TRANSMISSION **DEVELOPMENT** PLAN 2023-2040

NGCP

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BACKGROUND

1.1 NGCP as a Regulated Entity

With the enactment of the Philippines Electric Power Industry Reform Act of 2001 (EPIRA) into law in June 2001, the Philippine Electricity Industry was subdivided into four sectors: generation, transmission, distribution, and supply. The transmission and distribution sectors 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 by the Energy Regulatory Commission (ERC) under the Performance-Based Regulation (PBR). The PBR methodology is outlined in the Rules for Setting Transmission Wheeling Rates or RTWR that strengthens financial incentives to provide efficient service.

NGCP is persistently committed to the following international standards to advance the Vision and Mission of the corporation and currently on the process of re-certification for the following:

- Risk Management – International Organization for Standardization (ISO) 31000:2018
- Quality Management System (QMS) – ISO 9001:2015
- Environmental Management System (EMS) – ISO 14001:2015
- Occupational Health and Safety Management System (OHSMS) – ISO 45001:2018
- Business Continuity Management System (BCMS) – ISO 22301:2019
- Information Security and Management System (ISMS) – ISO 27001:2013

1.2. Transmission Grid Performance

The RTWR provides 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.

In accordance with the regulatory reset process for the Fourth Regulatory Period (4th RP) under Article VII of the RTWR, a new PIS was develop specifying the service quality measures/indices as well as the target level of performance 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.

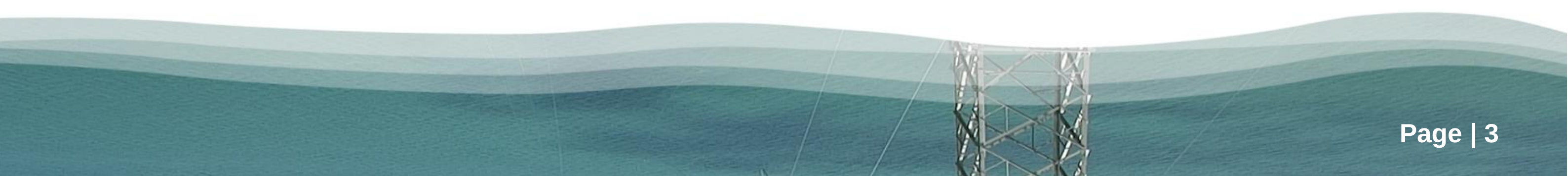
- System Interruption Severity Index (SISI)
- System Availability (SA)
- Voltage Limit Compliance (VLC)
- Frequency of Tripping (FOT)
- Congestion Availability Indicator (ConA)
- Ancillary Services Availability Indicator (ASAI)

The 2022 performance of the transmission grid covering the period 01 October 2021 – 30 September 2022 is shown in Table 1.1.

Table 1.1: 2022 Performance of Transmission Grid

Performance Indicator	System Interruption Severity Index, system-min.	Frequency of Tripping, count per 100ckt-km	System Availability, %	Frequency Limit Compliance, %	Voltage Limit Compliance, %	Congestion Availability Indicator, %	Ancillary Services Availability Indicator, %
Luzon	6.9938	0.8025	99.1341	100.0000	99.9989	99.0832	28.3904
Visayas	22.266	0.8310	98.6869	99.9930	99.9930		20.3253
Mindanao	9.2328	0.5918	99.7712	99.9987	99.9943		57.7112

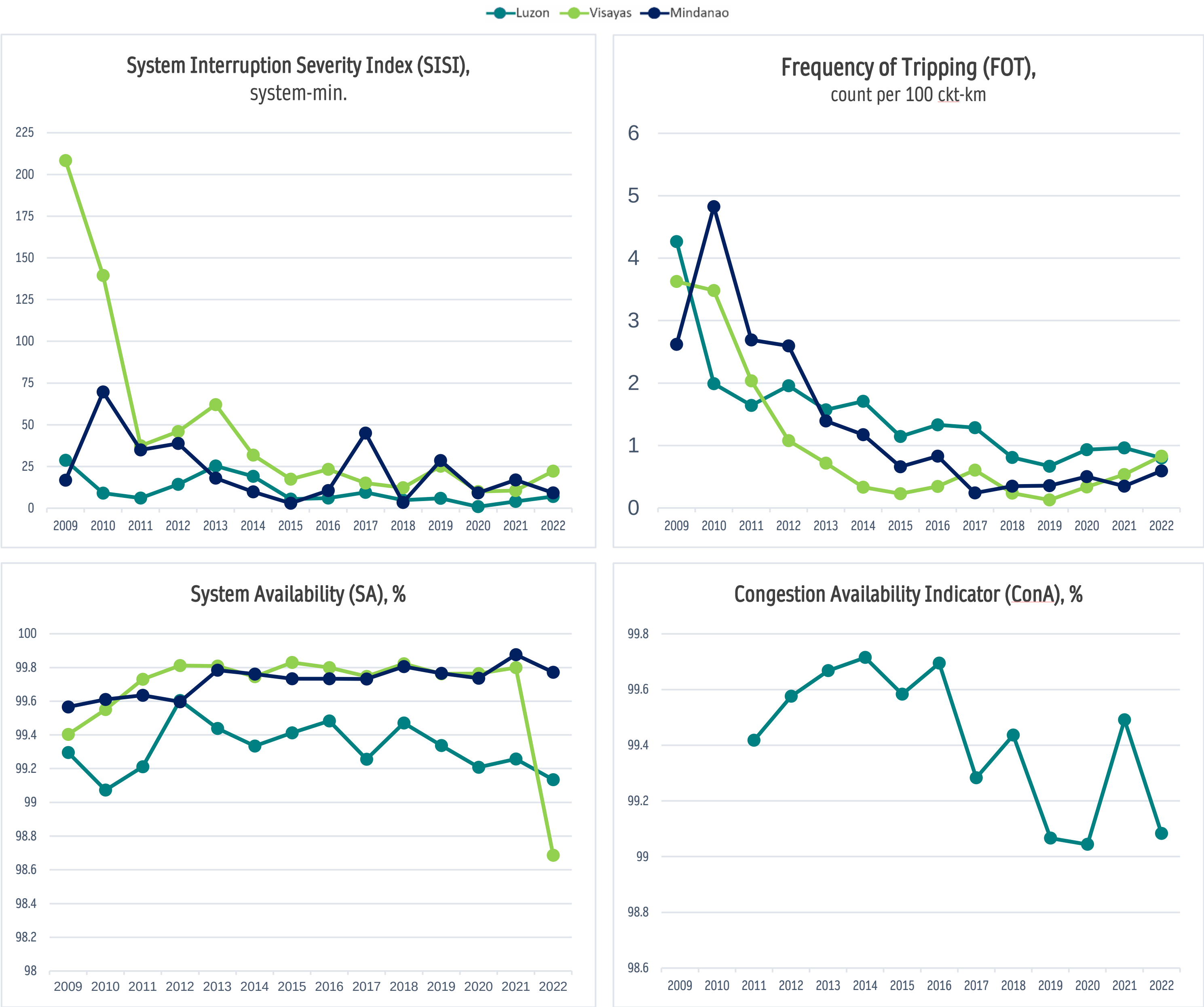
NGCP continues to improve the overall performance of the transmission system since taking over the transmission business from the government and commencing commercial operations in 2009. While there



are decreases in performance indices year-on-year, NGCP has continuously performed over and above the targets based on the 3rd RP-approved limits. This is a result of NGCP's relentless efforts to continuously upgrade, expand, and improve transmission facilities.

Reliability Indicators

As a regulated entity, NGCP provides Transmission Services to all users of the grid and is 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.



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.

Figure 1.1: 2022 Performance of Transmission Grid

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 TNP, 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 (DU), electric cooperatives, government-owned utilities, economic zones, and directly-connected customers. It is responsible for dispatching the power plants and transmitting the generated power to various DU 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. NGCP also determines the levels of Ancillary Services (AS) 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. Appendix 1 shows the NGCP Ancillary Service Agreement Procurement Plan (ASAPP).

1.4 TRANSMISYON 2040

NGCP is committed to build a strong and reliable power transmission network through various programs and projects that prioritize network development. Shown in Figure 1.2 is the medium (2020-2022) and long-term (2023-2040) Power Sector Roadmap involving the Transmission Sector based on the Philippine Energy Plan (PEP) 2020-2040 of the Department of Energy (DOE) issued in October 2021.

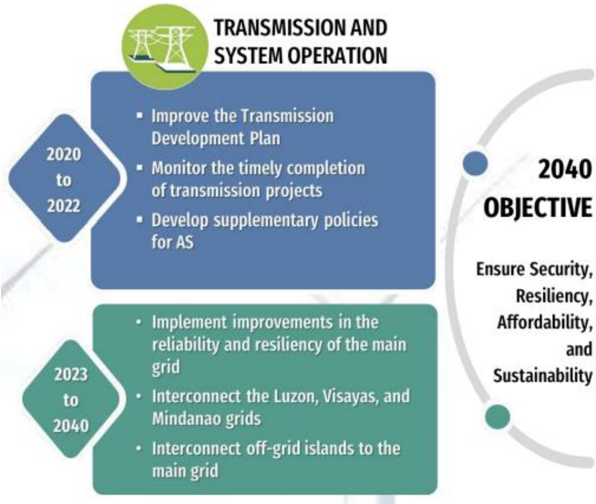


Figure 1.2: Power Sector Roadmap (Transmission) from DOE's PEP 2020-2040

In support to the PEP's Power Sector Roadmap, NGCP formulated the "TRANSMISYON 2040", i.e., Transmission Resiliency and Augmentation for Nationwide Smart Grid Management through Inter-connected Systems, Organization and Networks 2040. It highlights NGCP's goal for every Regulatory Period and the steps that will be taken to achieve each goal: enabling capacity-sharing through grid interconnection; transitioning to the smart grid one substation at a time; completion of grid looping configuration and mandatory redundancy; grid resilience through asset refresh; and full harmonization of Renewable Energy (RE) resources and alignment realization to AmBisyon Natin 2040. A more detailed Asset Administration complements the specific goal for each of the succeeding four Regulatory Periods towards the end of the planning period in 2040.

EXISTING PHILIPPINE GRID

2.1 Grid Profile

A total of 48,801 MVA substation capacity and 21,027.00 circuit-km are accounted for in the transmission assets being managed by NGCP, as shown in Figure 2.1. In addition, a total of 5,787 MVAR from Capacitor 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 PGC.

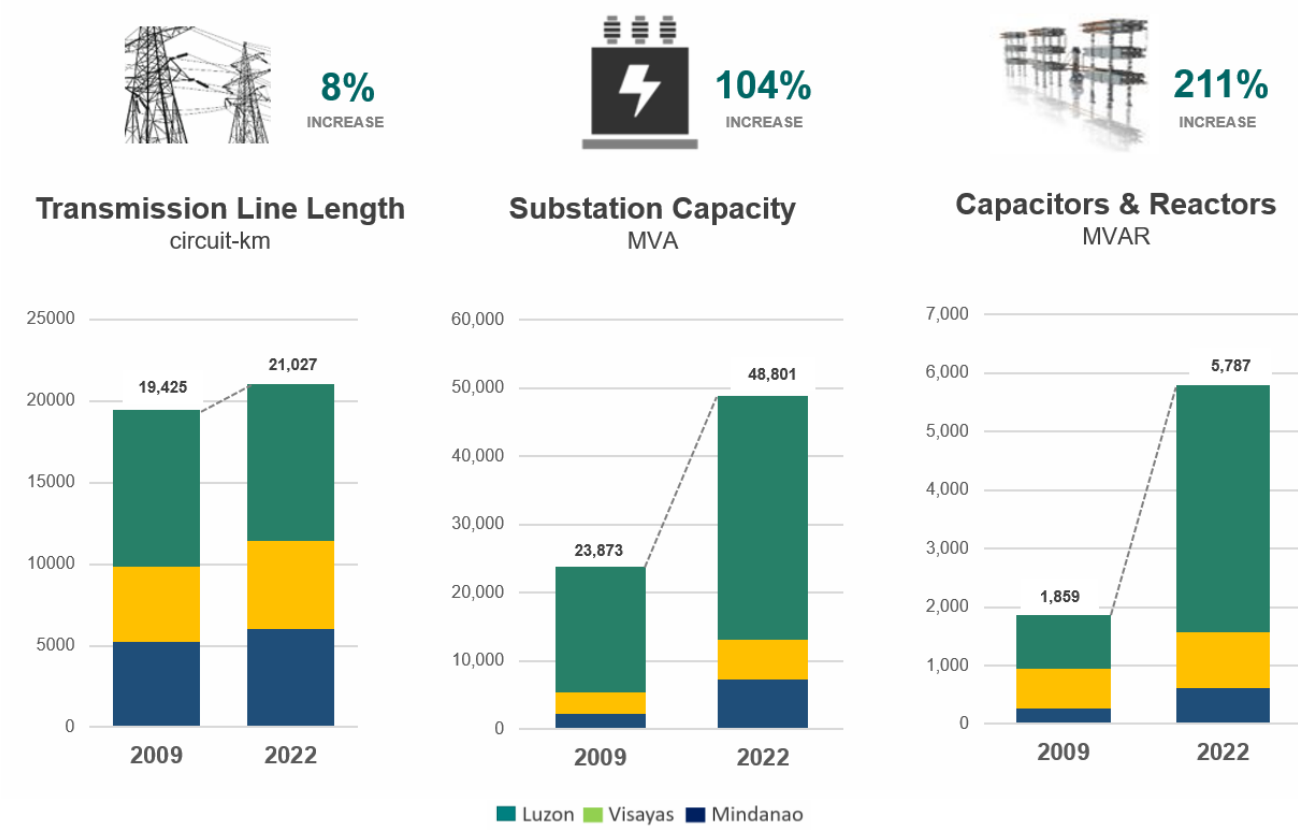


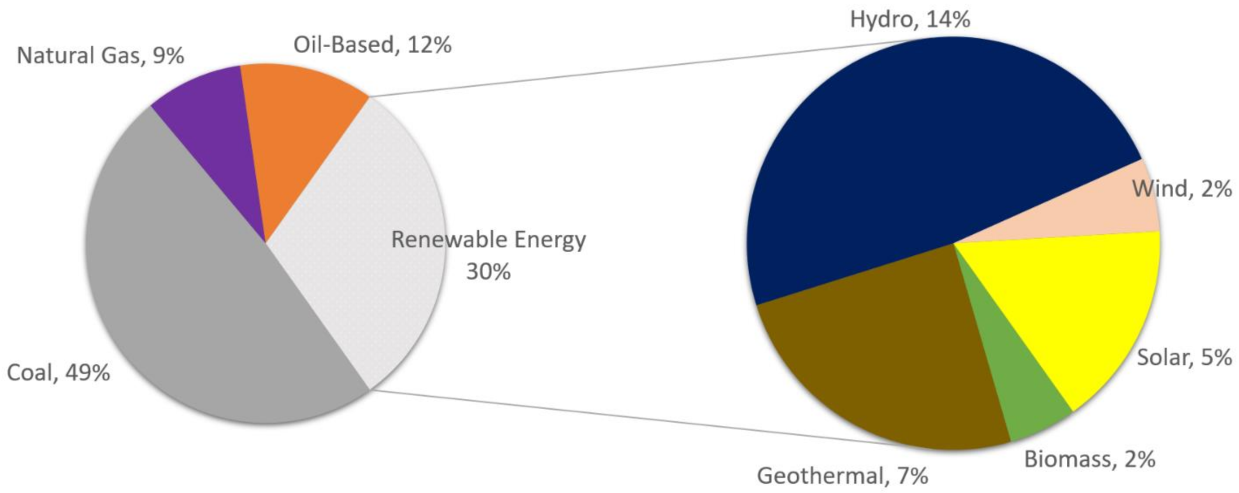
Figure 2.1: Summary of Existing Facilities as of December 2022
Note* Net Asset Growth considered decommissioning and replacements.

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 31 December 2022.

The Philippines has a total dependable capacity of 23,598 MW excluding off-grid generators. Coal-fired power plants (CFPP) recorded the largest share with 11,504 MW, while Natural gas and Oil-based accounted for 2,081 MW and 2,860 MW, respectively. On the other hand, RE-based plants recorded 1,763 MW for Geothermal, 3,444 MW for Hydro, 382 MW for Biomass, 1,150 MW for Solar, and 412 MW for Wind. The Luzon, the Visayas, and Mindanao Grids have 16,320 MW, 3,340 MW, and 3938 MW dependable capacities, respectively.

Figure 2.2 shows the total Philippine dependable capacity mix while in Figure 2.3 shows the historical Dependable Capacity Mix versus the Generation Mix respectively based on DOE data.



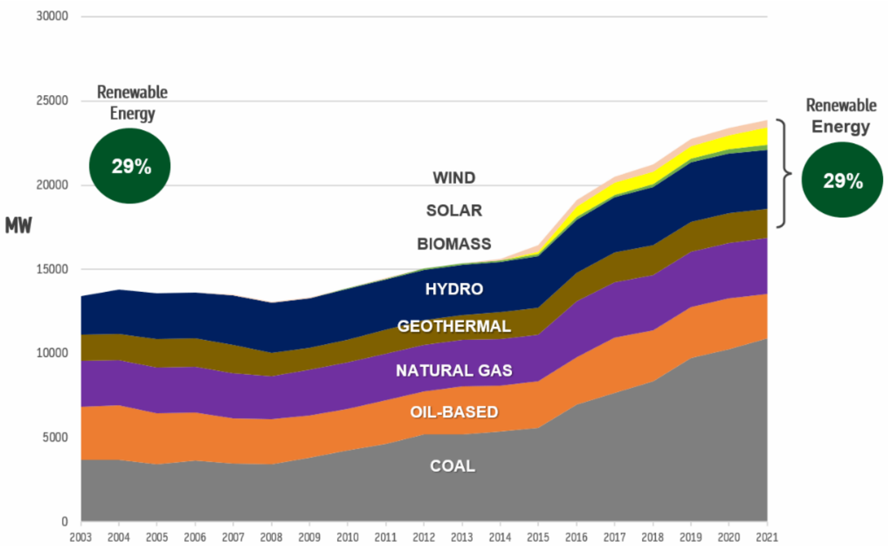


Figure 2.3 Existing Dependable Capacity Mix (MW)

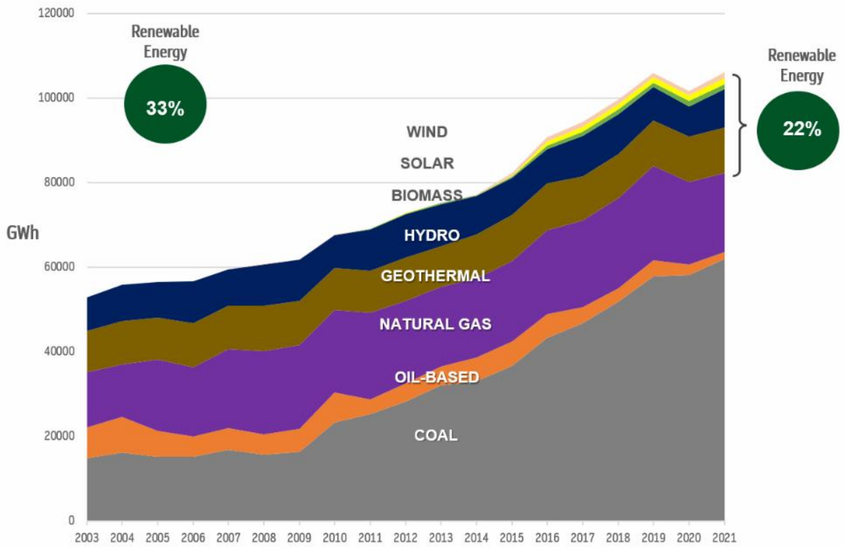
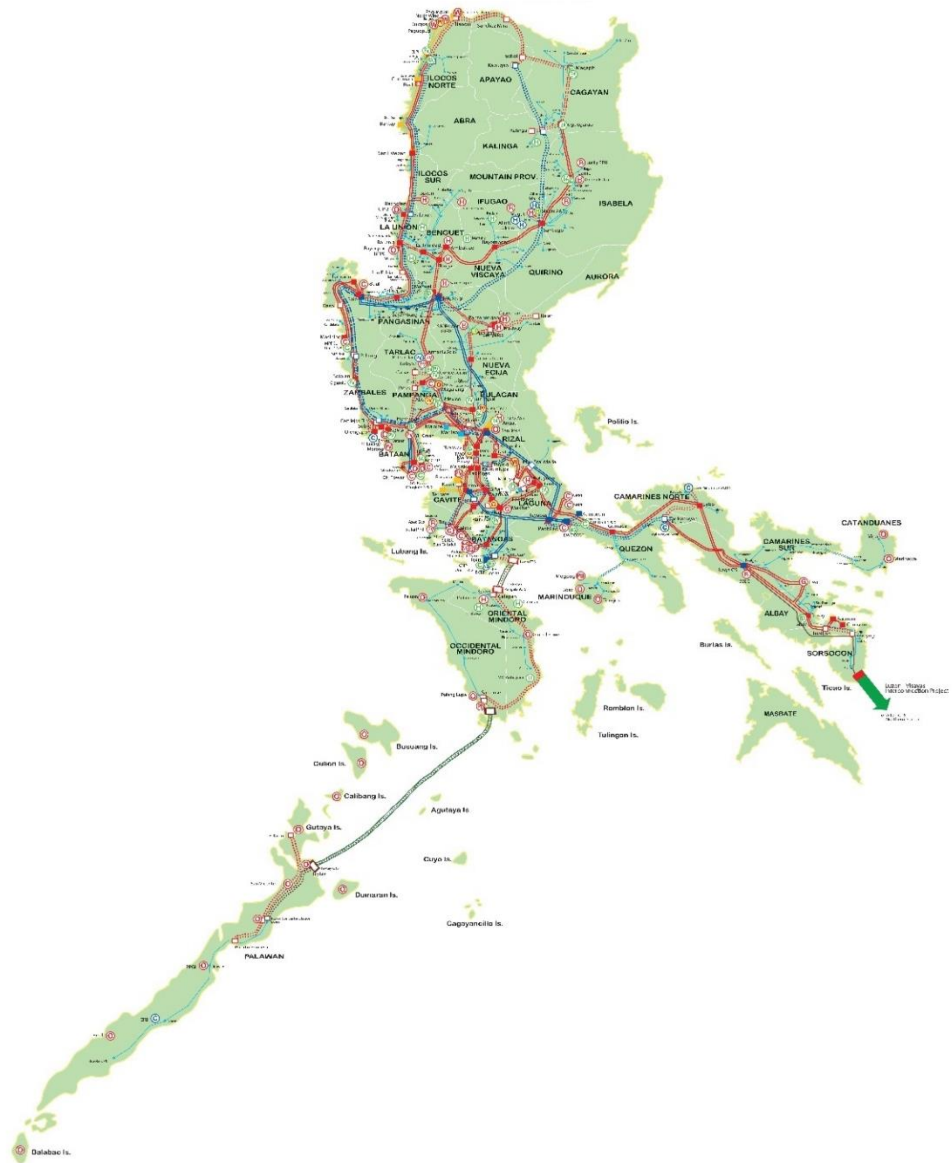


Figure 2.4 Existing Generation Mix (GWh)

2.3 Luzon Transmission Network

The bulk generation sources in the Luzon Grid are in the northern and southern parts of Luzon Island while the load center is in the 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 the 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 (DC) 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 Coal-Fired Power Plant (CFPP) to Metro Manila. Composed of six districts in northern Luzon while the southern part has three districts:

The Bolo and Nagsaag 500 kV Substations (SS) are the receiving ends of generation from the north. The power is then delivered to Metro Manila mainly via Mexico and San Jose SS. Other underlying paths are the 230 kV Transmission Line (TL):

- Labrador–Botolan–Olongapo 230 kV Single-Circuit (SC) Line
- Olongapo–Hermosa and Olongapo–Subic–Hermosa 230 kV Lines
- San Manuel–Concepcion–Mexico DC line
- San Manuel–Pantabangan–Cabanatuan–Mexico SC line

The San Manuel–Concepcion–Mexico 230 kV Line is an alternate corridor, which also caters the generation capacity of the Hydro Electric Power Plant (HEPP) delivering power to San Manuel 230 kV SS.

