo SS	Installed

Mindanao	With Clock Installed
General Santos SS	Installed
Butuan SS	Installed
Balo-i SS	Installed
Jasaan SS	Installed
Villanueva SS	Installed
Maramag SS	Installed
Bunawan SS	Installed
San Francisco SS	Installed
Kibawe SS	Installed
Davao SS	Installed
Tagoloan SS	Installed
Aurora SS	Installed
Nasipit SS	Installed
Bislig SS	Installed
Nabunturan SS	Installed
Maco SS	Installed
Tacurong SS	Installed
Matanao SS	Installed
Toril SS	Installed
Zamboanga SS	Installed
Tumaga SS	Installed
Sultan Kudarat SS	Installed
Kidapawan SS	Installed
Iligan SS	Installed
Polanco SS	Installed
Lugait SS	Installed
Cagayan de Oro SS	Installed
Naga Mindanao SS	Installed
Pitogo SS	Installed
Placer SS	Installed
Culaman SS	Installed
Manolo Fortich SS	Installed
Opol SS	Installed

Appendix 11 – 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

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
IEMOP	Independent Electricity Market Operator of the Philippines
PEMC	Philippine Electricity Market Corporation
WESM	Wholesale Electricity Spot Market

Government Oversight/Regulatory Agencies:

ERC	Energy Regulatory Commission
DOE	Department of Energy
NEDA	National Economic & Development Authority

Government-owned and Controlled Corporation and other Government Agencies:

NAMRIA	National Mapping and Resource Information Authority
NEA	National Electrification Administration
NPC	National Power Corporation
PSALM	Power Sector Assets & Liabilities Management
TRANSCO	National Transmission Corporation
SPUG	Small Power Utilities Group

Legal, Environmental and Other Requirements:

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
NREL	National Renewable Energy Laboratory
SGCC	State Grid Corporation of China
USAID	United States Agency for International Development

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
LA	Lanao Area
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 Subtransmission Charges
ConA	Congestion Availability
CSI	Customer Satisfaction Indicator
FD	Final Determination
FIT	Feed-in-Tariff
FLC	Frequency Limit Compliance
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 Subtransmission Assets
RTWR	Rules for Setting Transmission Wheeling Rate
SA	System Availability
SEIL	Std. Equipment Identification and Labeling
SISI	System Interruption Severity Index
VLC	Voltage Limit Compliance VLC

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 of Load Probability
SPD	System Peak Demand

Transmission Service Provider:

NGCP	National Grid Corporation of the Philippines

Transmission System/Projects:

ACC	Area Control Center
ACSR	Aluminum Cable Steel Reinforced
ACSR/AS	Aluminum Cable Steel Reinforced/ Aluminum-clad Steel
AIS	Air Insulated Switchgear
APG	ASEAN Power Grid
AS	Ancillary Service
ASPA	Ancillary Service Procurement Agreement
AVC	Automatic Voltage Control
BESS	Battery Energy Storage System
BMS	Battery Monitoring System
BRCC	Backup Regional Control Center
CREZ	Competitive Renewable Energy Zone
CTS	Cable Terminal Station
CS	Converter Station
DC1	Double Circuit Transmission Line First Stringing
DC2	Double Circuit Transmission Line Second Stringing
DU	Distribution Utility
EHV	Extra High Voltage
EMS	Energy Management System
ERS	Emergency Restoration System
ES	Electrode Station
ESS	Energy Storage System
ETC	Expected Target Completion
FMS	Facilities Management System
GIS	Gas Insulated Switchgear
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
ICT	Information and Communications Technology
IP	Internet Protocol
IPP	Independent Power Producer
MCM	Thousand Circular Mills
NDME	Network Disturbance Monitoring Equipment
NMS	Network Management System
NSO	National System Operations

OHTL	Overhead Transmission Line
O & M	Operation and Maintenance
OPGW	Optical Power Ground Wire
OTN	Optical Transport Network
PABX	Private Automatic Branch Exchange
PAN	Planned Activity Notice
PCB	Power Circuit Breaker
PGC	Philippine Grid Code
PLC	Powerline Carrier
PMU	Phasor Measurement Unit
PQA	Power Quality Analyzer
PQMS	Power Quality Management System
PST	Philippine Standard Time
RCC	Regional Control Center
RCC	Regional Control Center
RFMS	Remote Fiber Monitoring System
ROW	Right-of-Way
RTD	Real-time Dispatch
RTU	Remote Terminal Unit
SACS	Substation Automation Control System
SCADA	Supervisory Control and Data Acquisition
SDH	Synchronous Digital Hierarchy
SIPS	Systems Integrity Protection Scheme
SIS	System Impact Study
SO	System Operations
SO-MO	System Operator-Market Operator
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
TDM	Time-division Multiplexing
TL	Transmission Line
TNP	Transmission Network Provider
TRANSMISYON	Transmission Resiliency and Augmentation for Nationwide SMART Grid Management through Inter-connected Systems, Organization and Networks
VRE	Variable Renewable Energy
WAMS	Wide Area Measurement System
WAN	Wide Area Network
WESM	Wholesale Electricity Spot Market

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 12 – Contact Details

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