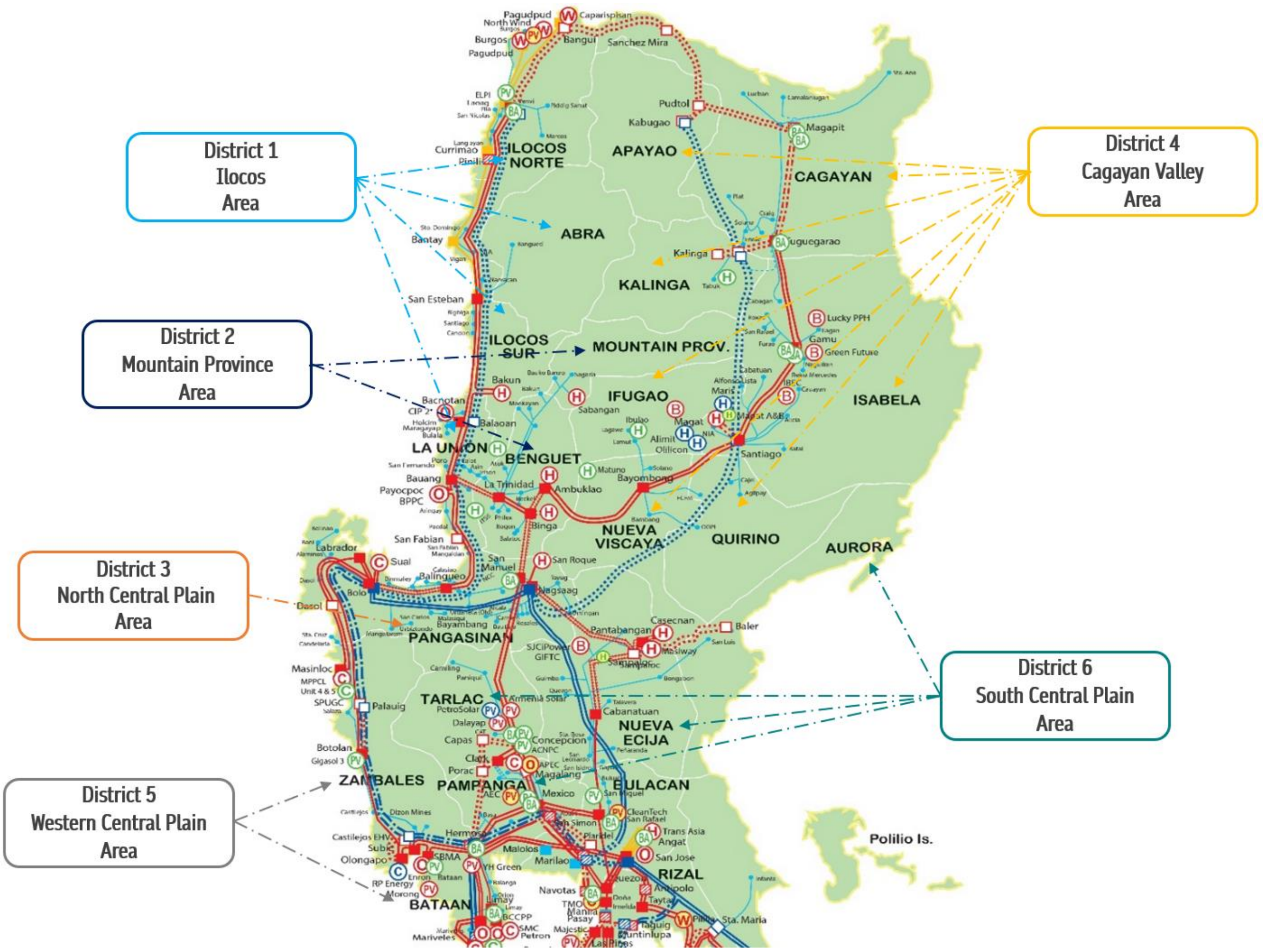


Figure 2.4: North Luzon Transmission Corridor

Metro Manila

As the center of commerce and trade, a further increase in demand within Metro Manila is expected, thus requiring the expansion of existing Substations and the building of new ones. The National Capital Region (NCR) accounts for 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. Thus, it will be challenging to secure the right of way to implement additional transmission lines.

The development of Antipolo, Navotas, and Pasay 230 kV SS Projects will cater to the demand increase in Metro Manila. Presently, there are three main load sectors within Metro Manila:

- Sector 1 is served through Quezon, Paco, Marilao (Duhat), and San Jose SS. Both Paco and Marilao (Duhat) SS are MERALCO-owned
- Sector 2 is served through Taytay and Doña Imelda 230 kV SS
- Sector 3 is served through Muntinlupa and Las Piñas 230 kV SS

The major supply lines for both Quezon and Taytay are the DC 230 kV line from San Jose as these Substations rely heavily on the supply from San Jose 500 kV SS.

In the southern part of Metro Manila, the power requirements are being drawn from Dasmariñas 500 kV SS and power plants directly connected to the 230 kV system. Las Piñas is connected through a DC 230 kV radial line from Dasmariñas, while Muntinlupa has a four-circuit supply line from Biñan.

Southern Transmission Corridor

The southern portion of the 500 kV transmission backbone stretches from Naga SS 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.

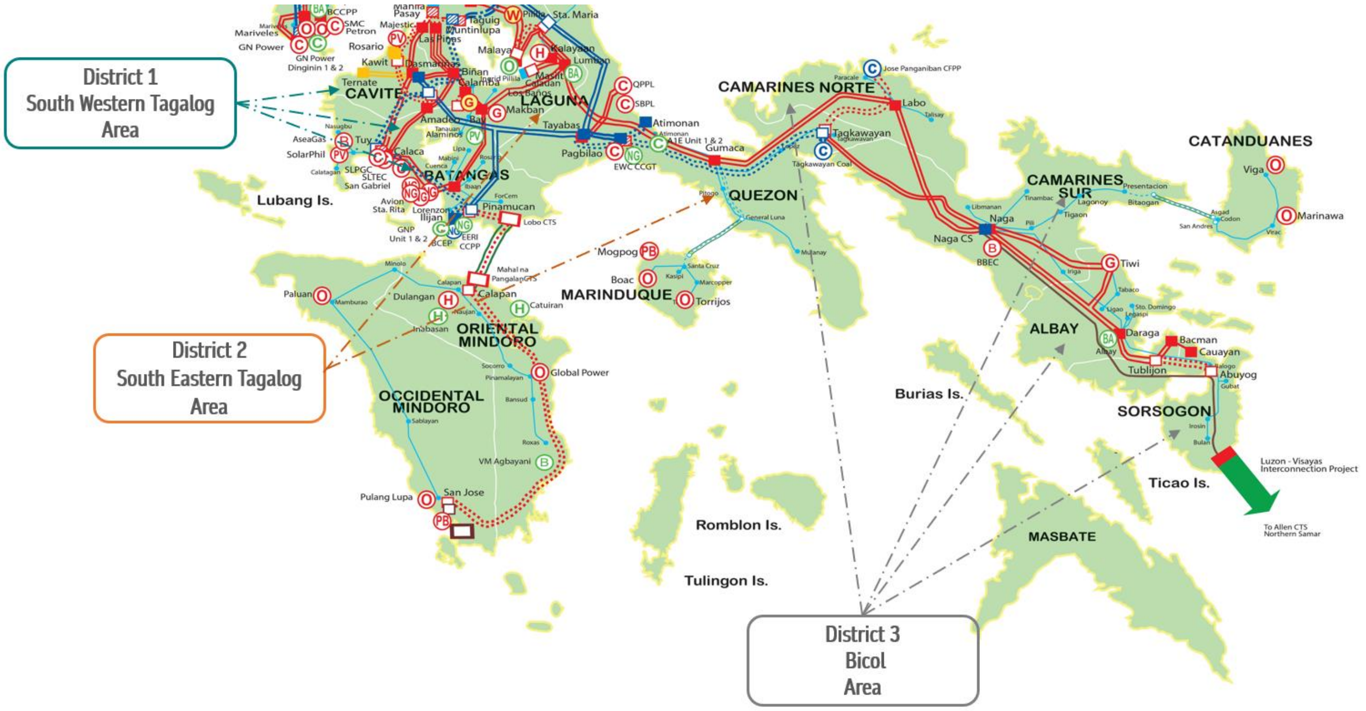


Figure 2.3: South Luzon Transmission Corridor

The 500 kV backbone segment from Pagbilao to Naga SS is currently energized at 230 kV. The Naga SS is also the termination point for the High Voltage Direct Current (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 Quezon Power Philippines Ltd. Company (QPPL) CFPP. The 230 kV transmission system in Batangas and Laguna area caters more than 3,100 MW total generation capacity of Calaca CFPP and other Natural Gas Plants (San Lorenzo, Sta. Rita, and Avion).

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

2.4 Visayas Transmission Network

The Visayas transmission system is divided into five different sub-grids: Panay, Negros, Cebu, Bohol, and Leyte-Samar. The sub-grids have existing AC interconnections with effective transfer capacity as of March 2023 as follows: Leyte-Cebu (1x200 MW, 1x240 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.

The transmission backbone of the Visayas Grid extends from Allen Cable Terminal Station in Samar, all the way to Nabas SS in Panay. This power delivery system comprises approximately 5,378 circuit kilometers of transmission lines.

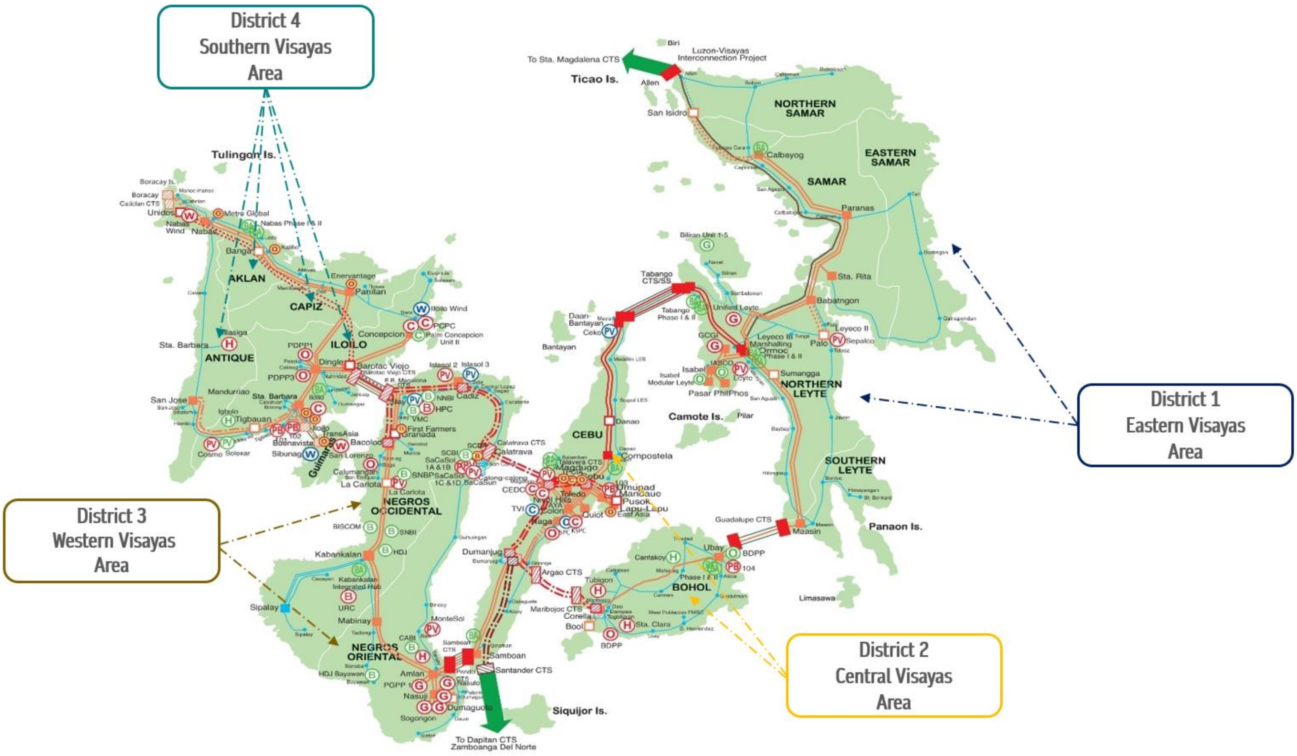


Figure 2.4: Visayas Transmission Corridor

Eastern Visayas 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 TL, 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 667 MW geothermal resources that comprise about 20% of the total dependable capacity in the Visayas.

Central Visayas is composed of Cebu and Bohol Islands. Cebu can be well considered as the major load center of the Visayas Grid. In 2022, it has a peak load of 1,065 MW which accounted for 45.6% of the grid's total demand. Bohol has the lowest peak load among sub-grids at 97 MW in 2022.

In the Island of Negros, 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 generating power plants in Northern Negros which are composed mostly of solar and biomass power plants. There is a total of 287.6 MW solar generation capacity in Negros Island which accounted for 71.2% of the grid's total solar generation capacity.

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

2.5 Mindanao Transmission Network

A large portion of power being used in the island is a combination of renewable and conventional power plants located in Lanao and Misamis Oriental for northern Mindanao, and in Davao Area for southern Mindanao. To enable bulk power transfer between northern and southern Mindanao, the new 230 kV backbone is implemented. In terms of transmission system configuration, Mindanao is relatively a robust grid. However, the security of the island remains a serious concern, thus NGCP is still facing major challenges in implementing its operations and construction of key transmission projects. Another vital issue in the Mindanao grid is the looming low voltage in Zamboanga City. The long and radial configuration of transmission lines supplying the area, and the continuous increase in demand entails low voltage that cannot be resolved by new transmission facilities alone. In this case, a power plant must be constructed near Zamboanga City to balance the reactive power requirement of the system.

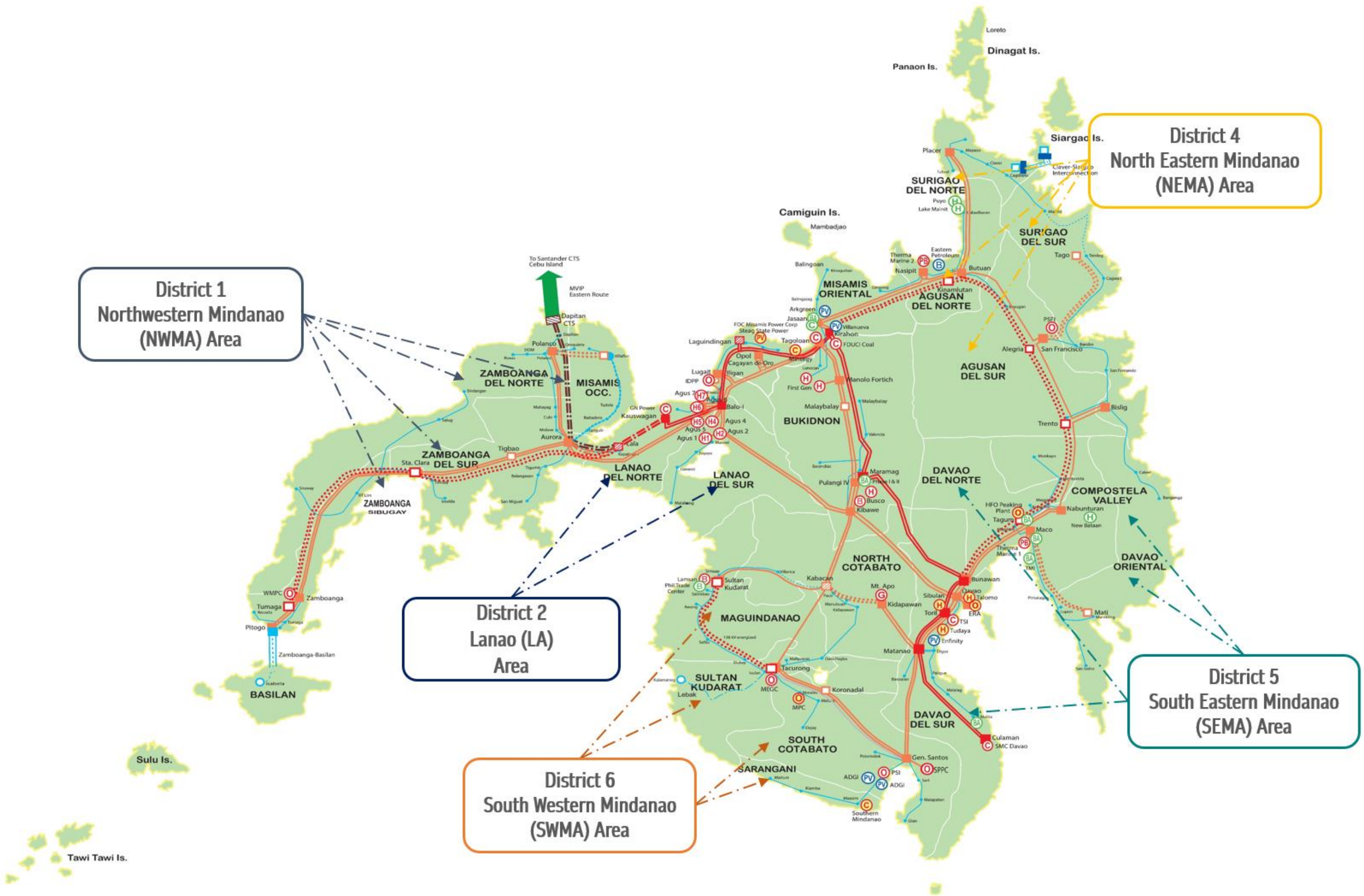


Figure 2.5: Mindanao Transmission Network

PLANNING PROCESS AND DRIVERS FOR GRID DEVELOPMENT

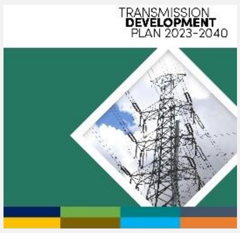
3.1 TDP Process Flow

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 substations (LES) expansion requirements.

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 DU, expansion programs of Generator Companies, and other directly connected customers. In addition, coordination meetings with other stakeholders are also conducted.



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 18 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.

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.

Submission to DOE

As provided in the EPIRA and its Implementing Rules and Regulation (IRR), the TDP shall be submitted to the DOE for approval and for integration with the Power Development Program (PDP) and the PEP.

Figure 3.1: TDP Process Flow

3.2 Planning Criteria

System Assessment.
Taking off from the model of the existing baseline case of the transmission network, the system planners refer to the following:

- The latest list of generation capacity additions
- Utilize the updated system peak load forecast and disaggregate into per substation transformer level

Develop the network model for the year covered planning horizon by the TDP.

Simulation.
Various generation dispatch scenarios are considered to provide a deterministic approach while providing sensitivity in the process as well as in the result in the simulation. This includes simulation considering single-outage contingency which can be very beneficial in determining the necessary or needed projects. This is to assess whether the NGCP Facilities would be able to support the system requirement and power transfer capability in the instance of the worst scenario would take place.

To also evaluate the market impact, NGCP continuously develops its market model utilizing a market-based approach program towards probabilistic approach as additional enhancements of long-term transmission planning. As there are many uncertainties in the future, the market simulation will aim to establish a range of plausible system condition -based scenarios.

Table 3.1 Generation Dispatch Scenarios for each Grid

LUZON Dispatch Scenarios			
Maximum North Wet Season	Maximum South Dry Season	Typical Generation Scenario	Other Generation Scenario
All generation facility outputs in the northern part of the grid are set to their maximum capacities	All generation facility outputs in the southern part of the grid are set to their maximum capacities	Power generation is based on the typical output levels of power plants during system peak load	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 East	Maximum West	Maximum Cebu
All generation facilities in Leyte and Samar Islands are set to their maximum capacities, while the conventional powerplants in Negros and Panay Island are set to minimum. Generation facilities in Cebu is also maximized.	All generation facilities in Negros and Panay Islands are set to their maximum capacities, while the conventional powerplants in Leyte and Samar Island are set to minimum. Generation facilities in Cebu is also maximized.	All generation facilities in Cebu Island are set to their maximum capacities, while the conventional powerplants in Leyte and Samar Island are set to minimum. Generation facilities in Panay and Negros are also maximized.

MINDANAO Dispatch Scenarios		
Maximum North Dispatch Scenario	Dry Season Dispatch Scenario	Other Future Scenarios
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	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	Development of thermal generation in Southeastern Mindanao Linking of the Visayas and Mindanao Grids, through the implementation of the proposed Mindanao-Visayas Interconnection Project.

Evaluation of Results and Project Proposals.
Based on the resulting TL loading, grid transformer loading, fault level at the Substations, voltage profile, and system response to disturbance, the system planners shall provide solutions or mitigations. The following are the solutions or mitigations that can be proposed:

- New TL project
- TL upgrading project
- New SS
- PCB Replacement Program Installation of Reactive Power Compensation Equipment
- Transmission Network Reconfiguration Project

One important consideration in the identification of projects is the overall long-term transmission development for each grid. This is where the line-up of projects in the given period is established as well as the required implementation period. Some projects may have to be implemented by stages or may be initially energized at a lower voltage level while waiting for the completion of other components, particularly for backbone and looping projects but will remain consistent with the target end-state of the grid. The selected solution from the network analysis, as well as the conduct of economic assessment, will form part of the documentation of the TDP.

In the case of expansion plans for Load-End Substations (LES), a direct comparison of the existing SS 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 availability in a SS. Moreover, the 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 in the grid.

The TDP 2023-2040 will be used as a reference in the Regulatory Reset application and 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 full documentation of economic analyses.

The major transmission projects for the period 2023-2040, with components shown in Chapters 8, 9, and 10, were based on the selected implementation scheme after considering all the technically feasible alternatives. The identification of project components would involve line routes, SS 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 prices of materials and equipment obtained through vendor consultation.

3.3 Project Drivers

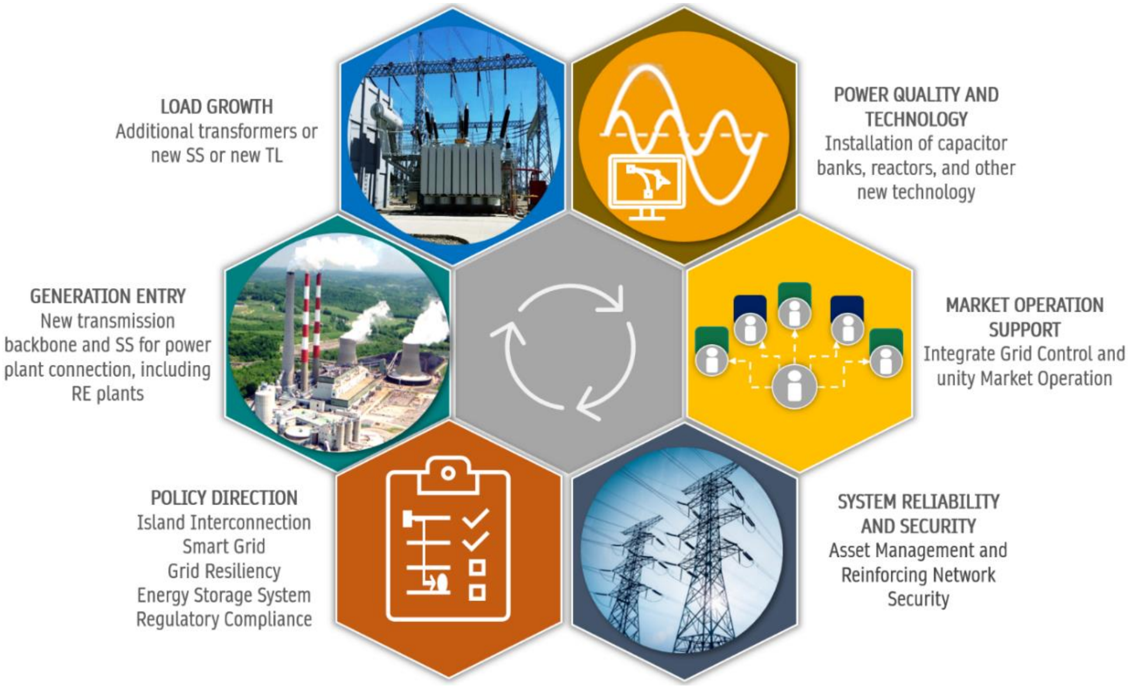


Figure 3.2: Project Drivers

- **Load Growth**. This pertains to ensuring transmission facility adequacy and projects that address the projected overloading, which will occur even during normal conditions or no outage condition, are given topmost priority.
- **Generation Entry**. This pertains to the 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.
- **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 effective planning for the replacement program to ensure that unwarranted asset failures will be prevented or mitigated. Procurement of spares for the

HVE, secondary devices, and TL equipment is regularly planned to ensure stable system availability.

- **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 a substantial application to the operation and maintenance of the transmission system, which includes, online monitoring of High Voltage Equipment (HVEs), centralized operation of substations, and the use of robots among others.
- **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. These include projects involving island/off-grid interconnection, Smart Grid, Grid Resiliency, Energy Storage System, Competitive Renewable Energy Zones (CREZ), among others.
- **Market Operation Support**. This pertains to projects related to the integration of grid control and the unification of market operation

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3.4 System Peak Demand

The annual System Peak Demand (SPD) forecast is one of the important input parameters in the preparation of the TDP.

The demand forecast for the TDP 2023-2040 adopted the SPD projections of the DOE Based on the Gross Domestic Product (GDP)-to-elasticity approach.

3.4.1 Historical Demand for Electricity

The total SPD (in MW, non-coincident sum) of the Philippines shows a consistent upward trend from 2005 to 2019. However, SPD in 2020 declined by 1.92% or 299MW across all Grids – Luzon, the Visayas, and Mindanao. This can be largely attributed to the economic downturn brought about by the COVID-19 pandemic. The implementation of community quarantine in varying stringency levels beginning 15 March 2020 and lasting until the end of the year limited movement across the country and gravely affected the operations of commercial and industrial sectors causing the decline in demand. As of December 2022, demand was able to recover as the Government loosen up quarantine restrictions and rolled out its COVID-19 vaccination program. A 4.93% growth in demand was recorded in 2021 followed by a 3.49% growth in 2022. The Average Annual Compounded Growth Rate (AACGR) is at 3.95% for 2005 to 2022.

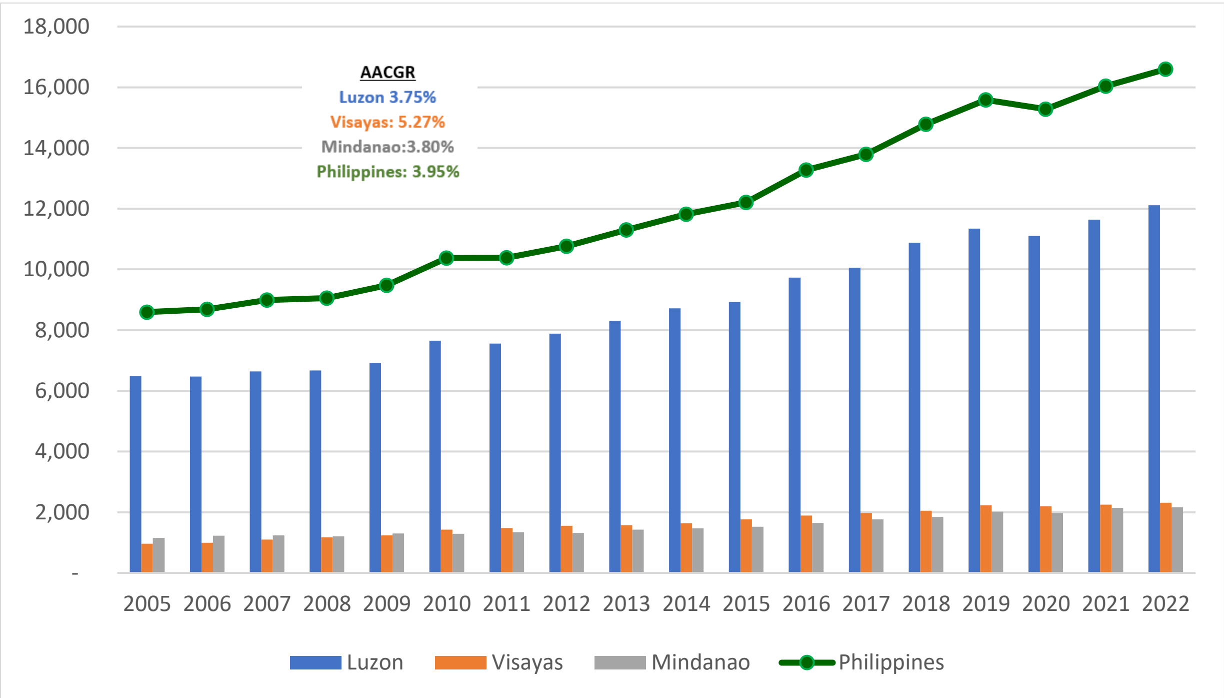
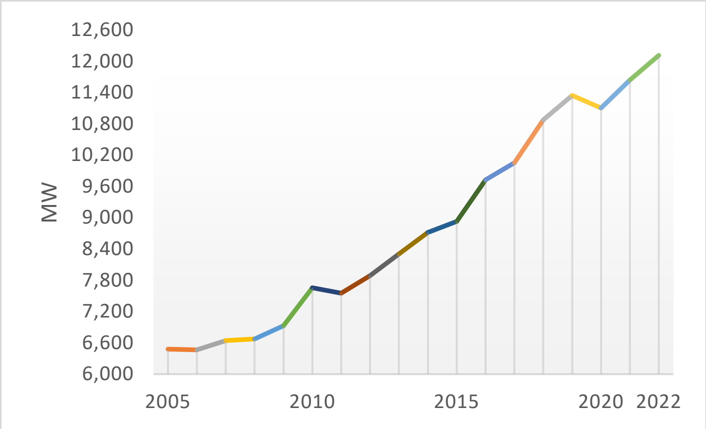


Figure 3.3: Summary of Historical Demand per Grid (2005-2022), in MW*
*Includes embedded generation monitored by NGCP

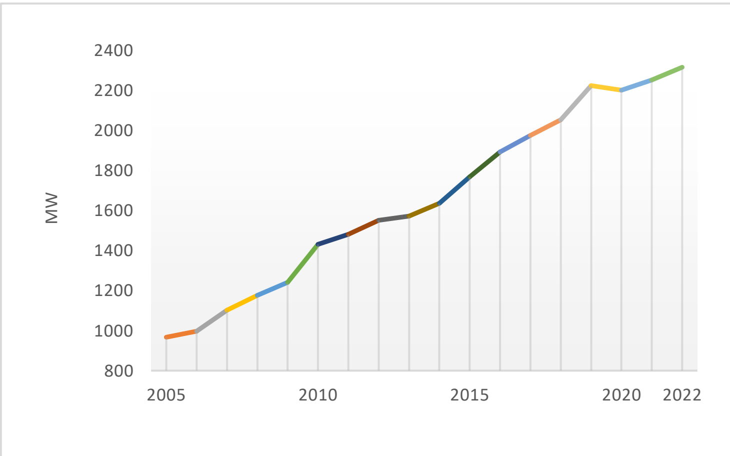
3.4.2 Luzon Historical Demand



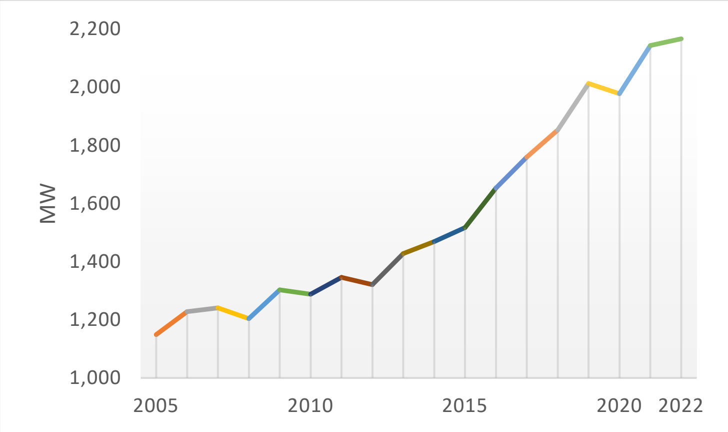
The Luzon Grid has posted an AACGR of 3.75% for the period 2006-2022. Consistent steady growth has been recorded for the Luzon Grid except for the decrease in demand observed in 2006 and 2011. This was due to the reduction in the power consumption of MERALCO for the two periods brought about by the effect of the global financial crisis in 2006 and the effect of the La Niña phenomenon experienced in 2011. MERALCO's demand accounts for at least 70% of the total 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 the 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. In 2020, Luzon SPD posted yet another decline of 2.12% or 241MW. This was observed beginning March of 2020 when Luzon was placed under community quarantine. Load centers Metro Manila, Central Luzon and CALABARZON (Cavite, Laguna, Batangas, Rizal and Quezon) were placed under the most stringent Enhance Community Quarantine (ECQ) for three months to prevent the spread of COVID-19. The government ordered under the ECQ that only essential establishments and industries shall operate during the quarantine period. This resulted in the temporary closure of large commercial, manufacturing, and industrial establishments over Luzon and Metro Manila, coincidentally occurred during the summer months when peak demand of Luzon were recorded for the past 10 years. Further, Metro Manila remained in General Community Quarantine (GCQ) by the end of 2020. The implementation of community quarantines resulted to lower electricity demand in 2020. The implementation of community quarantines resulted to lower electricity demand. In 2021 and 2022, demand was able to recover, registering a 4.84%and 4.06% growth respectively, as the Government loosen up quarantine restrictions and rolled out COVID-19 vaccination program. Across all grids, Luzon Grid recorded the highest demand growth in 2022.

3.4.3. Visayas Historical Demand

The aggregate demand in the Visayas Grid has posted an AACGR of 5.27% for the period 2006-2022. The year 2010 brought a 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 the 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 Cebu Energy Development Corporation (CEDC), KEPCO Salmon Power Corporation (KSPC), 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 two 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 a 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. Decreased demand of 1.03% or 23 MW was recorded in 2020 in line with the onset of the COVID-19 pandemic. Load centers Cebu, Iloilo and Bacolod City were placed under longer ECQ compared to other areas in Visayas—the effect of which was evident in the recorded decreased demand of large DU serving these areas and nearby provinces for the period of April to December in 2020 compared with the level recorded during the same period in 2019. Similar with Luzon, demand of Visayas Grid was able to recover and recorded 2.29% increase in 2021 and 2.84% in 2022.



3.4.4. Mindanao Historical Demand



Mindanao Grid has posted an AACGR of 3.80% for the period 2006-2022. 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 the years 2005, 2008, 2010 and 2012. The year 2005 was characterized by reduced demand from DU 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 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. More than 800 MW additional generation capacity was also added to Mindanao. In 2017 and 2018 the demand for 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. Similar with Luzon and Visayas, Mindanao SPD declined by 1.76% or 35MW in 2020. ECQ was also implemented in Davao, load center in Mindanao, for some time and was under GCQ by the end of 2020. Large DUs in Mindanao, including Davao, recorded decreased demand for the period of April to December in 2020 compared with the level recorded during the same period in 2019. In 2021, Mindanao recorded the highest percent growth in demand, across all grids, recording 8.42% growth. A 1.07% increase in demand was recorded in 2022.

3.4.6 Forecasted for TDP 2022-2040

The power demand for the country is expected to grow at an AACGR of 6.06% for the period 2022-2025, 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 7.81% for 2022-2040 while the Luzon and Visayas Grids at 6.04% and 7.11%, respectively. Table 3.2 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 19 August 2021 based on gross generation level. The power demand for the country is expected to grow at an AACGR of 6.06% for the period 2022-2025, 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 7.81% for 2022-2040 while the Luzon and Visayas Grids at 6.04% and 7.11%, respectively. Table 3.2 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 19 August 2021 based on gross generation level.

The implementation of community quarantine, starting March 2020, throughout the country due to the 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 this, the DOE adopted NEDA's low GDP economic growth assumption in updating the load forecast. The SPD forecast endorsed by the Department to NGCP contains the same levels used in the TDP 2021 to 2040.

A comparison of the projected load and generation capacity per area per grid is also available (see Appendix 2).

Table 3.2 Summary of Projected Demand per District (MW)

	Area	2023	2024	2025	2030	2035	2040
	LUZON	13,125	13,918	14,769	20,069	27,13	36,101
	MERALCO	8,826	9,123	9,502	11,531	13,978	16,954
1	NCR	5,736	5,929	6,175	7,494	9,084	11,018
2	North	486	502	523	635	770	934
3	South	2,604	2,692	2,804	3,402	4,124	5,002
	North Luzon	3,270	3,644	4,000	6,469	10,237	15,074
1	Ilocos	251	272	294	497	763	1,104
2	Mt. Province	144	156	169	273	409	587
3	North Central	351	392	429	710	1,165	1,692
4	Cagayan Valley	354	383	421	695	1,041	1,537
5	West Central	652	732	806	1,303	2,075	3,148
6	South Central	1,453	1,643	1,813	2,904	4,676	6,875
7	North Tagalog	64	66	68	88	108	131
	South Luzon	1,029	1,151	1,267	2,069	2,924	4,073
1	Batangas/Cavite	507	566	621	1,025	1,366	1,741
2	Laguna/Quezon	140	155	167	250	350	503
3	Bicol	381	430	479	795	1,207	1,829
	VISAYAS	2,691	2,891	3,111	4,423	6,280	8,827
1	Panay	469	504	542	771	1,094	1,538
2a	Cebu	1,283	1,378	1,483	2,108	2,993	4,208
2b	Bohol	115	123	133	189	268	377
3	Leyte-Samar	395	424	456	649	921	1,295
4	Negros	430	462	497	706	1,003	1,410
	MINDANAO	2,395	2,584	2,789	4,138	6,088	8,751
1	North Western	249	267	290	475	751	1,140
2	Lanao Area	142	146	154	226	324	457
3	North Central	601	625	653	997	1,413	1,967
4	North Eastern	159	169	183	298	470	709
5	South Eastern	683	743	844	1,226	1,864	2,748
6	South Western	561	634	664	916	1,267	1,730
	Philippines	18,211	19,392	20,669	28,631	39,506	53,679

3.4.7 Demand Projections for Substation Capacity Addition

The demand projections for SS 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.

3.4.8 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:

- 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.
- Indicative – Projects with service contracts, in the development/commercial stage but with no financing yet.
- Prospective – Projects with completed SIS as of March 2023 (See Appendix 3). 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 with 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.

New generating power plants are linked to the grid every year to increase and maintain the demand-supply balance in the system. Table 3.3 shows the list of grid-connected additional capacities in 2022 based on DOE's list of of existing power plant as of 31 December 2022.

Table 3.3 List of Grid-Connected Additional Capacities in 2022

Power Plant	Location	Installed Capacity (MW)	Dependable Capacity (MW)	Connection Point
LUZON				
GNPower Dinginin Supercritical CFPP - Unit 2	Sitio Dinginin, Barangay Alasasin, Mariveles, Bataan	725.0	668.0	GN Mariveles 230 kV SS (Interim Connection) Mariveles (Alas-asin) 500 kV SS
Hypergreen Rice Husk-fired	Brgy. Taal, Bocaue, Bulacan	12.0	10.0	MERALCO Facility
Sta. Rita Solar PP(Phase 3B)	Mt. Sta. Rita, Subic Bay Freeport Zone	34.4	27.5	SBMA 230 kV SS
Bataan Solar Energy Project	Barangay Batangas-II, Mariveles, Bataan	4.4	3.7	PENELCO Facility
Arayat-Mexico Solar PP	Barangay San Antonio, Arayat, Pampanga	72.0	51.0	Mexico–Clark 69 kV TL 2
Alaminos BESS	Brgy. San Andres, Alaminos, Laguna	60.0	60.0	Bay 69 kV SS
VISAYAS				
Isabel Modular Diesel Ancillary Service Power Plant	Barangay Libertad, Isabel, Leyte	86.3	70.7	Cut-in along Isabel – Pasar 138 kV Line 2 (Interim) Isabel 138 kV SS
TUBIG HEPP	Taft, Eastern Samar & Hinabangan, Samar	15.9	15.9	Tap connect along Paranas–Taft 69 kV line
San Carlos Biopower (SCBP)	Circumferential Road, San Carlos Economic Zone II, Barangay Palampas, San Carlos City, Negros Occidental	20.0	18.0	Interim connection in Cadiz-San Carlos 69 kV TL. To be transferred to San Carlos 69 kV SWS upon completion of the CNP3
South Negros Biopower	Barangay Cubay, La Carlota City, Negros Occidental	25.0	22.4	Tap connect along Bacolod - San Enrique 69 kV Transmission Line
North Negros Biopower	Barangay Sta. Teresa, Manapla, Negros Occidental	25.0	22.4	Tap connect along Bacolod - Cadiz 69 kV TL
Kabankalan BESS	Barangay Binucuil, Kabankalan, Negros Occidental	22.5	22.5	Kabankalan 138 kV SS
Kabankalan PH2 BESS	Barangay Binucuil, Kabankalan, Negros Occidental	12.2	12.2	Kabankalan 138 kV SS
MINDANAO				
MATI BUNKER-C*	Libudon Road, Lower Dawan, Mati City, Davao Oriental	11.0	11.0	Embedded in DORECO-1, within 69 kV network
Mindanao 3 (M3) Binary Geothermal Plant	Barangay Ilomavis, Kidapawan, North Cotabato	3.7	3.0	Kidapawan SS
TMI Hybrid Diesel-Battery System	Maco, Davao de Oro	49.0	49.0	Maco 138 kV SS

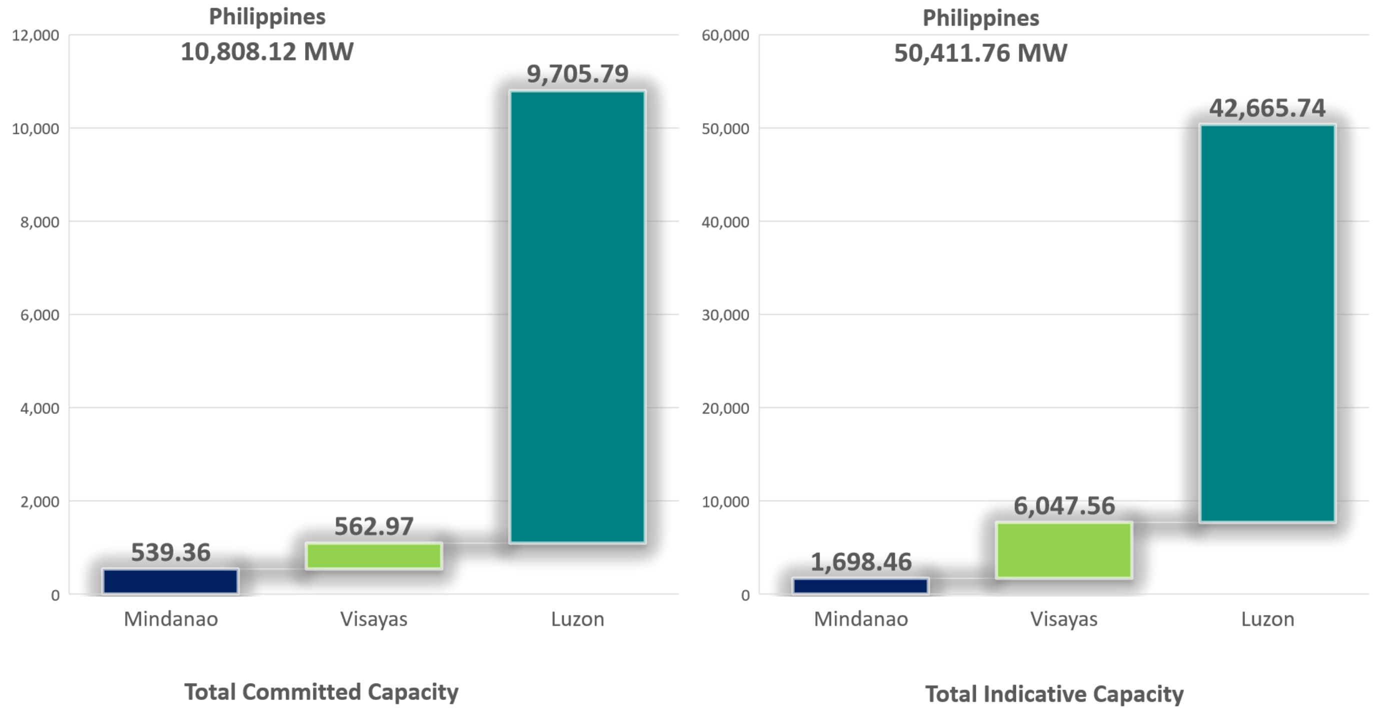


Figure 3.4 Capacity Summary of DOE's List of PSIPP as of 28 February 2023
Note: BESS not included

In addition to the existing capacity, Table 3.4 shows the capacity summary of DOE's List of PSIPP as of 28 February 2023 for Luzon, the Visayas, and Mindanao with associated transmission projects that will accommodate generation entry and the respective completion Date. A detailed list of PSIPP is shown in Appendix 4.

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 DU from NGCP Substations and would not generally require reinforcement in the transmission network.

Table 3.4 Luzon Committed Power Plants and Associated Transmission Projects
*with SIS

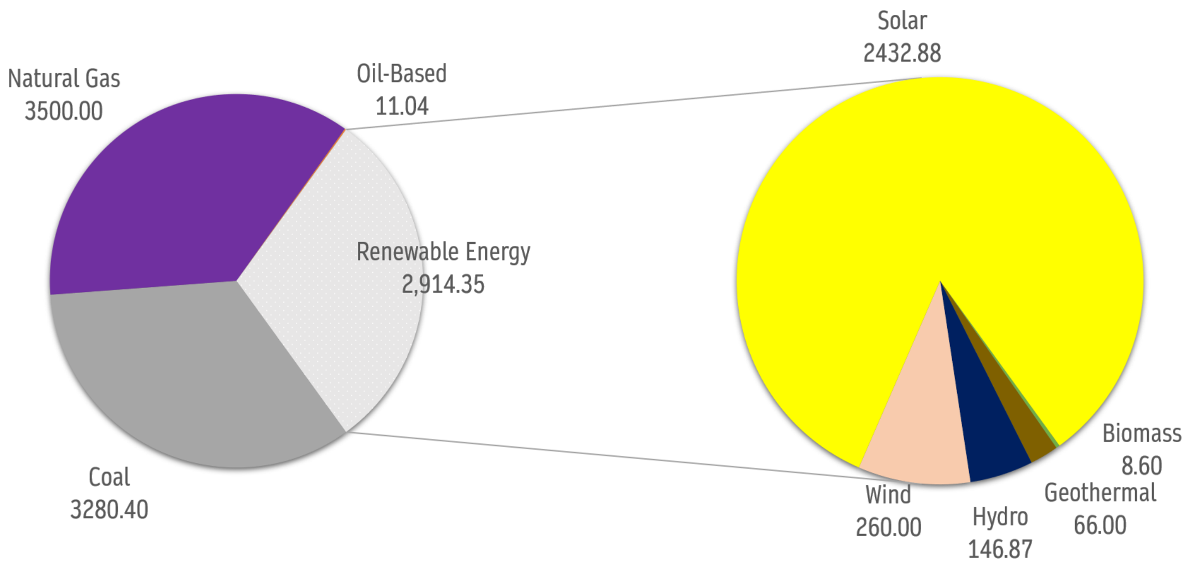
Proposed Major Power Plants	Capacity (MW)	Commissioning Year	Connection Point	Associated Transmission Project	ETC/ Completion Date
COAL					
Petron Corporation Refinery Solid Fuel-Fired Project – Phase 3*	44.4	Mar 2023	BCCPP 230 kV SS	Mariveles–Hermosa 500 kV TL Hermosa-San Jose 500 kV TL	Dec 2022 Aug 2023
Mariveles CFPP*- Phase I, Unit, 1	150	Aug 2023	Mariveles (Alas-asin) 500 kV SS	Mariveles–Hermosa 500 kV TL Hermosa-San Jose 500 kV TL	Dec 2022 Aug 2023
- Phase I, Unit, 2	150	Sep 2023			
- Phase I, Unit, 3	150	Jan 2024			
- Phase I, Unit, 4	150	May 2024			
- Phase II, Unit, 5	150	Dec 2025			
- Phase II, Unit, 6	150	Mar 2026			
- Phase II, Unit, 7	150	Jun 2026			
- Phase II, Unit, 8	150	Sep 2026			
Masinloc Power Plant* - Unit 4	350	Jun 2025	Castillejos 500 kV SS (interim)	Western 500 kV Backbone Stage-2 (Masinloc-Castillejos TL as Ph. 1 in 2024)	Dec 2025
- Unit 5	350	Dec 2025	Palauig 500 kV SS		

Proposed Major Power Plants	Capacity (MW)	Commissioning Year	Connection Point	Associated Transmission Project	ETC/ Completion Date
A1E CFPP* - Unit 1	668	TBD	Pagbilao 500 kV SS	Pagbilao 500 kV SS Project	Jun 2022
- Unit 2	668	TBD		Pagbilao–Tayabas 500 kV TL	Mar 2025
OIL-BASED					
SPC – Capas Bunker C-Fired DPP*	11.04	Jun 2023	TARELCO II Facility	None	N/A
NATURAL GAS					
EWC CCGT Power Plant*	650	TBD	Pagbilao 230 kV SS	Pagbilao 500 kV SS	Jan 2022
Batangas CCPP - Phase 1, Unit 1*	437.50	Sep 2024	Ilijan 500 kV Switchyard	None	N/A
- Phase 1, Unit 2*	437.50	Sep 2024			
- Phase 1, Unit 3*	437.50	Dec 2024			
- Phase 2	437.50	TBD			
BCEI Natural Gas-Fired Power Plant	1,100	Jan 2027	Pinamucan 500 kV SS	Pinamucan-Tuy 500 kV TL	Dec 2031
GEOTHERMAL					
Palayan Binary Power Plant*	29	Jun 2023	Bacman 230 kV SS	None	N/A
Tiwi Binary Geothermal Project	17	Dec 2023	Tiwi-C 69 kV SS	None	
Bacman 3 (Tanawon) Geothermal Project*	20	Dec 2023	Bacman 230 kV SS (through Palayan 230 kV Switchyard)		N/A
WIND					
Caparispisan II Wind PP	70	Mar 2024	Laoag 115 kV SS	None	N/A
Calatagan Wind PP	30	Dec 2025	Tuy 230 kV SS	Tuy 500/230 kV SS - Stage 1	Dec 2024
Balaoi and Caunayan Wind PP - Phase 1	80	May 2023	Laoag 115 kV SS	Bolo–Balaoan 500 kV TL Balaoan–Laoag 500 kV TL	Apr 2032 Apr 2034
- Phase 2	30	Aug 2023			
- Phase 3	25	Jan 2024			
- Phase 4	25	Dec 2025			
HYDRO					
Colasi HEPP*	4	Apr 2023	CANORECO Facility	None	N/A
Matuno HEPP*	8.66	Apr 2023	Bayombong–Lagawe 69 kV TL	None	N/A
Biyao HEPP	0.80	Dec 2023	KAELCO Facility	None	N/A
Mariveles HEPP	0.60	May 2023	PENELCO Facility	None	
Laguio (Laginbayan) Malaki 1 HEPP	1.60	Aug 2023	MERALCO Facility	None	N/A
Labayat River (Lower Cascade) HEPP	1.40	May 2023	Lumban–FAMY-Infanta 69 kV TL	None	N/A
Lalawinan HEPP	3	Dec 2024	Lumban–FAMY-Infanta 69 kV TL	None	N/A
Likud 2 HEPP	0.56	Jul 2023	IFELCO Facility	None	N/A
Asin-Hungduan HEPP	9.8	Jun 2024			
Tibag HEPP	5	May 2023	Lumban–FAMY-Infanta 69 kV TL	None	N/A
Rangas HEPP	2.40	Dec 2025	CASURECO IV Facility	None	N/A
Ibulao HEPP*	4.5	Apr 2023	Bayombong–Lagawe 69 kV TL	None	N/A
Ibulao 1 HEPP*	7.6	Jun 2024		None	N/A
Dupinga HEPP	4.80	Jun 2023	NEECO II A2 Facility	None	N/A
Kapangan HEPP *	60	Dec 2025	Bacnotan 69 kV SS	None	N/A
Daet HEPP	5	Dec 2025	CANORECO Facility	None	N/A
Tignoan River (Upper Cascade) HEPP*	1.50	Dec 2025	Lumban–FAMY-Infanta 69 kV TL	None	N/A
Tubao HEPP	1.50	Dec 2025	LUELCO Facility	None	N/A
Dipalo HEPP	4.15	Dec 2025	Nagsaag-Umingan 69 kV TL	None	N/A
Sablan 1 HEPP	20	Nov 2025	La Trinidad–Calot 69 kV TL	None	N/A
BIOMASS					
Isabela Rice husk-Fired BPP	5	May 2023	ISELCO II Facility	None	N/A
FEAC Biogas	2.4	Aug 2023	PELCO III Facility	None	N/A
FQBC Biogas	1.2	Jan 2024	MERALCO Facility	None	N/A
SOLAR					
Pinugay SPP	67.5	Apr 2023	Tap connection along the MERALCO-owned Dolores–Teresa–Malaya 115kV Sub-TL which is radially connected to NGCP's Taytay SS	None	
Currimao SPP	48.11	Jun 2023	Currimao 115 kV SS		

Proposed Major Power Plants	Capacity (MW)	Commissioning Year	Connection Point	Associated Transmission Project	ETC/ Completion Date
CGRI Bulacan 2 SPP*	17.6	May 2024	San Rafael 69 kV SS	None	N/A
Ilocos Norte SPP*	87.59	Apr 2023	Laoag 115 kV SS	None	N/A
Raslag III Solar PV PP	13.6	Mar 2023	Mexico-Clark 69 kV TL 1	Clark-Mabiga 69 kV TL Line	
Santa Rosa Nueva Ecija 2 SPP - Phase 1A	33.348	Jul 2023	San Antonio 230 kV SS	San Antonio-Baras 500 kV TL (ETC: Dec 2030)	Dec 2023
- Phase 1B	108.4				
- Phase 2	171.6				
Cayanga-Bugallon SPP*	75.088	May 2023	Bolo 230 kV SS	Bolo-Balaoan 500 kV TL	Apr 2032
Lal-lo Hybrid SPP	82.48	Sep 2023	Lal-lo (Magapit) 69 kV SS	Santiago–Nagsaag 500 kV TL	
Arayat-Mexico SPP Phase 2	30.93	Apr 2023	Mexico–Clark 69 kV TL 2	None	
PAVI Green Naga SPP	40.40	Dec 2024	Naga-Lagonoy 69kV TL	None	
Talugtug SPP	99.98	Mar 2025	Nagsaag–Umingan 69 kV TL	Nagsaag–Tumana 69 kV TL	Mar 2024
Bulacan 2 SPP		May 2023	San Rafael 69 kV SS	None	
Concepcion 1 SPP - Phase 3	12	May 2023	Concepcion 69 kV SS	None	N/A
- Phase 4	30	Aug 2023	Concepcion 69 kV SS	None	
Concepcion Tarlac 2 SPP	200	Dec 2025	Concepcion 230 kV SS	Mexico–Marilao 230 kV Tl Upgrading	Aug 2023
Tayabas Solar PP	450	Dec 2025	Tayabas 230 kV SS	Taguig-Silang 500 kV TL	
Sapang Balen SPP 1	96.236	Dec 2025	Magalang 230 kV SS	Magalang 230 kV SS	Dec 2027
Sapang Balen SPP 2 - Phase 1	92.799	Dec 2024	Magalang 230 kV SS	Magalang 230 kV SS	Dec 2027
- Phase 2	92.799	Jun 2025			
- Phase 3	92.799	Dec 2025			
- Phase 4	92.799	Jun 2026			
- Phase 5	92.799	Dec 2026			
San Marcelino SPP - Phase 1	224	Aug 2023	Castillejos 230 kV SS	Western Luzon 500 kV Backbone - Stage 1	Dec 2023
- Phase 2	80	Aug 2023			

Total Capacity: 9,705.79

Based on DOE data as of February 2023



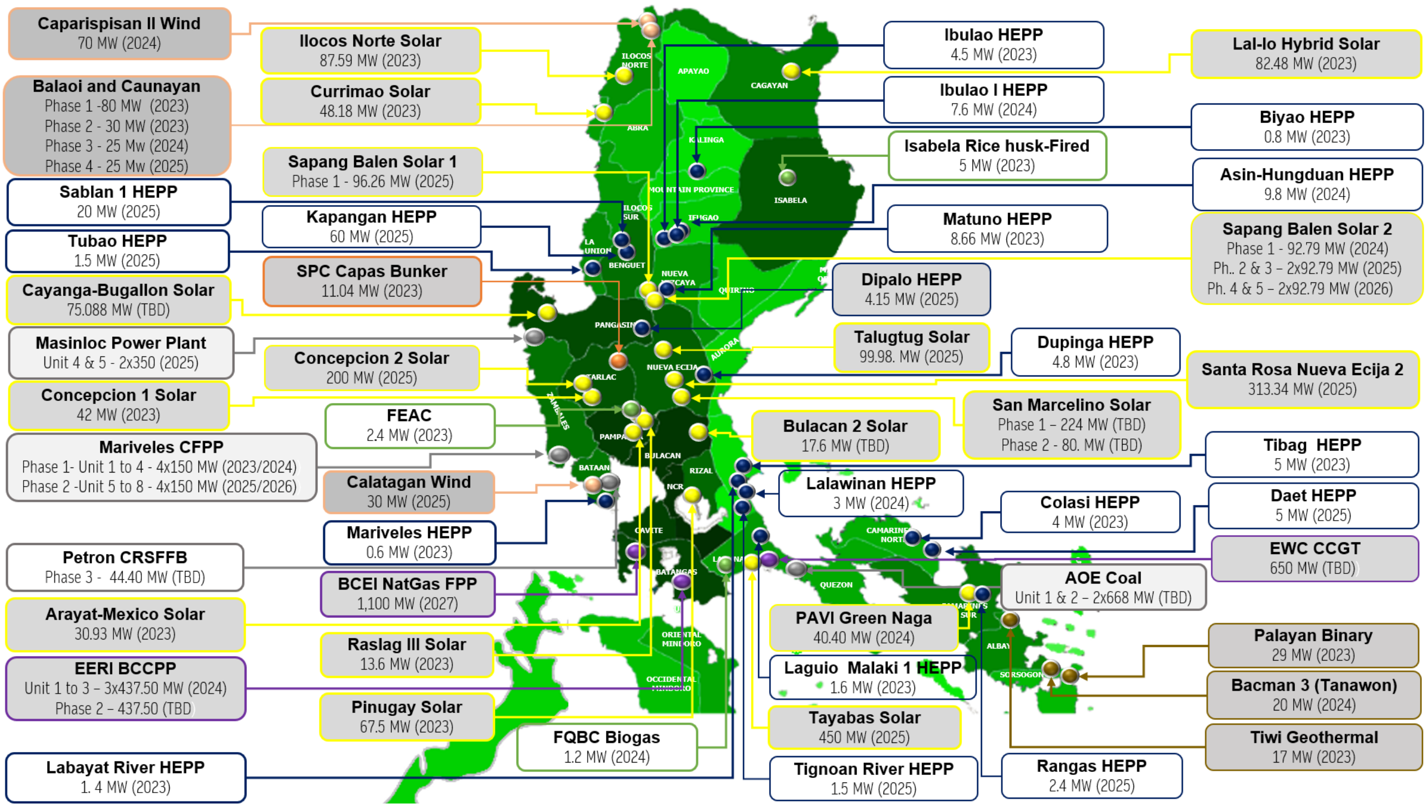


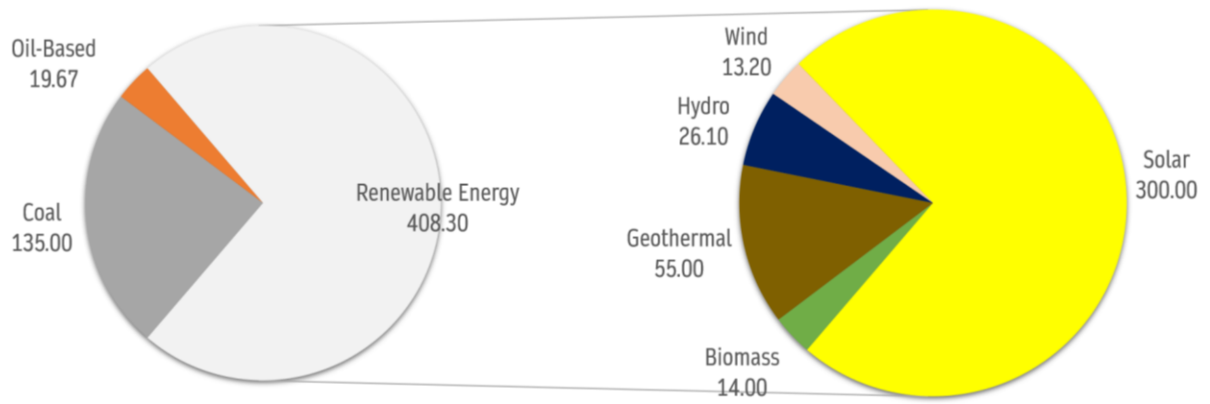
Figure 3.5: Luzon Major Committed Power Plants

Table 3.5 Visayas Committed Power Plants and Associated Transmission Projects
*with SIS

Proposed Major Power Plants	Capacity (MW)	Commissioning Year	Connection Point	Associated Transmission Project	ETC/ Completion Date
COAL					
Palm Concepcion CFPP Unit II*	135	Mar 2025	Concepcion 138 kV SS	Negros – Panay 230 Interconnection L2 CNP 230 kV Backbone Stage 3	Aug 2023
OIL-BASED					
Calbayog Bunker C-Fired DPP*	11.17	Feb 2023	Calbayog 69 kV SS	Visayas SS Upgrading Project 2	Dec 2025
Caterpillar DPP	2	Sep 2023	Lapu-lapu 69 kV SS	None	N/A
Cummins DPP	1	Sep 2023	Lapu-lapu 69 kV SS	None	N/A
Sulzer DPP	5.5	Sep 2023	Lapu-lapu 69 kV SS	None	N/A
GEOTHERMAL					
Northern Negros GPP	5	Aug 2024	Bacolod 138 kV SS	CNP 230 kV Backbone Stage 3	Aug 2023
Biliran GPP - Unit 1	2	Mar 2023			
- Unit 2	6	Nov 2024			
- Unit 3	10	2025			
- Unit 4	10	2026			
- Unit 5	22	2027			
HYDRO					
Timbaban HEPP*	18	Jun 2023	Tap Connection to Panitan-Nabas 69 kV TL	CNP 230 kV Backbone Stage 3	Aug 2023
Igbulo (Bais) HEPP*	8L1	Apr 2023	Cut-in along Sta. Barbara-San Jose 69 kV TL	CNP 230 kV Backbone Stage 3	Aug 2023
BIOMASS					
CASA BPP	8	Dec 2023	Dingle 69 kV SS		
HDJ BPP*	6	Jun 2023	Tap connection along Bayawan-Tadlong 69 kV line	CNP 230 kV Backbone Stage 3	Aug 2023

Proposed Major Power Plants	Capacity (MW)	Commissioning Year	Connection Point	Associated Transmission Project	ETC/ Completion Date
SOLAR					
Kananga-Ormoc SPP	300	Dec 2025	Ormoc 230 kV	Cebu–Leyte 230 kV Interconnection Lines 3 and 4 Project	Dec 2031
WIND					
Nabas-2 WPP Project	13.2	May 2025	Through Nabas – Caticlan 69 kV line	CNP 230 kV Backbone Stage 3	Aug 2023

Total Capacity: 562.79
Based on DOE data as of February 2023



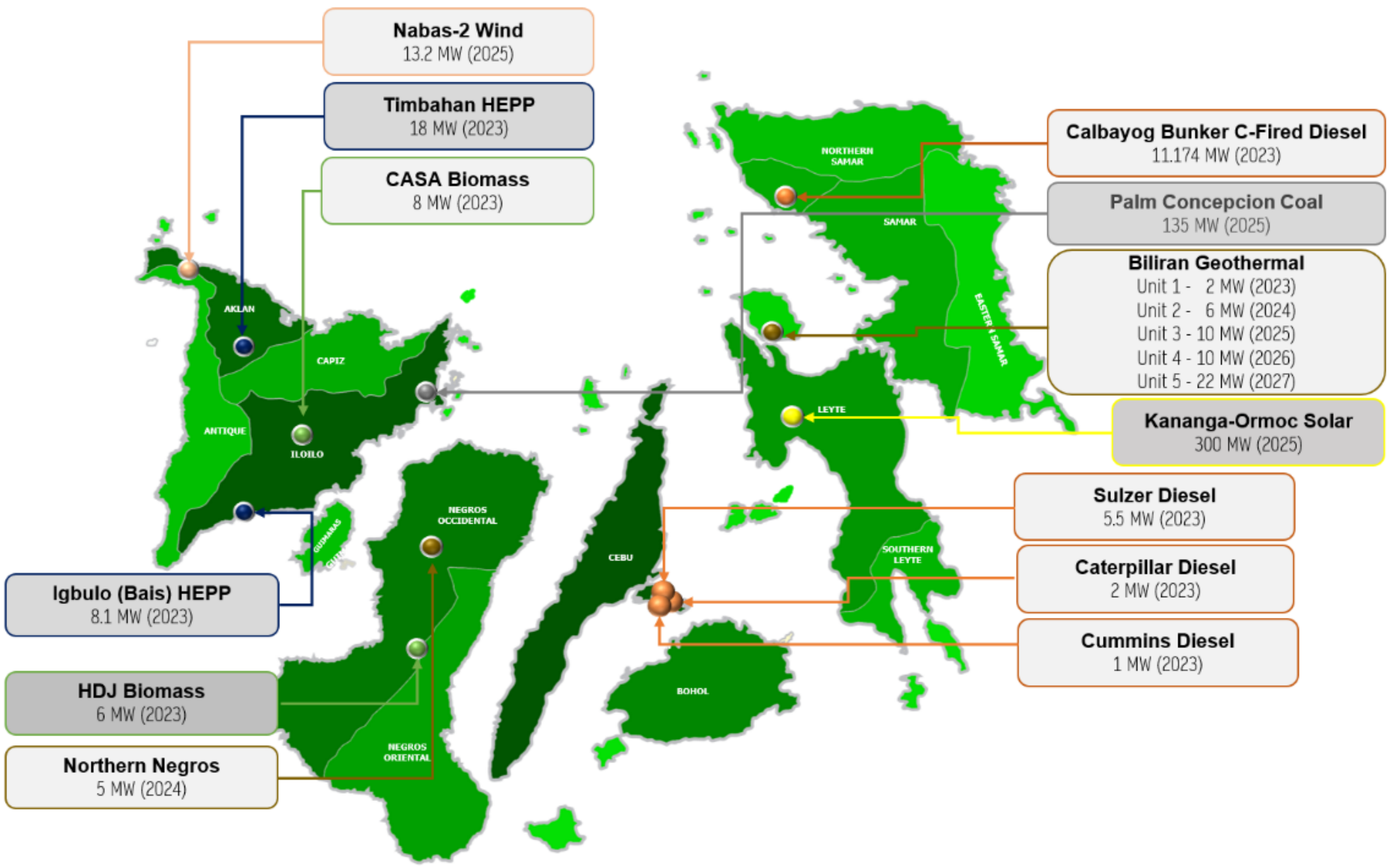
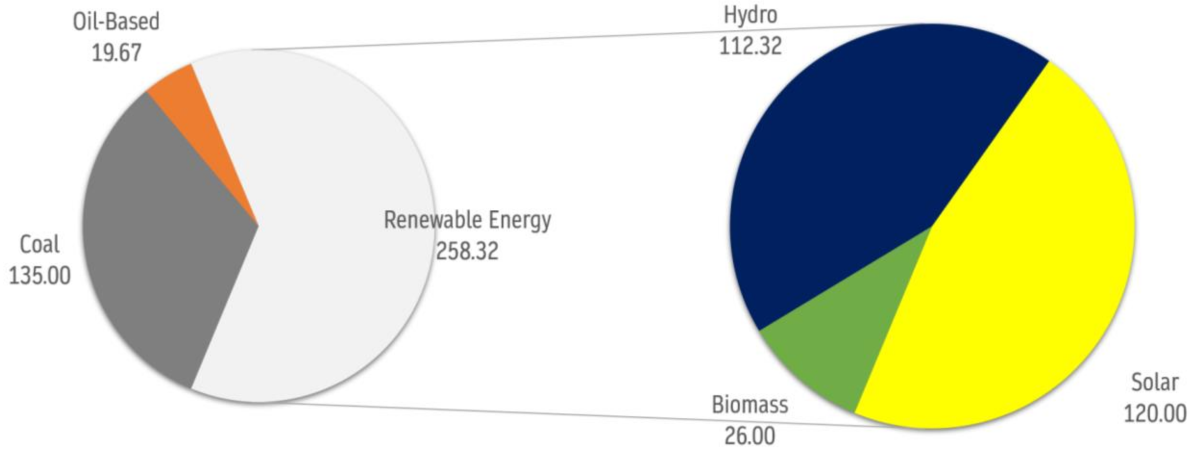


Figure 3.6: Visayas Committed Power Plants

Table 3.6 Mindanao Committed Power Plants and Associated Transmission Projects
*with SIS

Proposed Major Power Plants	Capacity (MW)	Commissioning Year	Connection Point	Associated Transmission Project	ETC/Completion Date
COAL					
Misamis Oriental 2 x 135 MW Circulating Fluidized Bed CFPP*	270	Mar 2027	Villanueva 138 kV SS	None	N/A
OIL-BASED					
SPC DPP*	11.04	TBD	Mati 69 kV SS	None	N/A
HYDRO					
Lake Mainit*	24.9	Apr 2023	ANECO Facility	None	N/A
Alamada HEPP	3	Jun 2023			
Sipangpang HEPP	1.80	Jun 2023			
Maramag HEPP	2.04	Apr 2023			
Liangan HEPP*	18	Apr 2023	Agus 6-Kauswagan 69 kV Line	None	N/A
Siguil HEPP	14.50	Jun 2023	-SOCOTECO 2's proposed Tinoto Line 3		
Tagpangi HEPP	1.70	Dec 2023			
Osmeña HEPP	1	Dec 2023			
Gakaon HEPP	2.23	Dec 2024			
Maladugao (Upper Cascade) HEPP*	8.40	Jan 2025	Maramag 138 kV SS	None	N/A
Titunod HEPP	3.60	Dec 2024			
Malitbog HEPP	3.70	Sep 2024	Villanueva 69 kV SS		
Silo-o HEPP	3.70	Oct 2024	Villanueva 69 kV SS		
Mat-I HEPP	4.85	Nov 2025	Jasaan – Balingasag 69 kV Line		
Clarin HEPP	6.90	Nov 2025	Villanueva 230 kV SS		
Mangima HEPP	12	Jan 2025			
BIOMASS					
CSCCI 10 MW BPP	10	Nov 2023			
DSCCI 10 MW BPP	10	Dec 2023			
LPEC 6 MW BPP	6	Dec 2023			
SOLAR					
Gen. Santos SPP	120	Dec 2025	General Santos 138 kV SS		

Total Capacity: 539.36
Based on DOE data as of February 2023



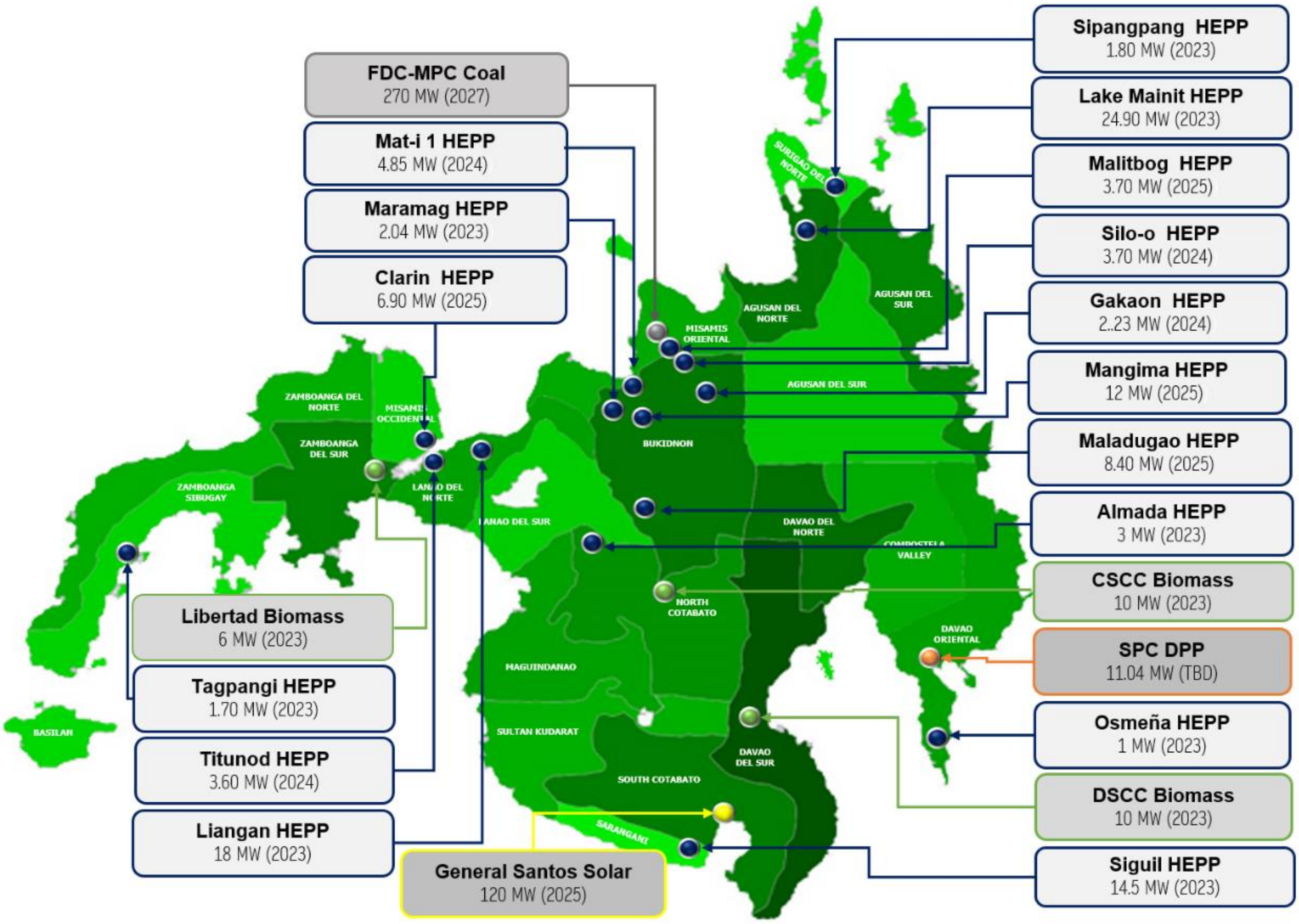


Figure 3.7: Mindanao Committed Power Plants

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:

- Fuel supply/transport
- Topology/geology of site
- Accessibility
- Availability of area
- Availability of cooling water
- Fresh water supply
- Security
- 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 a pre-requisite for the entry of new large capacity plants.

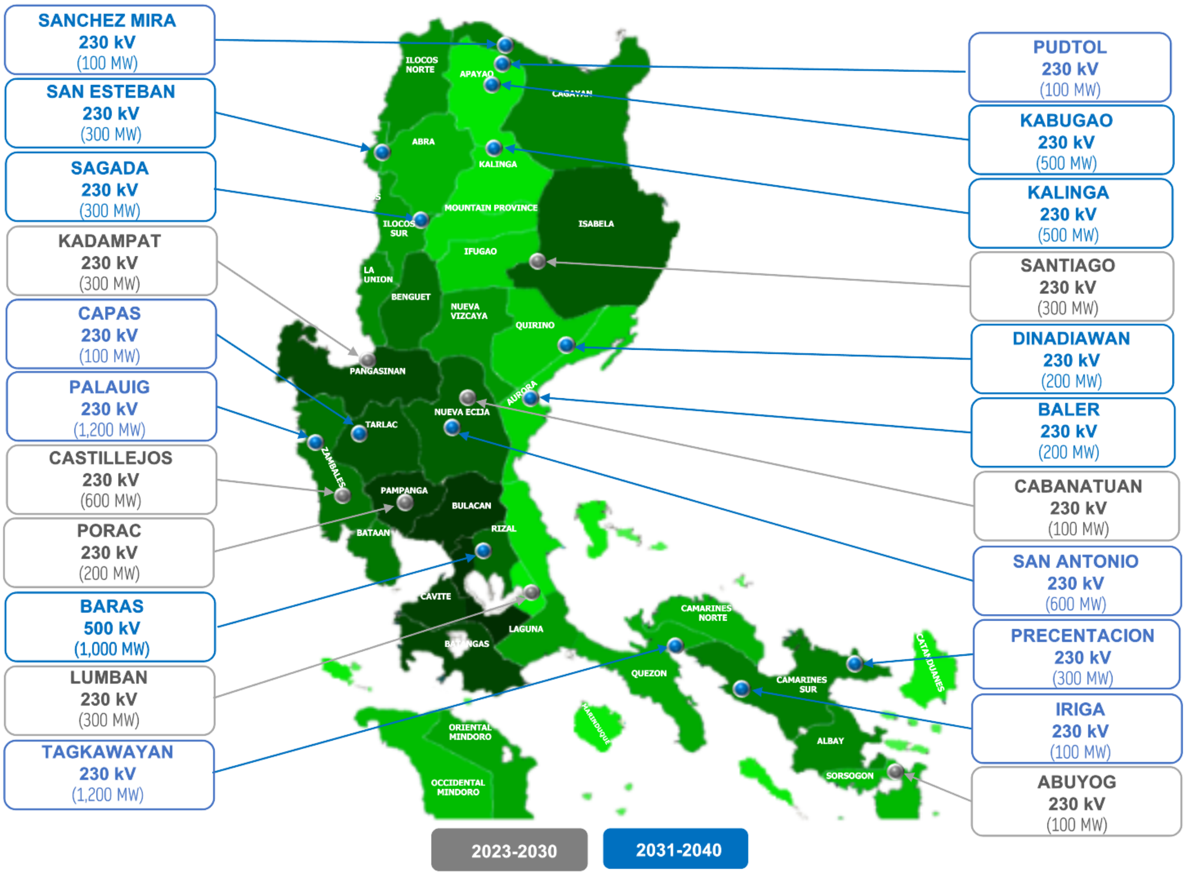


Figure 3.8: Recommended Power Plant Connection Points (Luzon)

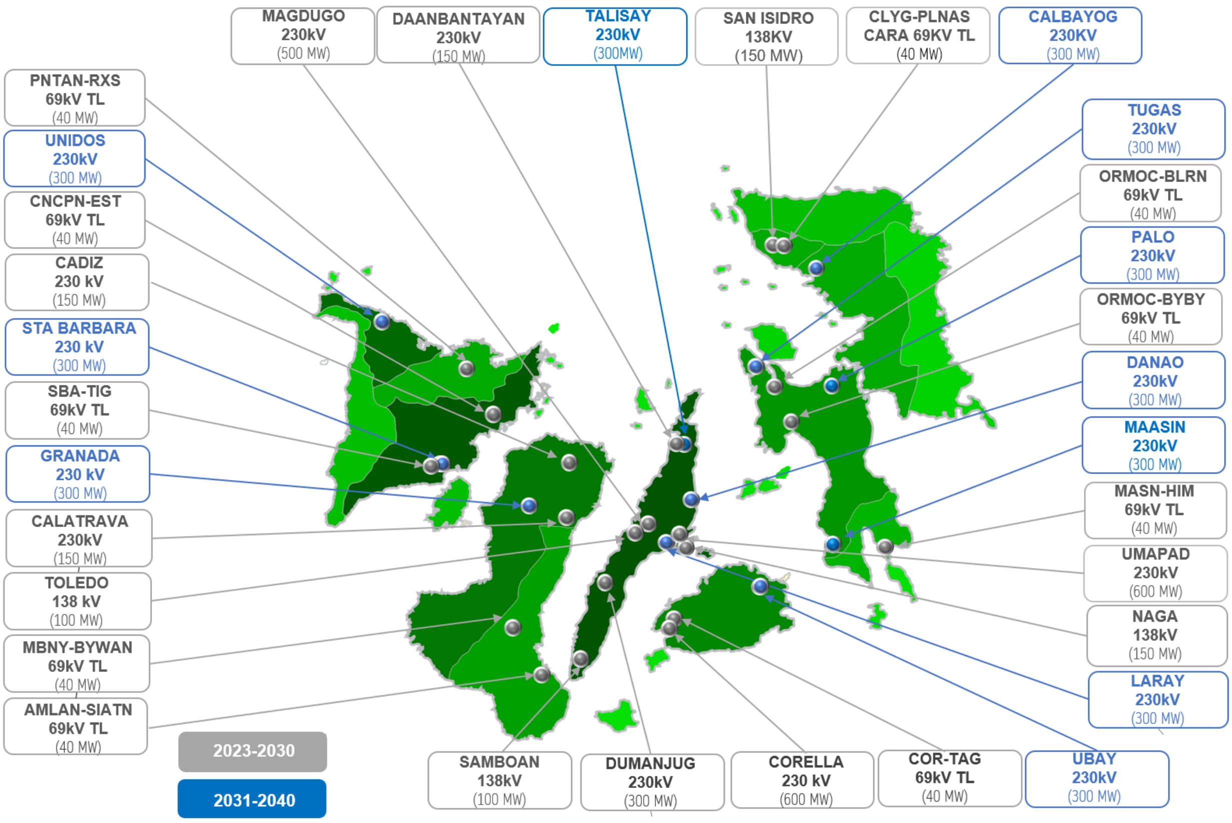


Figure 3.9: Recommended Power Plant Connection Points (Visayas)

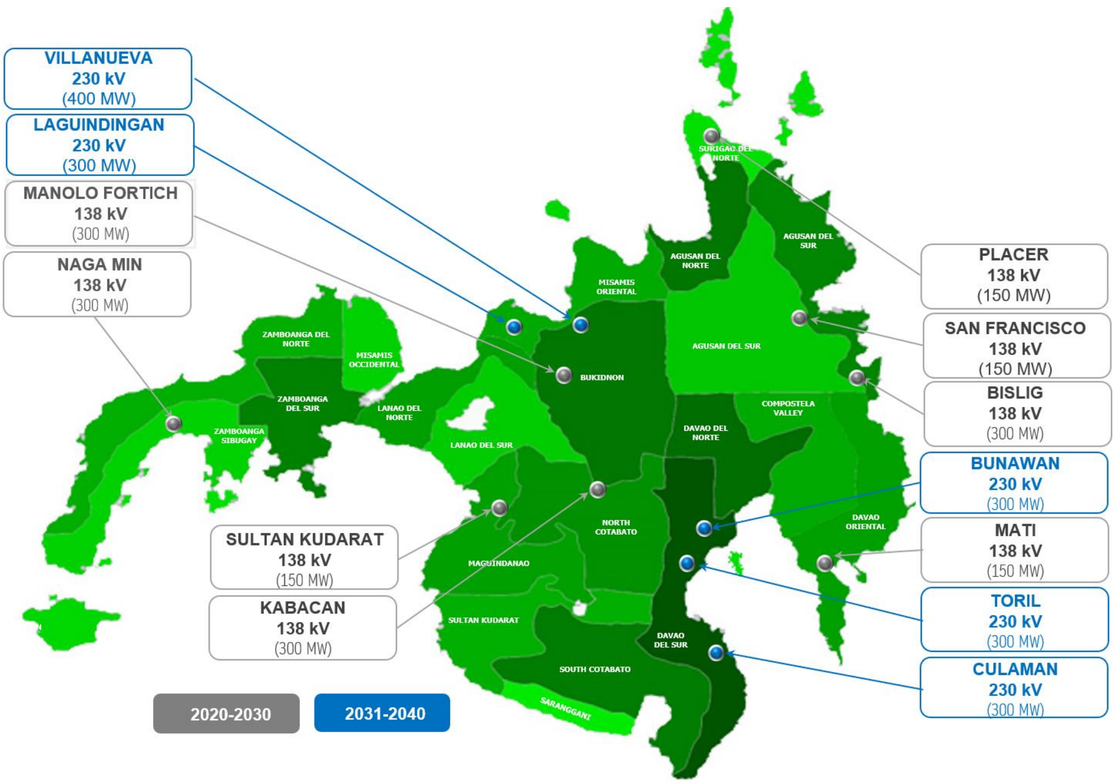


Figure 3.10: Recommended Power Plant Connection Points (Mindanao)

3.6 Project Clustering

To achieve optimal resource utilization, NGCP transmission projects were grouped in different clusters or components based on geographic location to enable sharing of resources, including manpower, project partner/suppliers, and knowledge. With clustering, resources can be optimized which would result in lower costs, better flexibility, and higher productivity.

The table below shows the list of project clusters from Luzon, the Visayas, and Mindanao. A cluster is defined technically as interrelated ventures with similar geographical location, project driver, and purpose based on NGCP's TRANSMISYON 2040:

Table 3.7 Project Clusters and Project Name

Metro Manila Backbone (North) Projects for Resiliency, System Reliability, and Smart Grid Development • Marilao 500kV SS • Marilao–Mexico 230kV TL • Marilao-Navotas 230kV TL (Associated component of Navotas SS) • Navotas–Dona Imelda 230kV TL	**Metro Manila Backbone (South) Project for Resiliency, System Reliability, and Smart Grid Development** • Antipolo 230kV SS • Baras 500kV SS • Luzon Voltage Improvement Project 3 • Manila (Navotas) 230kV SS • Pasay 230kV SS • Silang–Taguig 500kV TL • South Luzon SS Upgrading Project Stage 1 • Taguig 500kV SS • Taguig-Taytay 230kV TL	**Southeastern Mindanao 230/138 kV Backbone Project for Resiliency, System Reliability, and Island Interconnection** • Eastern Mindanao Voltage Improvement Project - MRBD • Maco–Tagum 69 kV TL Project - MRBD • Maco–Mati 138 kV TL - MRBD • Mindanao SS Expansion 4 Project • Mindanao SS Rehabilitation Project • Mindanao SS Upgrading Project
North Luzon 500/230 kV Transmission Projects for Reliability 1 • Bataan 230 kV Grid Reinforcement Project 2 • Castillejos 230kV SS • Dasol 230kV SS - NLRBD • Hermosa–San Jose 500kV TL • Luzon Voltage Improvement Project 3 • Mariveles–Hermosa 500kV TL • Olongapo 230kV SS - NLRBD • San Rafael-San Jose 230kV TL • Western 500 kV Backbone Stage 1 • Western Luzon 500kV Backbone Stage 2	**North Luzon 230/115 kV Transmission Projects for Reliability** • Capas 230 kV SS - NLRBD • Clark–Mabiga 69kV TL • Concepcion–Sta. Ignacia 69 kV TL • Luzon Voltage Improvement Project V • Minuyan 115 kV Switching Station • Nagsaag–Tumana 69 kV TL • North Luzon SS Upgrading Project II • Plaridel 230kV SS • Porac 230 kV SS • San Simon 230kV SS – NLRBD	**Southwestern Mindanao 230/138 kV Backbone Project for Resiliency, System Reliability, and Island Interconnection** • Kabacan SS - MRBD • Koronadal 138kV SS Project • Mindanao SS Rehabilitation Project • Mindanao SS Upgrading Project • Tacurong–Kalamansig 69 kV TL Project-MRBD • Mindanao SS Expansion 4 Project - MRBD • Sultan Kudarat (Nuling) Capacitor • Sultan Kudarat–Tacurong 230 kV TL Project

North Luzon 500/230 kV Transmission Projects for Reliability 2

- Ambuklao–Binga 230 kV TL
- Baler 230kV SS
- Binga–San Manuel 230 kV TL
- Cabanatuan–Sampaloc–Nagsaag 230kV TL
- La Trinidad–Calot 69kV TL
- Luzon Voltage Improvement Project
- Nagsaag–Santiago 500kV TL
- Sampaloc 230kV SS
- Sampaloc Nagsaag–Santiago 500kV TL
- Sampaloc–Baler 230kV TL
- San Manuel–Nagsaag 230kV TL Project

North Luzon 500/230 kV Backbone for Resiliency and System Reliability 3

- Balaoan–Laoag 500kV TL
- Bauang–La Trinidad 230kV TL Upgrading
- Bolo–Balaoan 500kV TL
- Luzon Voltage Improvement Project 3
- Multicircuit Project in Ilocos
- North Luzon SS Upgrading Project
- Northern Luzon 230kV Loop
- Pinili 230kV SS
- San Fabian 230kV SS Project
- Tuguegarao–Lal-lo 230kV TL
- Tuguegarao–Enrile 69kV TL

Northeastern Mindanao 230/138 kV Backbone Project for Resiliency, System Reliability, and Island Interconnection

- Eastern Mindanao 230 kV TL Project
- Mindanao SS Expansion 4 Project
- Mindanao SS Rehabilitation Project
- Mindanao SS Upgrading 2 Project
- Mindanao SS Upgrading Project
- San Francisco–Tago 138 kV TL Project

South Luzon 500/230 kV Backbone Project for Resiliency and System Reliability

- Batangas Mindoro Interconnection
- Calamba-Dasmarinas 230kV TL
- Calamba 230kV SS – SLRBD
- Calaca-Salong 230kV TL 2 Project
- Kawit 230kV SS
- Luzon Voltage Improvement Project 6
- Pagbilao EHV SS - SLMBD
- Pagbilao–Tayabas 500kV TL - SLMBD
- Palawan- Mindoro Interconnection Project
- Pinamukan 500kV SS
- Pinamukan Tuy 500kV TL Project
- Silang 500kV SS
- Tanauan 230kV SS - SLRBD
- Tuy 500/230kV SS (Stage 1)
- Tuy 500/230kV SS (Stage 2)

South Luzon 230/115 kV Transmission Project for Resiliency and System Reliability

- Abuyog 230kV SS - SLRBD
- Batangas–Mindoro Interconnection Project
- Daraga–Bitano 69kV Line - SLRBD
- Eastern Albay 69kV TL
- Luzon Voltage Improvement Project 4
- Luzon Voltage Improvement Project 5 - SLRBD
- Luzon–Visayas HVDC Bipolar Operation Project
- Permanent Restoration of Tower Damaged by Typhoon Tisoy
- Salvacion-Sta. Misericordia 69kV TL
- Salvacion(APEC)–Sto. Domingo 69kV TL
- South Luzon SS Upgrading Project Stage 1
- South Luzon SS Upgrading Project Stage 2
- Tagkawayan 500kV SS - SLRBD
- Tiwi SS Upgrading
- Tower Resiliency of Bicol Transmission Facilities

Northwestern Mindanao 230/138 kV Backbone Project for Resiliency, System Reliability, and Island Interconnection

- Agus 6–Kiwalan–Lugait 69 kV TL Proj - MRBD
- Balo-i-Kauswagan-Aurora 230 kV TL
- Kauswagan-Lala 230kV TL
- Lala–Naga–Zamboanga 230 kV TL Project
- Laguindingan 230kV SS Project
- Mindanao SS Upgrading 2 Project (MSU2P) - MRBD
- Mindanao - Visayas Interconnection Project
- Naga (Min) –Salug 138 kV TL Project
- Mindanao SS Expansion 4 Project
- Mindanao SS Rehabilitation Project
- Mindanao SS Upgrading 2 Project
- Mindanao SS Upgrading Project
- Oroquieta 69 kV Switching Station Proj-MRBD
- Polanco-Oroquieta 138kV TL Project
- Tigbao 138kV SS Project
- Tumaga 138kV SS Project
- Zamboanga Peninsula Voltage Improvement Project (ZPVIP) - MRBD

Metro Cebu 230/138 kV Backbone Project for Resiliency and System Reliability and Island

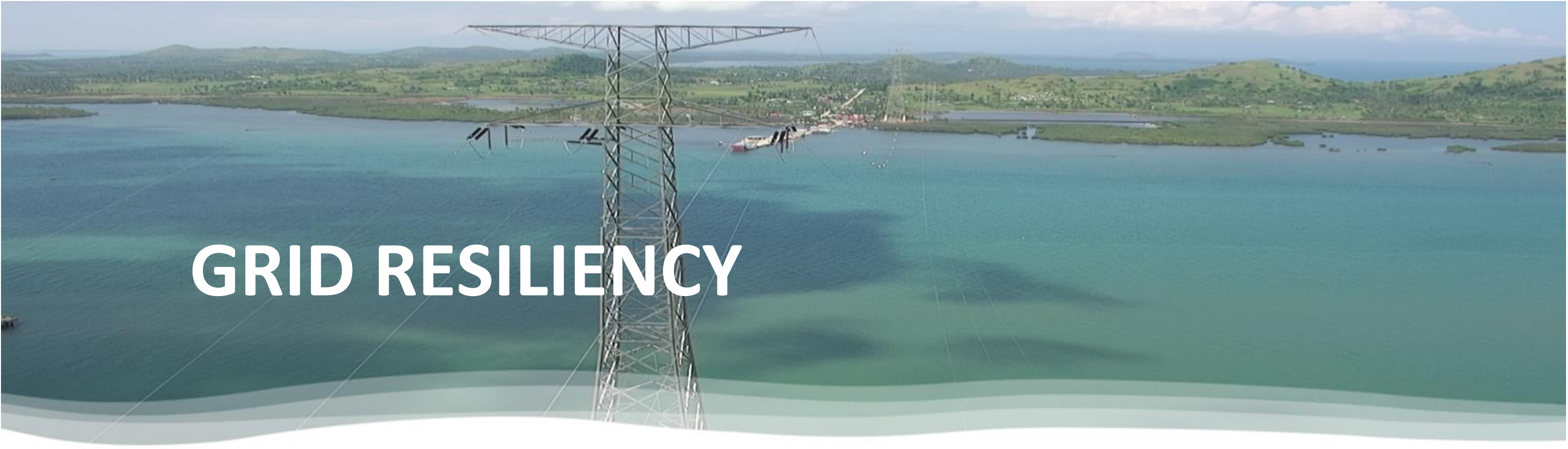
- Danao 230kV SS Project
- Cebu-Bohol 230kV Interconnect Project – VBD
- Cebu–Lapu-Lapu TL
- Cebu–Negros-Panay 230 kV Backbone Stage 1 - VBD
- Cebu–Negros-Panay 230 kV Backbone Stage 2
- Cebu–Negros-Panay 230 kV Backbone Stage 3
- Colon-Samboan Permanent Restoration
- Laray 230 kV SS (Initially energized at 138 kV)
- Laray–Alpaco 230 kV Energization Project
- Laray–Cordova 230 kV Interconnection Project
- Lapu-lapu 230 kV SS Project
- Mindanao-Visayas Interconnection Project
- Naga (Visayas) SS Project (Remaining Works)
- Nivel Hills 230 kV SS Project - VBD
- Visayas SS Upgrading Project 1
- Visayas Voltage Improvement (Stage 1)

Negros and Panay 230/138 kV Backbone Projects for Resiliency, System Reliability, and Island Interconnection

- Amlan–Dumaguete 138 kV TL Project - VBD
- Banga 138kV SS Project
- Barotac Viejo–Natividad 69 kV TL Project - VBD
- Bayawan–Sipalay 138 kV TL (Initially energized at 69 kV)
- Cebu–Negros–Panay 230 kV Backbone - Stage 1 - VBD
- Granada 230 kV SS Project
- Banga 138kV SS Project
- La Carlota 138 kV SS Project
- Nabas–Caticlan–Boracay TL Project - VBD
- Negros–Panay 230 kV Interconnection L2 Proj - VIP
- Tigbauan 138 kV SS Project
- Panay–Guimaras 138 kV Interconnection Project
- Panay–Guimaras 138 kV Interconnection Proj Line 2
- Siaton–Bayawan 138 kV TL (Initially energized at 69 kV)
- Sipalay 138 kV SS Project
- Visayas SS Upgrading Project 2
- Visayas SS Uprading Project 3

Leyte, Samar and Bohol 230/138 kV Backbone Projects for Resiliency, System Reliability, and Island Interconnection

- Babatngon–Sta. Rita 138 kV TL
- Babatngon–Palo 138 kV TL Project
- Bool 138kV SS Project
- Calbayog-Allen TL Project
- Cebu-Leyte 230kV Interconnection Lines 3 and 4 Project
- Corella-Ubay 138kV Line 2 Stringing Project
- Ormoc-Babatngon 230kV TL Project
- Sumangga 138 kV SS Project
- Tagbilaran 69kV SS
- Typhoon Ursula Restoration Project
- Visayas Voltage Improvement Project



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 the high availability of the electricity supply service, while excellent system security gives robustness to the power system to withstand unexpected events that have severe consequences[1].

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 climate change. In 2018, the DOE 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 disruptive events.

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 are summarized as follows:

- Strengthen existing infrastructure facilities
- Incorporate mitigation improvements – "Build Back Better" principle
- Improve operational and maintenance standards and practices
- Develop resiliency standards

4.1.1 Resiliency Planning for Transmission System

In anticipation of the 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[2]. 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:

- New transmission structures to be built using upgraded wind speed design
- Replacement of old transmission lines – stage by stage
- Establishment of transmission backbone loop configuration including the telecommunication network
- Enhanced substation site and transmission line route selection criteria using hazard maps issued by government agencies
- Establishment of spares for Emergency Restoration System (ERS), steel poles, and HVE including mobile transformers
- Flood control at existing Substations, slope protection/concrete bored-pile foundation for existing overhead TL structures

4.1.2 Enhancement of Transmission Line and Substation Site Selection

- In the process for TL route selection, 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.
- For SS sites, the risk of flood or flash flood is carefully assessed, while avoiding areas that are considered possible sources of pollution, e.g., industrial plants/buildings that generate polluted gases, storage areas for explosive or inflammable materials, bulk oil storage tanks, and oil/gas pipelines. If necessary, proximity to seashore is also avoided to prevent or

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

minimize corrosions and depletion or failure of insulations of substation equipment.

- For existing overhead transmission lines that exhibit critical function to the grid and are in areas vulnerable to typhoon and storm surges, the use of HV underground cables will be thoroughly considered.
- Furthermore, NGCP selects overhead TL routes and SS sites that have minimal effect on human settlement or as much as possible, minimize the removal of vegetation or cutting of trees

4.1.3 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). 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.

- OHTLs to be erected in Luzon are recommended to be upgraded to withstand a wind speed of 300 kph to be able to meet the effects of super typhoons occurring due to climate change;
- Existing transmission towers which are designed at 3-second gust wind speed 270 kph should be upgraded or retrofitted to carry higher wind speeds;
- 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.

Based on the latest design of NGCP, a new tower design that can withstand 300 kph wind speed is being adopted and to be implemented for Tower Structure Upgrading of Bicol Transmission Facilities and Tower Resiliency of Bicol Transmission Facilities Projects.

As of the 2022 latest improvements in the transmission towers, there are already 267 at 270 kph design and 147 towers at 300 kph design.

4.1.4 Security of Transmission Assets

In areas with security issues, each proposed transmission project is subjected to security assessment as part of the TL route or SS 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.

4.1.5 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 systems involving 138kV, 230kV, and 500kV lines will be implemented in stages, but part of several segments that will eventually form a transmission loop as the end state.

4.1.6 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 the land is a valuable resource. Securing ROW is a great challenge and aesthetics is a paramount consideration.

4.2 Asset Replacement

NGCP replacement program adopts international best practices 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 the following sub-sections.

4.2.1 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, PCB, 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 estimated life of an asset.

Based on 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 assets. 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.

4.2.2 Asset Prioritization

Prioritization of specific assets shall be based on a calculated health index which shows an estimate of the asset's relative condition. 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.

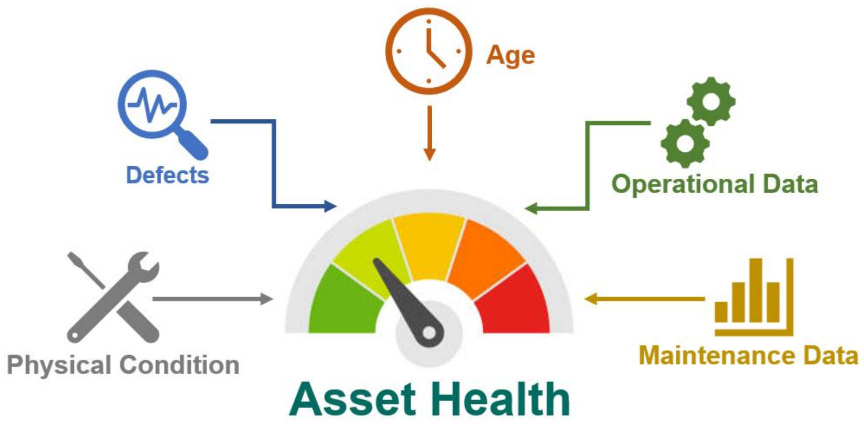


Figure 4.1: Asset Health Composition

4.2.3 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 5 shows the summary of Asset Lives and Figure 4.2 shows the 115 kV to 500 kV OHTL age profile.

The existing asset database was obtained from Enterprise Asset Management (EAM) utilized by NGCP. This software is utilized to monitor and perceive existing major equipment to optimize the utilization of assets and their condition throughout their lifecycle as well as to provide a database for relevant information. 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.

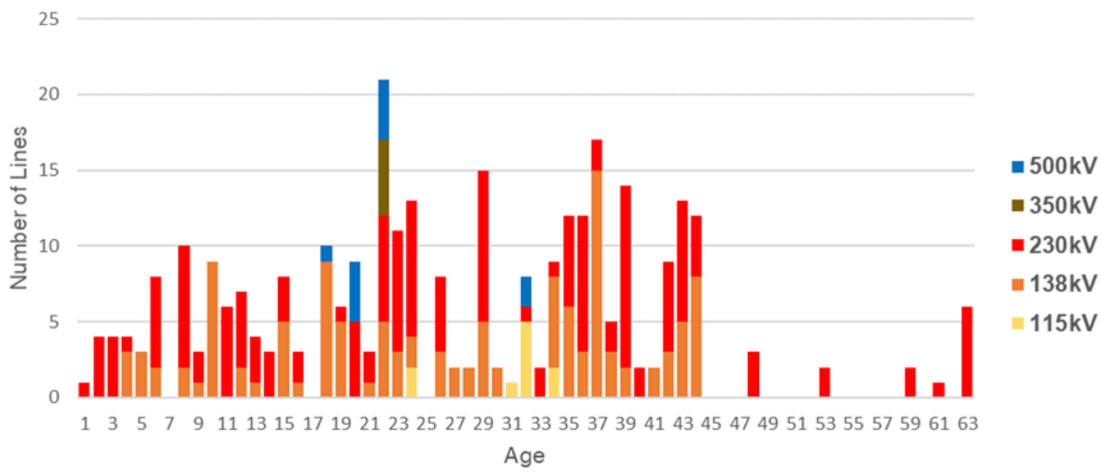


Figure 4.2: Overhead Transmission Line Age Profile (August 2021)

TECHNOLOGY APPLICATION

5.1 Battery Energy Storage System

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 Energy Storage System (ESS) among others. It recognizes that the ESS technologies are applied to serve a variety of functions in the generation, transmission, and distribution of electric energy, which include Energy Generation, Peak Shaving, and AS. The increasing integration of Variable Renewable Energy (VRE) 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.

Among the ESS, the Battery Energy Storage System (BESS) is still considered a new technology in the Philippines with various applications for the transmission system, these are 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 flexible generation. With a focus on large-scale wind and solar power generation connected to the grid, rapidly varying power output depending on many factors results 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 transmission congestion when power demand exceeds the transmission network capability which may lead to a violation of thermal or voltage stability.

5.1.1 NGCP’s Recommended Sites and Capacities for BESS

5.1.1.1 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 3.2 were considered in the system simulation involving BESS.

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

- No overloading of the existing and future equipment and facilities once the BESS are connected and operating as a load and as a generator
- The resulting voltages are within the PGC prescribed limits
- SS termination is available

5.1.1.2 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 the adoption of the best practices in other jurisdictions in determining additional reserves due to rapidly increasing VRE penetration in the grid.

5.1.1.3 List of Recommended Capacities and Sites

The following are the initial lists of recommended capacities and sites of BESS are primarily reserved in Luzon, the Visayas and Mindanao Grids:

Table 5.1 Recommended BESS Capacity (MW) and Sites in Luzon

Substation	Voltage	Recommended BESS Capacity (MW)
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
Luzon	Total Capacity	290

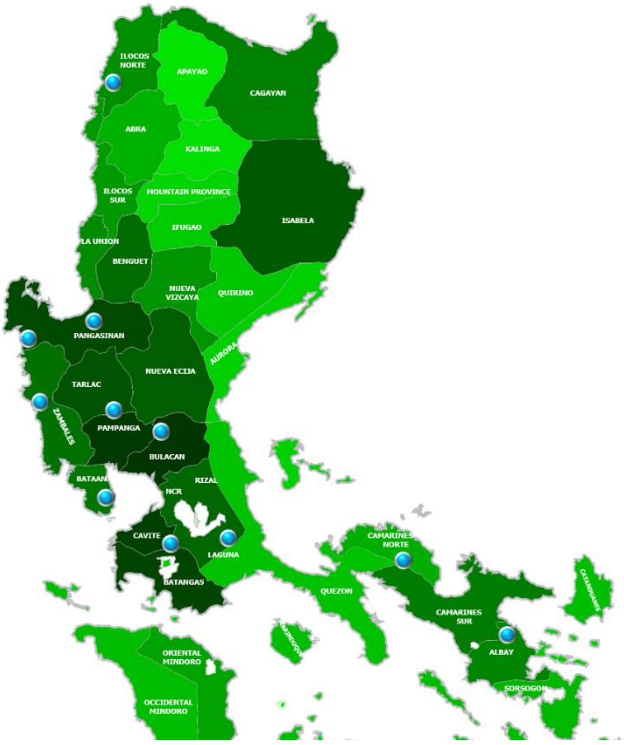
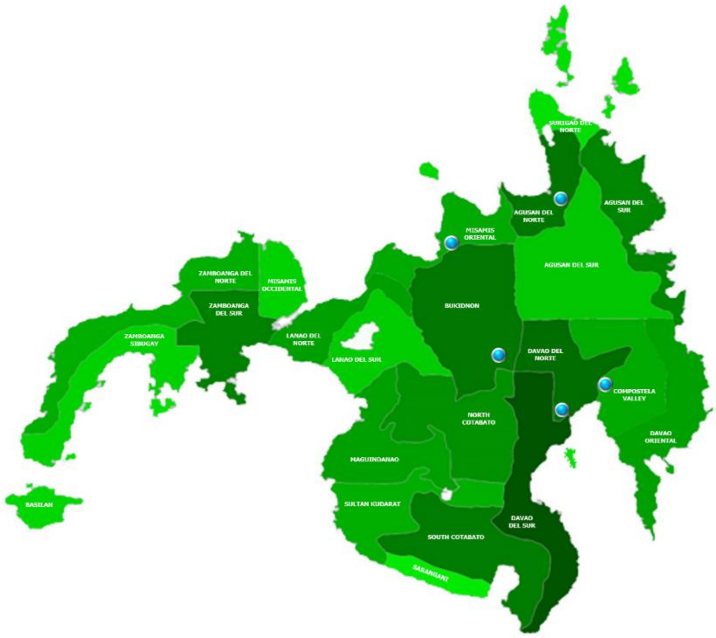


Table 5.2 Recommended BESS Capacity (MW) and Sites in Visayas

Substation	Voltage	Recommended BESS Capacity (MW)
Kabankalan	138 kV	10
Ormoc	69 kV	20
Samboan	69 kV	10
Sta. Barbara	138 kV	10
Compostela	230 kV	20
Visayas	Total Capacity	70

Table 5.3 Recommended BESS Capacity (MW) and Sites in Mindanao

Substation	Voltage	Recommended BESS Capacity (MW)
Villanueva	138 kV	10
Davao	69 kV	20
Maco	69 kV	20
Kibawe	69 kV	20
Butuan	69 kV	20
Mindanao	Total Capacity	90



5.1.2 Committed BESS

Several BESS power plants are included in the DOE list of Committed power plants as of 28 February 2023 as shown in Figures 5.1 to 5.3.

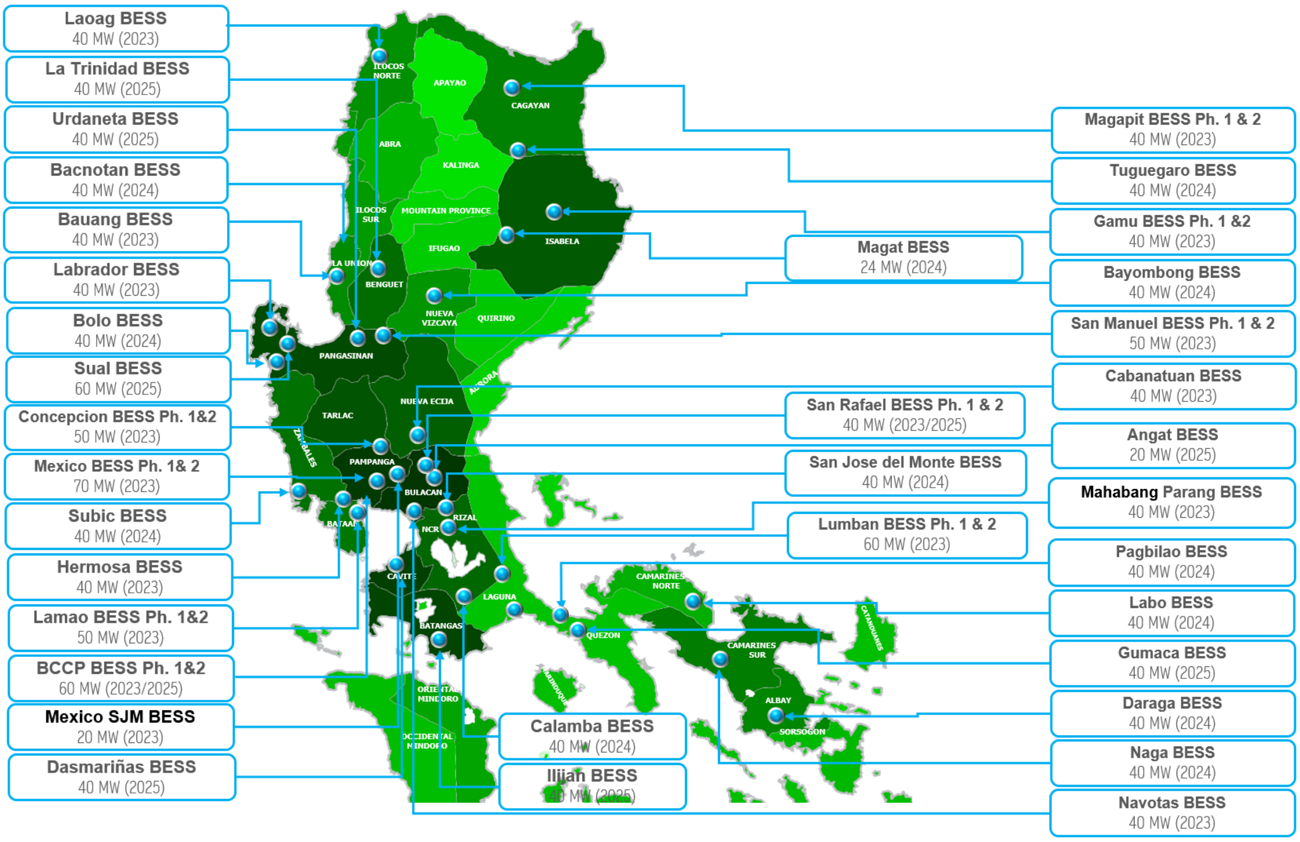


Figure 5.1: Committed BESS in Luzon

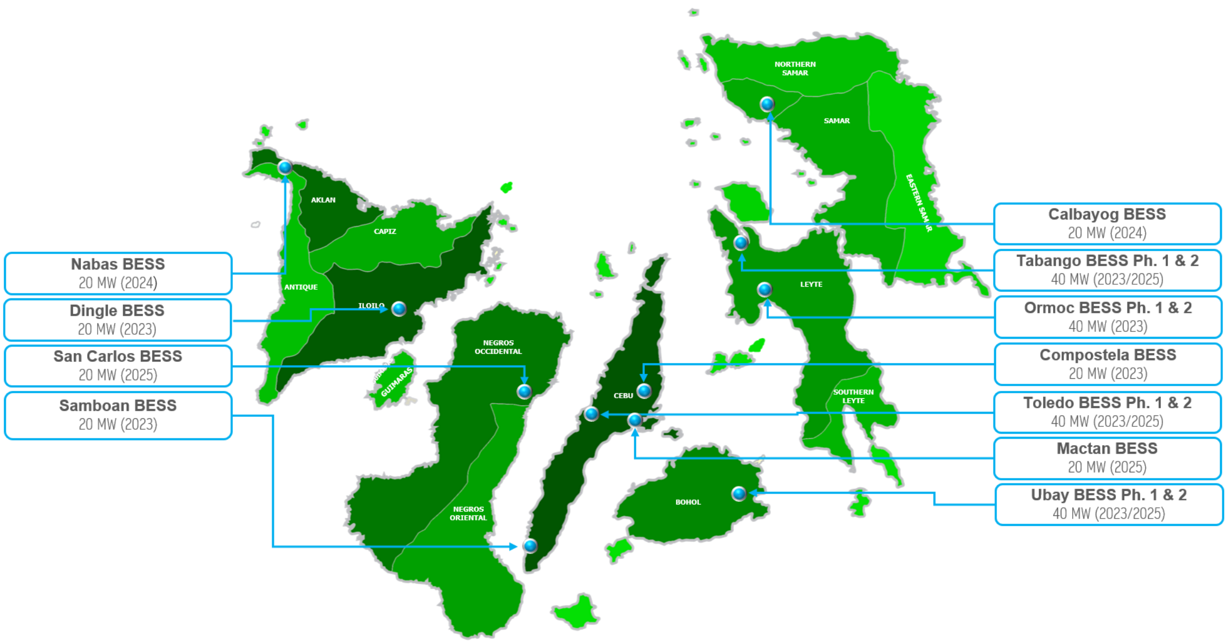


Figure 5.2: Committed BESS in Visayas

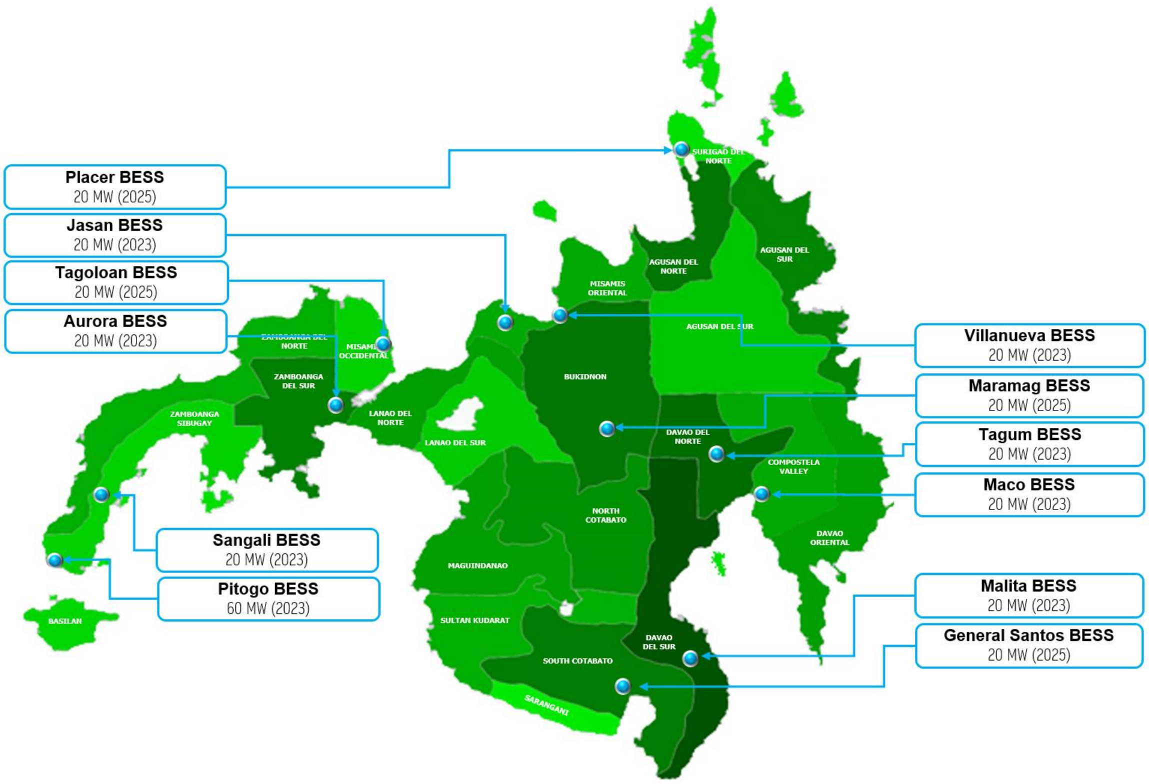


Figure 5.3: Committed BESS in Mindanao

5.2 Adoption of SMART Grid Technologies

There has been continuing research and development over the years toward the 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 a global trend for power utilities.

In the Philippines, with the goal to develop a Smart Grid Policy and Roadmap for the country, the DOE issued on 11 March 2013 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, namely:

- Self-healing grid
- Full implementation of Retail Competition and Open Access (RCOA), Renewable Portfolio Standards (RPS), Green Energy Option (GEOP), and Net Metering
- Full Customer Choice, Demand Response and Peak Load Management
- Optimized Energy Storage Systems (ESS), Energy Management Systems (EMS), and Distribution Energy Resources (DER) Management Systems; Virtual Power Plant Integration
- 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.[3]

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

[3] From IEC Definition of Smart Grid

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.[4]

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 power transmission in the Philippines under the operation of NGCP can be classified into three broad areas: transformation, consolidation, and standardization.

Moreover, for an increased level of observability and controllability for the power grid, NGCP has a 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 project will be the pilot substation with applied smart grid technology.

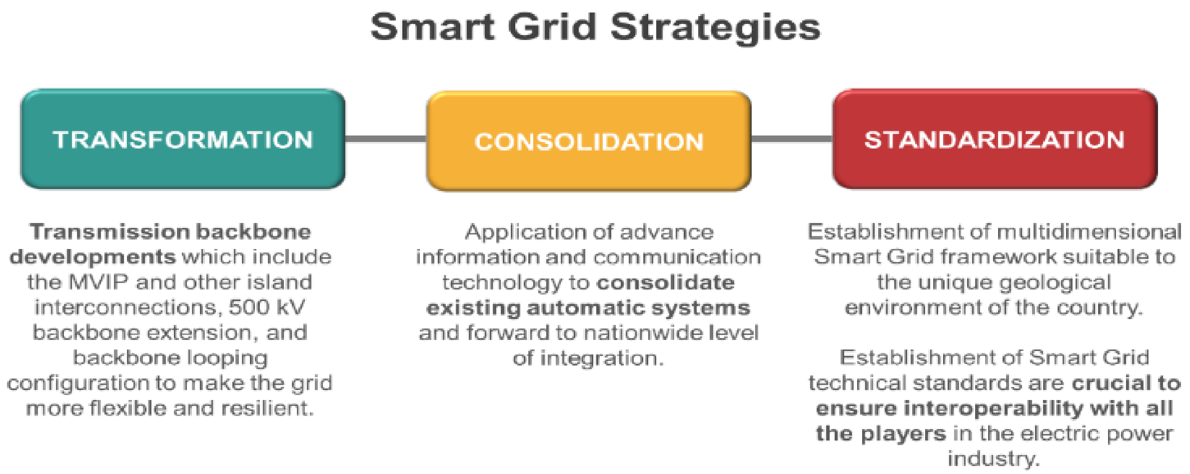


Figure 5.4: Smart Grid Strategies

The need for Smart Grid is rooted in climate change and the need to move to more sustainable sources of Energy. A Smart Grid is one that incorporates information and communications technology (ICT) into every aspect of electricity generation, delivery, and consumption to minimize environmental impact, enhance markets, improve reliability and service, and reduce costs and improve efficiency." [5]

This translates to improved grid security and information management, efficient integration of the connection between generators and load customers, effective response to the needs of the transmission network, and greater reliability and quality of power transmitted by the grid.

In the other words, a SMART Grid aims to

- Support and integrate renewable energy sources like Solar, Hydro and Wind.
- Empower consumers with real-time information about their energy consumption.
- Assist utility companies to reduce moves and outages.

As transmission network provider, NGCP adopts best practices, monitoring and control, data analytics, smart metering, supply reliability, green energy, energy storage integration, security and customer empowerment and satisfaction as shown in Figure 5.4.

[4] From IEC Smart Grid Standardization Roadmap
[5] From Electric Power Research Institute (EPRI)

5

5.3 Static Synchronous Compensator

Static Synchronous Compensator (STATCOM) is a kind of Flexible AC Transmission System (FACTS) device with parallel reactive power compensation. The use of FACTS devices in a power system can potentially overcome the 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. The application of STATCOM in the Zamboanga Peninsula is being proposed to augment voltage support in the area.

Installation of STATCOM in the Zamboanga Peninsula

The 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, the installation of additional Capacitor in General Santos and Tacurong substations will provide additional reactive power support in the network to maintain the system voltage within the nominal voltage during normal conditions and contingencies. The installation of reactive power compensating device is proposed based on the following reasons:

- To balance the reactive power in the system and attain better voltage regulation
- To accept the import of power from distant sources
- To achieve rapid and smooth power factor correction preventing voltage spikes

Figure 5.6 shows the proposed installation of reactive power compensating devices in the Zamboanga Peninsula with 200 MVAR STATCOM in the Zamboanga SS and additional Capacitors in Naga and Pitogo substations.

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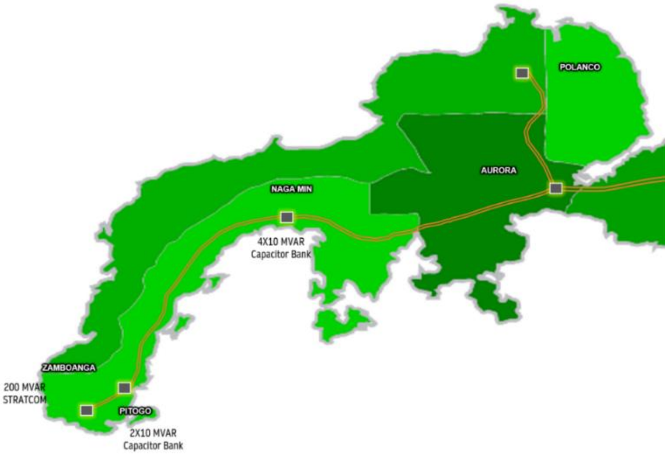

Figure 5.5: Installation of reactive power compensating devices in the Zamboanga Peninsula

5.4 Other Technology

With the continuous advancement in technology, NGCP is open to the adaption of new and developing technologies that have a 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 operations and maintenance.

5.4.1 Aerial Drone for Transmission Line Inspection

The pilot application of TL drone inspection showed positive results in terms of the reduction of inspection time compared to the manual inspection. The output of the drone was sufficient 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. A total of 45 drones have been delivered to different Regions. All the delivered drones have gone through functionality testing and an In-

Figure 5.6: Dasmarinas-Las Pinas 230 kV Line Inspection of parallel groove clamps and insulators for potential deterioration

House Training is facilitated for drone pilots flight assessment.

Since 2019, NGCP continues to upgrade transmission facilities across the country despite the ongoing COVID-19 pandemic by using Unmanned Aerial Vehicle (UAV) and Remotely Piloted Aircraft (RPA) or drone technology. With its high-definition photo and video capabilities, transmission line inspections are efficiently completed within a shorter amount of time, in contrast to the previous practice of climbing transmission towers.

NGCP will continue to roll-out the use of drones around the country as very useful in conducting rapid assessment during emergencies, typhoon-damaged facilities and other disasters. And better monitoring of vegetation along transmission corridors and no boundaries in inspection, with or without ROW issues, the facility can be inspected any time of the day.

5.4.2 Online Monitoring of HVEs

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

- Online Bushing Monitor
- Oil/Winding Temperature
- Online Dissolved Gas Analysis

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

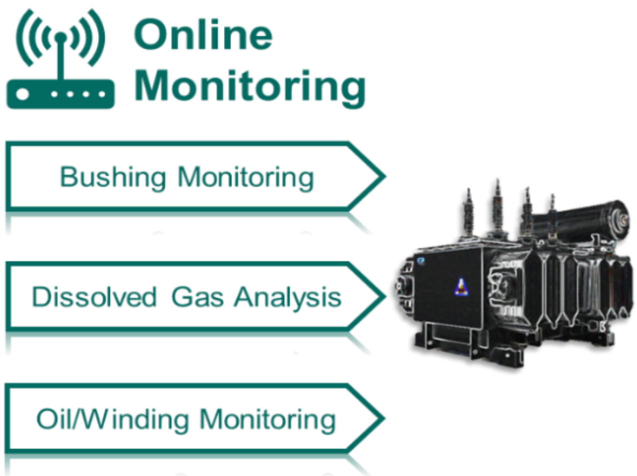

Figure 5.7: Online Monitoring System framework

5.4.3 Central Control Monitoring System (CCMS)/ CCTV

As part of its ongoing efforts to improve energy/power transmission capabilities and bring the country closer to running on a Smart Grid, NGCP will be implementing the CCMS.

The Central Control Monitoring System (CCMS) is a management system that can provide reliability and security of the energy/power transmission system through management and monitoring the supply and delivery of electric energy to its various stakeholders as well as customers through automation.

- To automate the substations and achieve work efficiency by leveraging on technology and equipment.
- To support the organization's plans for automation and the initialization of the SMART Grid operation.
- To improve manpower efficiency and work environment moving forward to SMART Grid system.

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Through the CCMS, NGCP will centralize the operations, control and monitoring of substations in one control center strategically located in every district, improving the operational performance of transmission facilities and provide greater flexibility for expansion.

For the project to be realized, the technical requirements must be met, all Substations should be MBSC compliant, and all manually operated should be replaced by motorized-operated disconnecting/ earthing switches (DS/ES), remote reset of lockout relays, and all connections should be properly wired to prevent mis-operation.

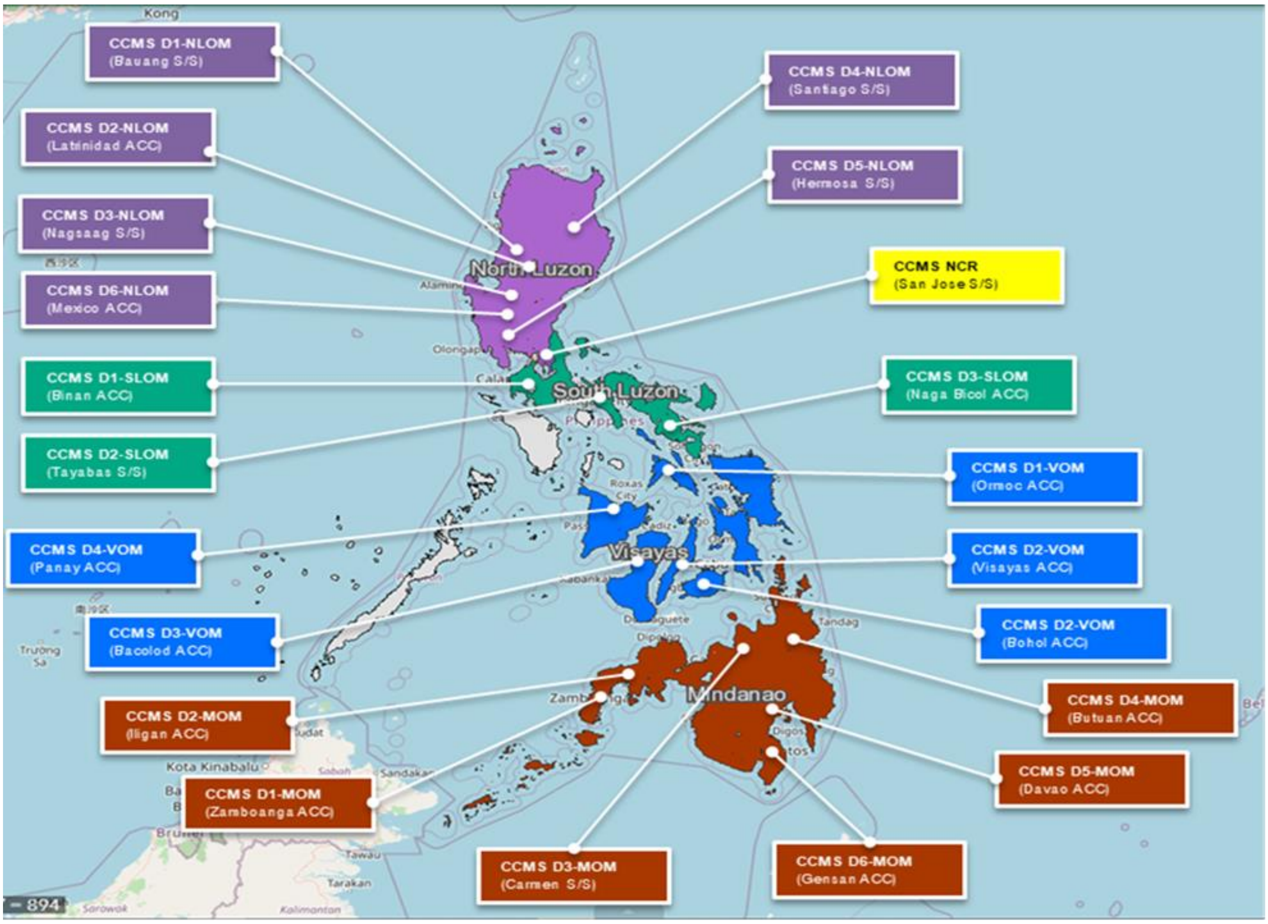


Figure 5.8: CCMS Map with 21 CCMS Station

Once operational, CCMS will be supported by Quick Response Team (QRT). QRT teams will be strategically stationed based on the geographical location of monitored substations to respond immediately during planned maintenance and unplanned outages. The Integration and set-up of our existing substations to CCMS workstations is still in establishment stage and the Pilot CCMS station and QRT implementation can be present through actual demonstration.

At present, we have a total of 138 major Substations all over the country as shown in Table 1.

However, given the rapidly changing world of technology, the adaptation to these new technologies towards digital substations has also been associated with the increased vulnerability to cyber-attacks. With such vulnerabilities, NGCP is continuously improving its cyber-security implementation to provide a more reliable, and secured Power Grid, especially once CCMS is established.

Table 1. Major Substation

Region	No. of CCMS Stations	No. of Link Substation
North Luzon	6	37
NCR	1	7
South Luzon	3	20
Visayas	5	36
Mindanao	6	38
TOTAL	**21**	**138**

Moreover, centralizing the operations control and monitoring in one control center will simplify the operations process, safety and risk reduction, full utilization of the equipment and preparation towards Smart Grid operations. This system will further improve manpower efficiency and maximize the capability of existing equipment.

5.4.4 LiDAR Applications

With the strict compliance to the policies/guidelines incumbent upon the government regulators in forest reservations and protected areas, there is a compelling reason to adapt a technology that will align O&M's activity to the said guidelines by properly managing the affected forestland/protected areas. The fact is that some portions of transmission facilities traverse these forestlands/protected areas which cannot be avoided for economic and technical reasons.

Vegetation, specifically hazard trees, is the number one cause of tripping the flow of electric current to customers through transmission lines which NGCP needs to resolve. NGCP is mandated to ensure the reliability of these transmission facilities. As such, NGCP would like to utilize airborne LiDAR (Light Detection and Ranging) to monitor and determine specific trees/obstructions which shall be cleared along the transmission lines.

In this way, pruning and trimming of danger trees could be done accurately and therefore compliant to the policies and guidelines being imposed by the regulators. Power utilities in the world specifically in the US and Europe have been using LiDAR for some years back since it was made commercially available.

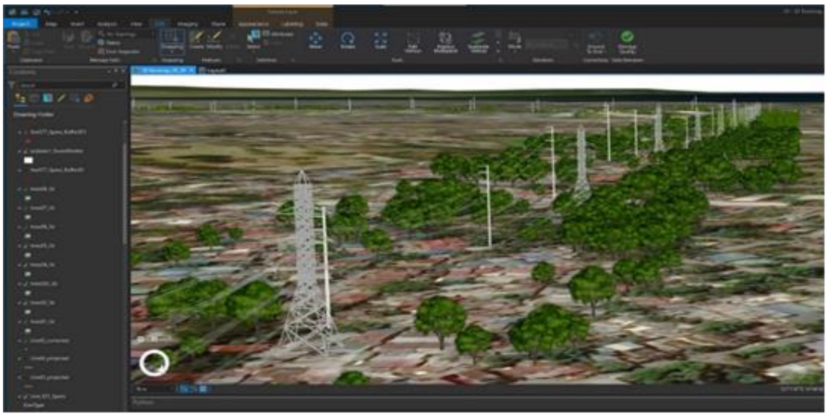


Figure 5.9: LiDAR Applications

LiDAR is a powerful data collection system that provides 3-D information for an area of interest or a project area for various applications:

- Surface mapping
- Vegetation mapping
- Transportation corridor mapping
- Transmission route mapping
- 3-D building mapping

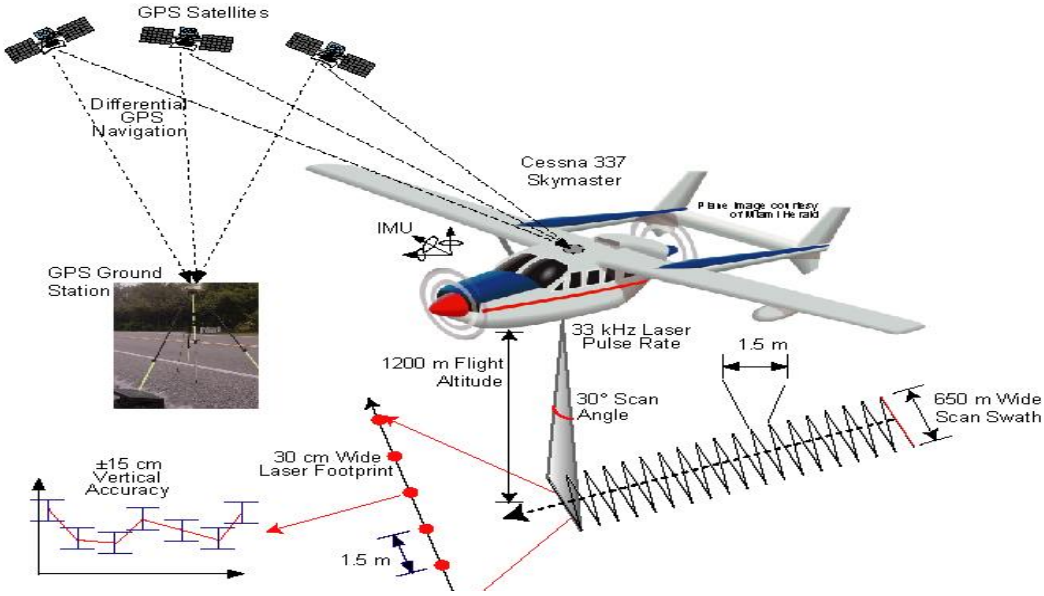


Figure 5.10 LiDAR instrument principally consists of a laser, a scanner, and a specialized GPS receiver.

The accuracy of LiDAR technology is evident and acknowledged by government agencies and the commercial sector. In the future, LiDAR can also assist in wind flow modelling and the pre-construction design for wind farms. LiDAR has the capacity to be a useful laser-based wind profiler device for wind speed measurement and directional data capture, as a tool for resource assessment. LiDAR's remote sensing technology can be utilized for wind mapping applications in the years to come.

5.4.5 Centralized Online Monitoring System (COM

Project Centralized Online Monitoring System (COMS) shall address the need to improve the asset monitoring of Operations and Maintenance (O&M) through centralized data collection and management. It intends to provide a readily available source of information for monitoring and predicting the health condition of a substation equipment. The project platform will be a web-based online application that will be developed in-house. Likewise, the needed project requirements will utilize the existing hardware and software of IT.

Figure 5.11: CCMS Stations Map

The project aims to deliver the following:

- To provide Automatic Online Assessment and Evaluation to determine the overall Health Condition of the Equipment with corresponding maintenance recommendation.
- To serve and provide Real-time information that will guide O&M in the development of Maintenance and Reliability Program
- To have a Centralized Database of all essential maintenance and operational information from different data sources

With the completion of Project COMS, this will form part as one of the tools of Central Control and Monitoring System (CCMS) which is the first step towards unmanned substation.

Further, the data that will be collected will also be used in the Condition-Based Maintenance (CBM) under the Asset Management System.

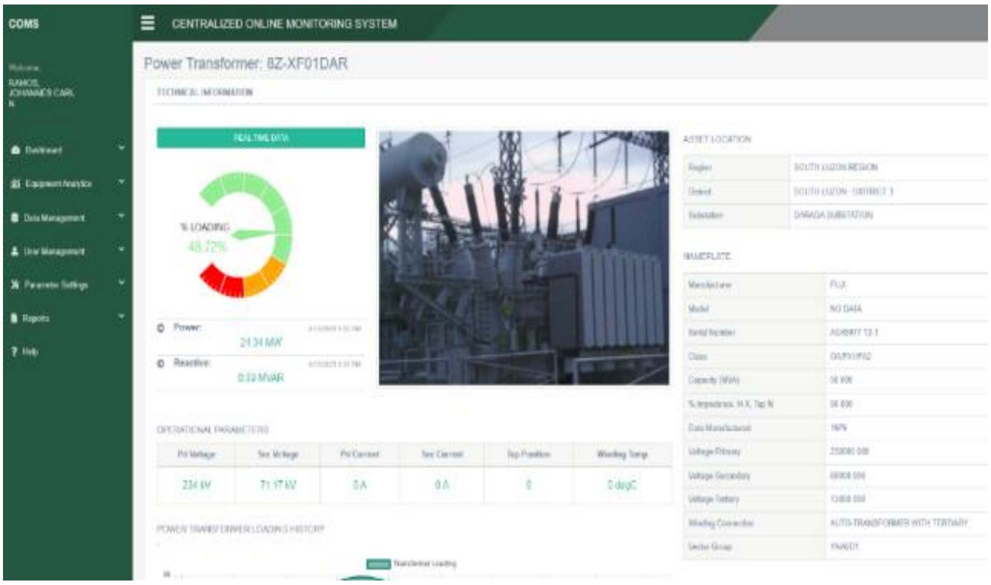


Figure 5.12: Centralize Online Monitoring System Interface

RENEWABLE ENERGY

The Philippines' National Renewable Energy Program (NREP) aims for a 35 percent share of RE in the power generation mix by 2030 and a 50 percent share by 2040. There have been government policies, initiatives, and programs to help realize these goals. Among these measures are the establishment of the Philippine Competitive Renewable Energy Zones (CREZ) and the introduction of the Green Energy Auction Program (GEAP). These measures encourage the participation of private sectors in RE development, thus the influx of RE project proposals, including new and emerging technologies, such as floating solar and offshore wind.

6.1 Philippine Renewable Energy

The general objectives and principles behind the CREZ were adapted from the DOE's Department Circular 2018-09-0027, entitled Establishment and Development of CREZ in the Country. The CREZ Process intends to:

- Identify abundant, high-quality, economic RE resources
- Reduce RE deployment barriers
- Improve national coordination for power system planning
- Enhance opportunities for RE investment

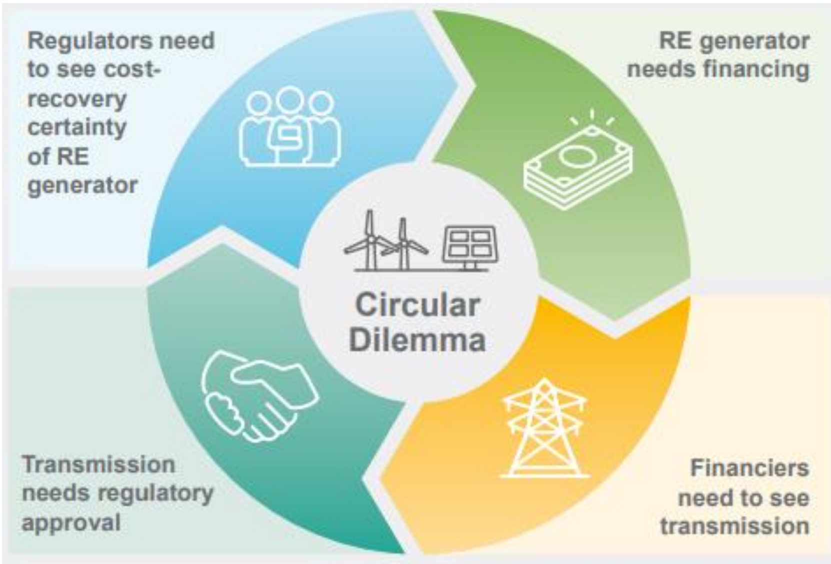


Figure 6.1: Circular Dilemma

The Zone Working Group (ZWG) selected candidate Competitive RE Zones, which are geographical areas that enable the development of profitable, cost-effective, grid-connected RE. These zones were prescreened for high-quality resources, suitable topography, potential land-use constraints, and demonstrated private developer interest, thereby reducing overall feasibility assessment costs. From 34 candidate CREZ, the ZWG selected 25 CREZ in the Philippines.

Since traditional transmission planning could not efficiently support the RE developments mainly due to misalignment in terms of planning and construction time of RE and transmission facilities, both the transmission development and VRE projects go through circular dilemmas when these two do not meet (see Figure 6.1 Circular Dilemma). By evaluating the transmission needs of the system, as opposed to upgrading the system incrementally based on the needs of specific projects, costs will be reduced while amplifying the benefits[6]. As part of the CREZ Process, the Transmission Working Group developed transmission expansion options that could provide sufficient transfer capability to accommodate the CREZ. Shown in Figure 6.2 are the identified CREZ in the Philippines and the associated transmission projects.

For the next phase of the CREZ Process, NREL and USAID will provide technical support to DOE and ERC to prepare a CREZ implementation plan. TransCo and NGCP are also engaged as key stakeholders in this activity. The next phase will cover topics such as CREZ Implementation Support, Improved Energy Storage Modeling and Considerations, and Enhanced Load Modeling and Forecasting for Long-term Power System Planning.

[6] Lee et al. (2020). Ready for Renewables: Grid Planning and CREZ in the Philippines

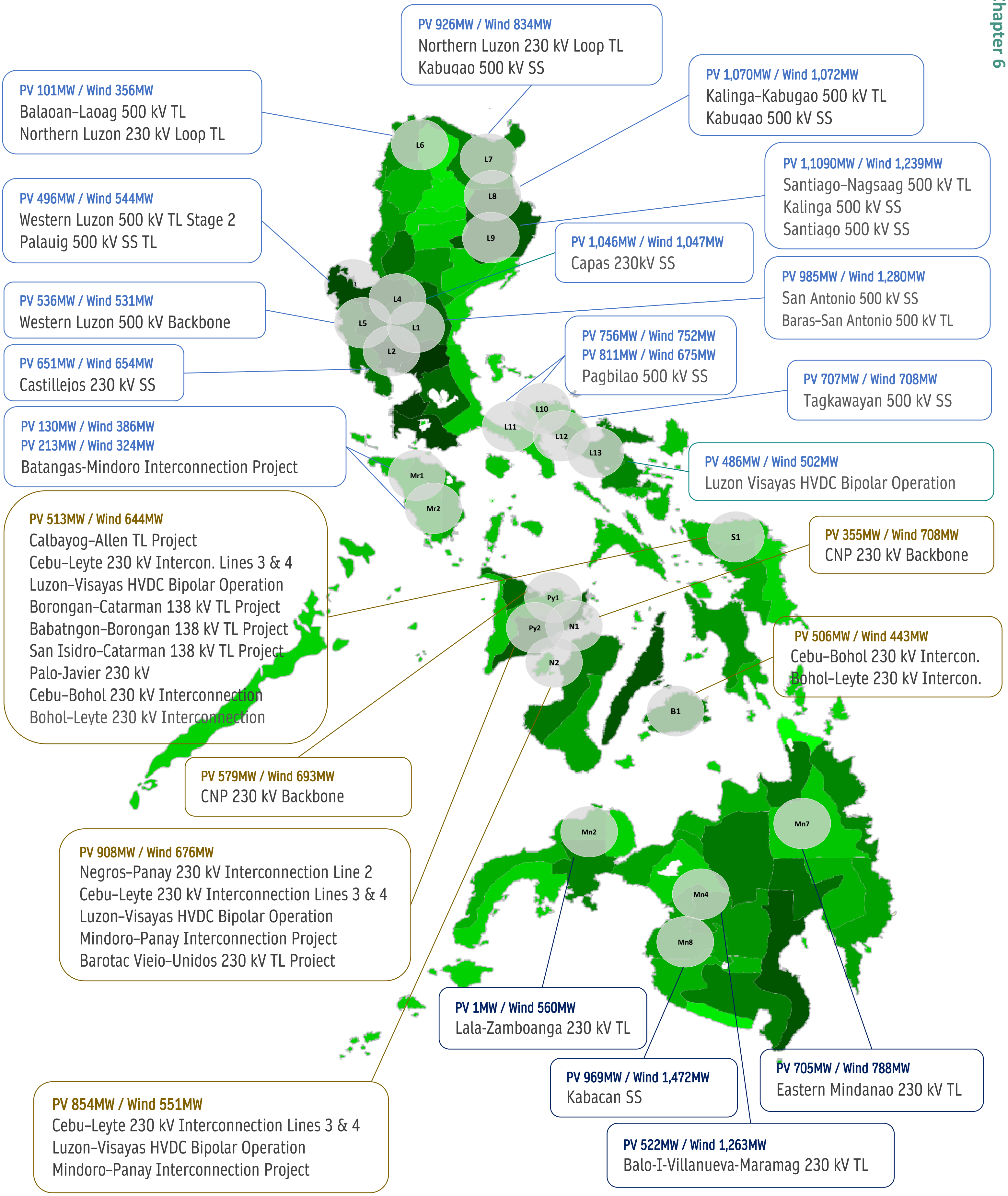


Figure 6.2: CREZ Approximate Location and Associated Transmission Projects

6.2 Offshore Wind Potential in the Philippines.

The DOE and the World Bank Group (WBG) released a new roadmap in April 2022 showing that the Philippines has the potential to install as much as 21 GW of offshore wind power by 2040 and 40 GW by 2050 with the right long-term vision, infrastructure development, investment, and policies.

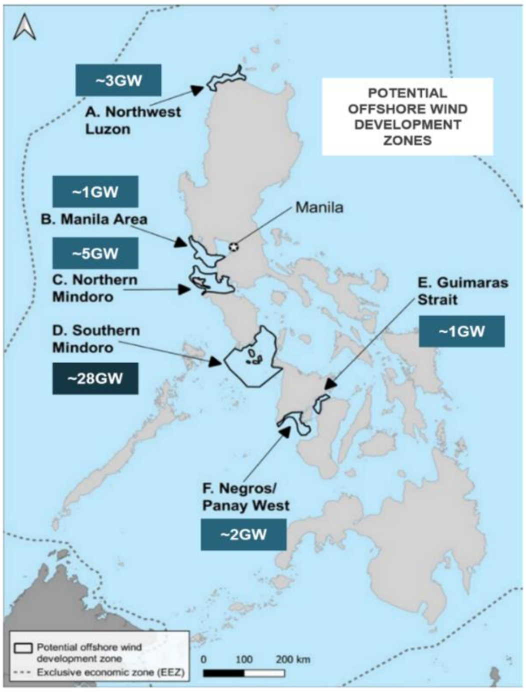
The roadmap was initiated by the World Bank country team in the Philippines under the umbrella of the WBG's Offshore Wind Development Program—which aims to accelerate offshore wind development in emerging markets—and was funded by the Energy Sector Management Assistance Program (ESMAP) in partnership with the International Finance Corporation (IFC).

This roadmap provides a strategic analysis of the offshore wind development potential in the Philippines, considering the opportunities and challenges under different hypothetical growth scenarios. The goal is to provide evidence to support the Government of the Philippines in establishing policies, regulations, processes, and infrastructure to enable the successful growth of this new industry.

The roadmap also provides guidance on actions that must be taken by the government, putting in place a long-term plan for offshore wind until 2050 as part of a decarbonized energy mix; establishing offshore wind development zones through further marine spatial planning; investment in transmission, port and other energy infrastructure upgrades; increasing collaboration with industry and other relevant government agencies; among others.

As of 16 May 2023, The DOE has awarded 65 offshore wind service contracts with an aggregate potential capacity of 51.228 GW. Among the awarded service contracts are offshore wind plants spread mainly in north of Luzon, west of Metro Manila, north and south of Mindoro, Guimaras Strait, Negros and Panay west. The target period of entry of the proposed offshore wind plants is from 2026 to 2033.

It can be noted that the huge potential for offshore wind development is on top of the CREZ capacity earlier established. In effect, the green transmission system as planned would require further modifications, e.g. extension of the 500 kV backbone up north and locating the new 500 kV substation closer to offshore wind locations instead at Laoag, use of 500 kV backbone within Mindoro island instead of 230 kV design only. As tapping the offshore wind resources would require massive transmission backbone development, further coordination with the DOE will be undertaken in updating the transmission build-out. The coordination would include the necessary inclusion of offshore wind in CREZ and update of the generation expansion plan that will serve as guide in the prioritization of generation projects and transmission projects. It is noted that in the High Growth Scenario in the roadmap, the offshore wind capacity by 2040 is 21 GW while the total capacity of offshore wind service contracts is 51 GW. The Offshore Wind Roadmap for the Philippines as published by WBG has initially recommended a "Transmission Vision in the High Growth Scenario for 2050" as shown in the map below.



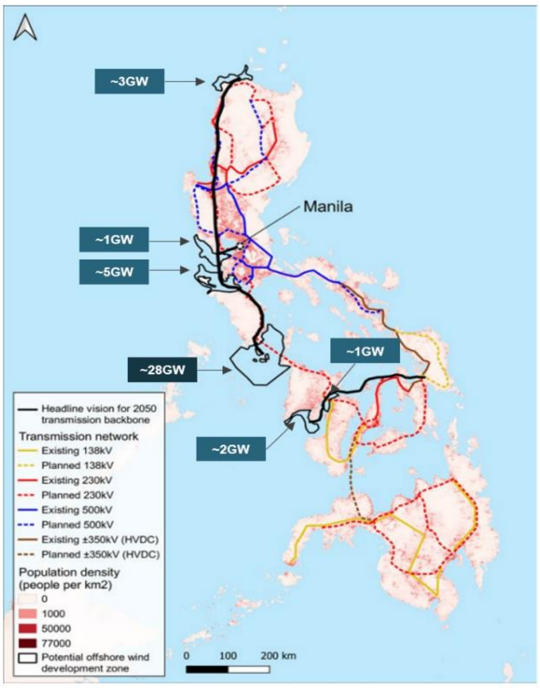


Figure 6.3: World Bank Group Offshore Wind Development Road Map

6.3 Floating Solar in the Philippines

In recent years, floating solar power plants have grown popularity with their main advantage—solving land issues associated with ground-mount solar power plants—as they do not require valuable land space. These are installed where the water is very calm, such as lakes, hydro dam reservoirs, and wastewater treatment ponds.

In its memorandum on 02 February 2022, the Laguna Lake Development Authority (LLDA) offered an initial pre-determined area of about 2,000 hectares in Laguna De Bay for floating solar projects. Based on the memorandum, an RE developer applicant will be allocated a maximum of 100 hectares per block. The location of the solar projects would be 200 meters away from the lake's shoreline, with a 10.5-meter elevation requirement.

With the initial offering of LLDA in Laguna de Bay alone, approximately 2 GW in total will be added to the installed generation capacity in the country. Other locations being explored by the developers include the Mappanuepe Lake in San Marcelino Zambales.

6.4 Green Energy Auction Program

The GEAP was issued on 03 November 2021 through DC No. DC2021-11-0036. It aims to foster greater private sector participation through the transparent and competitive selection process of RE suppliers and to accelerate the development of RE projects, ensuring that projects will be awarded at reasonable costs.

On 17 June 2022, the first auction round of GEAP was conducted through an electronic bidding platform. The first round generated 1,966.93 MW RE capacities from various RE resource types such as hydro, biomass, solar, and wind. The winning bidders will deliver energy from the period 2023 to 2025 at a competitive price lower than or equal to the Green Energy Auction Reserve prices set by the ERC. Table 6.1 shows the list of the first round's winning bidders, corresponding project capacity, and location.

In pursuit of the energy transition goal of the government, the DOE issued the Notice of Auction (NOA) on 27 March 2023 inviting all qualified suppliers to participate in the second round of the Green Energy Auction 2 (GEA-2).

While the GEA-2 is expected to encourage more investments in power generation, it further pursues to promote the growth of renewable energy (RE) as one of the country's primary sources of energy by facilitating transparent and competitive selection of RE facilities to support the major goal of the government of attaining energy security through the entry of new capacities in the grid.

The GEA-2 will offer a total capacity of 11,600 MW installation target, with 3,600 MW for 2024, 3,600 MW for 2025, and 4,400 MW for 2026.

Table 6.1: GEAP First Auction Round's Winning Bidders

Winning Bidders	Capacity (MW)	Project	Location
Luzon			
Solar Philippines Nueva Ecija Corporation	280	Santa Rosa Nueva Ecija 2 Solar Project	Santa Rosa, Nueva Ecija
Solar Philippines Commercial Rooftop Projects, Inc.	200	Concepcion Tarlac 2 Solar Power Project	Concepcion, Tarlac
Solar Philippines Commercial Rooftop Projects, Inc.	450	Tayabas Solar Project	Tayabas, Quezon
Greenergy Solutions Inc.	99.98	Talugtug Solar Project	Talugtug, Nueva Ecija
Cordillera Hydroelectric Power Corporation	60	Kapangan HEPP	Kapangan, Benguet
Hedcor Inc. of the Aboitiz Group	20	Sablan 1 HEPP	Sablan, Benguet
Amihan Renewable Energy Corporation	70	Caparispisan II Wind Project	Pagudpud, Ilocos Norte
Solar Philippines Calatagan Corporation	30	Calatagan Wind Project	Calatagan, Batangas
Bayog Wind Corporation of the Ayala Group	160	Balaoi and Caunayan Wind Project	Pagudpud, Ilocos Norte
CleanTech Global Renewables Inc.	100.8	Kalayaan 2 Wind Project	Laguna and Quezon
PAVI Green Renewable Energy Inc.	40.4	PAVI Green Naga Solar Power Project	Naga, Camarines Sur
Visayas			
Solar Philippines Visayas Corporation	300	Kananga-Ormoc Solar Project	Leyte
Petrowind Energy, Inc.	13.2	Nabas 2 Wind Power Project	Nabas, Aklan
Mindanao			
Philnewriver Power Corporation	3.7	Malitbog HEPP	Malitbog, Bukidnon
Philnewriver Power Corporation	3.7	Silo-O HEPP	Malitbog, Bukidnon
Philnew Hydro Power Corporation.	4.85	Mat-I 1 HEPP	Claveria, Misamis Oriental

Winning Bidders	Capacity (MW)	Project	Location
Philnew Hydro Power Corporation.	6.9	Clarin HEPP	Clarin, Misamis Occidental
Solar Philippines Commercial Rooftop Projects, Inc.	120	General Santos Solar Power Project	General Santos City
Cotabato Sugar Central Company, Inc.	3.4	Biomass Cogeneration Plant	Cotabato

6.5 Grid's Readiness with the Penetration of Renewable Energy Resources

While the projected increase in the penetration of RE resources is encouraging, the intermittent nature of RE resources, particularly VRE, poses new challenges for grid planning and operation. It requires strengthening the transmission network through expansion and upgrades. The development of strong backbones in Luzon, the Visayas, and Mindanao Grids, as well as significant stretches of interconnection lines through submarine cables, are the minimum requirements to ensure energy transmission from various potential RE development zones to the loads throughout the Philippines.

Operational flexibility is also crucial in addressing the additional net-load variability brought by VRE. Advanced forecasting to reduce the uncertainty of VRE and the deployment of more flexible and fast-acting energy storage systems for ancillary service applications are among the options to improve operational flexibility.

NGCP is already considering RE developments in grid planning and operation. Further studies are being conducted to understand the potential impacts of high penetrations of RE and to identify solutions that will address RE integration challenges, ensuring the grid's readiness for the realization of RE goals in the future.

Figure 6.4: Green Energy Transmission System

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 able 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 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:

- Ensure continued quality, reliability, security, and affordability of electric service to end-users
- 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
- Enhance the inflow of private capital and broaden the ownership base of sub-transmission assets
- Provide for the orderly and transparent sale and transfer of sub-transmission 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."

7.2 Age Distribution of 69 kV Lines Nationwide

The 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 the 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.

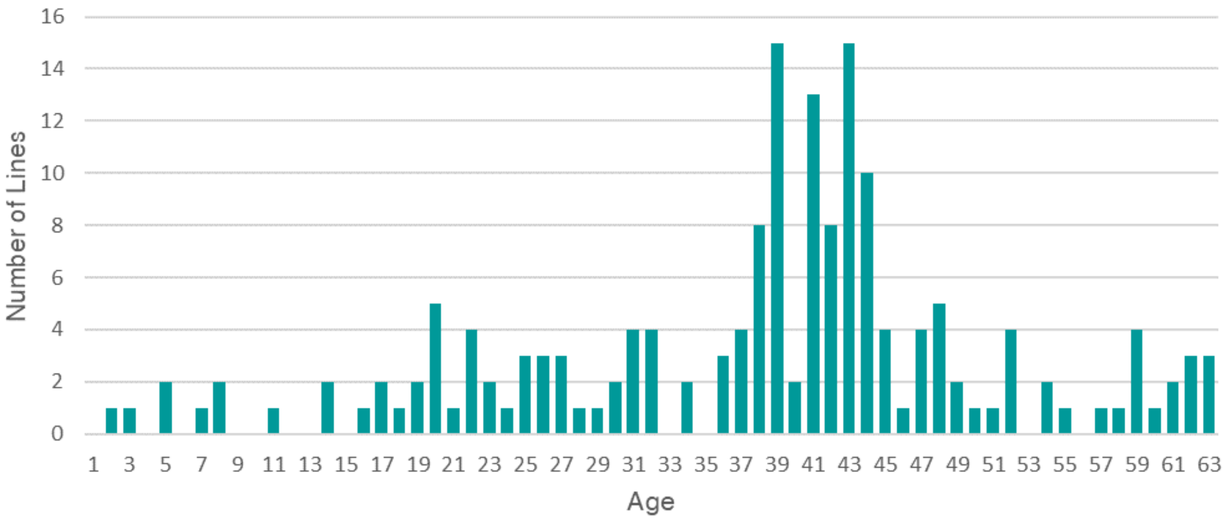


Figure 7.1: Age Distribution/Profile of NGCP-operated 69 kV Lines Nationwide (August 2021)

7.3 Way Forward

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

Short-Term

- Co-location of NGCP-operated 69kV capacitor at DU load-end substations
- Implementation of new 69 kV lines or reconductoring of existing lines
- Installation of RTU at LES to support the market operation
- Relocation of metering location pursuant to ERC Resolution 23, S. 2016

Long-term

- NGCP to develop new 230/69 kV or 138/69 kV substations to serve as an alternate source of the DU
- For all new LES to be developed by DU – capacitor installation to be considered or at least with space provision
- Encourage the distribution utilities to implement additional outgoing 69 kV lines from existing NGCP 69 kV SS.

LUZON TRANSMISSION OUTLOOK

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 the priority site in Taguig City. Being close to the load center, Taguig is a strategic location, but it has major challenges in the construction of its associated 500 kV TL that traverses the portion of Laguna Lake. Another 500 kV drawdown substation will be constructed in Marilao, Bulacan.

Along with the support given to grid integration of new power plants, NGCP is paying special attention to 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 a 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.

As one of the major infrastructures supporting the country'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 the right-of-way (ROW) 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 and Marilao 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 the installation of additional transformers at existing substations or the development of new substations and reinforcements of the 69 kV TL.

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.

8.1 Transmission Outlook for 2023-2030

The major transmission projects covering the years 2023-2030 aim to support the adequacy and reliability of power supply to Metro Manila, which is the country's center of commerce and trade, and accommodate bulk generation capacities in the province of Batangas and in Bataan and Zambales area.

Three major 500/230 kV drawdown substations will be developed around Metro Manila to meet its forecasted load growth. These will be in Taguig City, Marilao Bulacan, and Silang Cavite, which will also be complemented by the development of additional 230/115 kV drawdown substations in Antipolo, Navotas, and Pasay.

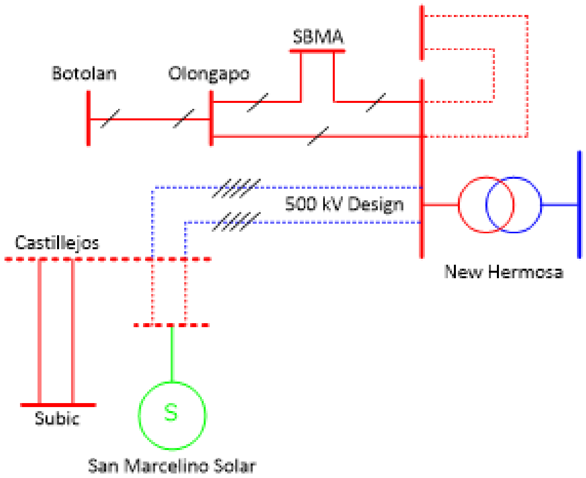
The reliability of power transmission delivery to Metro Manila will be addressed through the development of new transmission corridors in Metro Manila such as the Silang–Taguig 500 kV TL, Taguig–Taytay 230 kV TL.

Outside Metro Manila, several drawdown substations will also be developed to address the forecasted load growth. These are the Lal-lo 230 kV SS (Tuguegarao – Lal-lo 230 kV TL Project) in Cagayan, Pinili 230 kV SS in Ilocos Norte, San Simon and Porac 230 kV SS in Pampanga, Capas 230 kV SS in Tarlac, Kawit 230 kV SS in Cavite, Sampaloc 230 kV SS in Nueva Ecija, Castillejos 230 kV SS in Zambales, Tanauan 230 kV SS in Batangas, and Abuyog 230 kV SS in Sorsogon. In addition to these substations, new 69 kV transmission facilities will also be developed. Second, the development of the Tuy 500 kV SS (Stage 2) will be developed to accommodate the generation capacities in the province of Batangas. The project involves the implementation of the 500 kV-designed Tuy–Silang 500 kV TL. It will also be complemented by the development of a new 500 kV transmission corridor from Pinamucan to Tuy 500 kV SS.

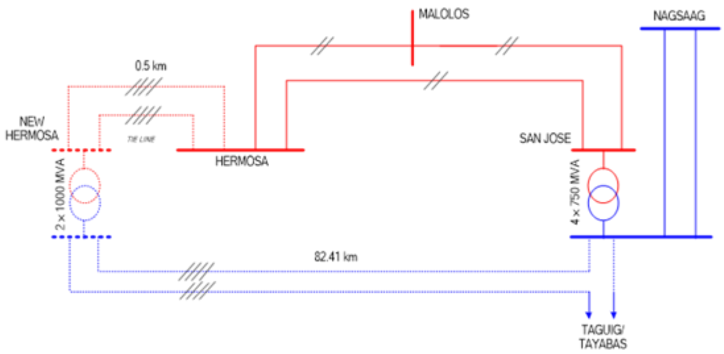
Lastly, to accommodate generation capacities in Bataan and Zambales Area, the Mariveles–Hermosa–San Jose 500 kV TL Projects and Western 500 kV Backbone will be developed.

Table 8.1 List of Luzon transmission projects for the period 2023-2030

TRANSMISSION LINE						
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
500 kV PROJECTS						
Western Luzon 500 kV Backbone (Stage 1) The project aims to 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. It involves the implementation of a 34 km DC 500 kV designed TL from Castillejos to Hermosa. This facility will be initially energized at 230 kV voltage level and will connect to the proposed Castillejos 230 kV SS to accommodate the proposed VRE plants in Zambales Area. The 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 SS.	• Generation Entry • ERC-approved	• Hermosa (Balsik) 500 kV SS: 4-500 kV PCB and associated equipment.	• Castillejos–Hermosa 500 kV TL: ST-DC, 4-410 mm² TACSR/AS, 34 km.	2,281M	Bataan, Zambales	Dec 2023

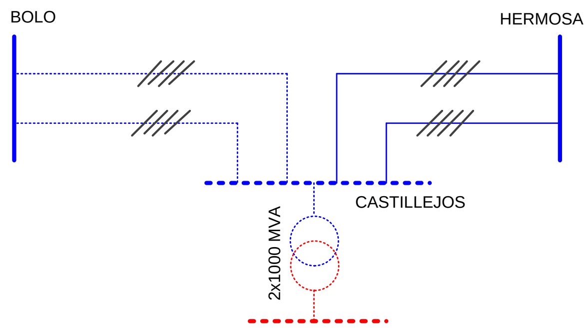


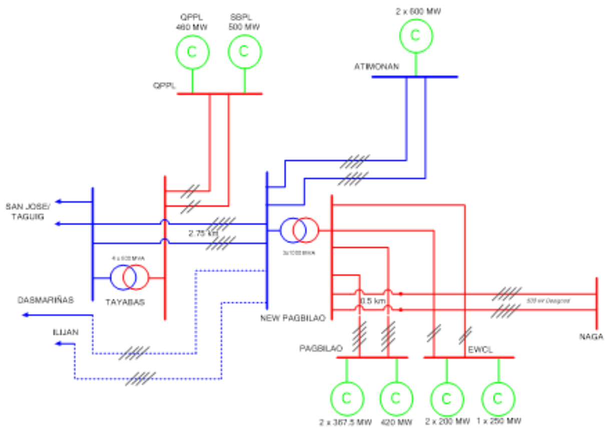
Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Hermosa–San Jose 500 Transmission Line The project aims to accommodate the generation capacity additions in Bataan and Zambales area. It will serve as a new 500 kV corridor for the bulk power generation coming from the existing Limay CCPP, Petron RSFF, Subic Enron DPP, Mariveles CFPP, and the programmed generation capacity	• Generation Entry • ERC-approved	• Balsik (Hermosa) 500 kV SS: 2x1000 MVA, 500/230 kV Power Transformer, 10-500 kV PCB and associated equipment, 10-230 kV PCB and associated equipment, 2-230 kV Definite Purpose PCB and associated equipment, 2x60 MVAR, 500 kV Shunt Reactor, 1x90 MVAR, 500 kV Line Reactor, 2x100 MVAR, 230 kV Shunt Capacitor • Hermosa 230 kV SS: 1-230 kV PCB and associated equipment	• Hermosa-San Jose 500 kV TL: ST-DC, 4-410 mm² TACSR/AS, 82.41 km. • New Hermosa-Old Hermosa Tie Line: SP-DC, 4-795 MCM ACSR, 0.5 km.	15,035M	Bataan, Bulacan	Aug 2023



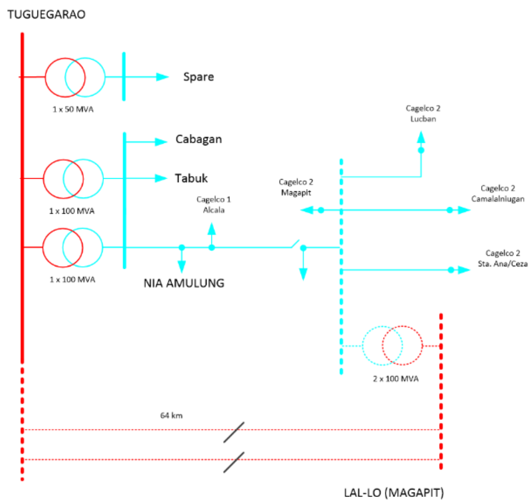
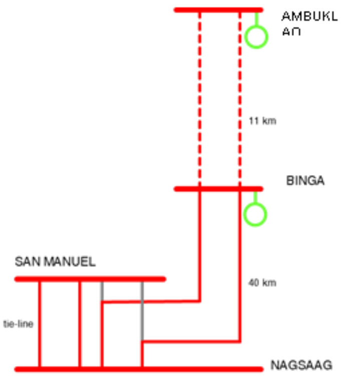
TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
additions which include San Marcelino Solar Plant and SMC CFPP. The project involves the development of a new Hermosa 500 kV SS and construction of a 500 kV TL from the new Hermosa 500 kV SS up to the San Jose 500 kV SS.						
Bataan–Cavite Transmission Line Feasibility Study The project 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.	• Generation Entry • ERC-approved	• Power System Study • Feasibility Study		194M	Bataan, Cavite	Jun 2023
Western Luzon 500 kV Backbone (Stage 2) The project aims to accommodate the incoming bulk generation entry in North Luzon, which complements the proposed Balaoan–Laoag 500 kV Line, Bolo–Balaoan 500 kV Line and Santiago–Nagsaag 500 kV Line. It involves the construction of a 500 kV, 4-410 mm2 TACSR, ST-DC, 174 km TL from Castillejos to Bolo SS. In addition, the Castillejos–Hermosa 500 kV Line, which is energized at 230 kV voltage level, is to be energized at 500 kV. Lastly, 2x1000 MVA 500/230 kV transformers is to be installed in Castillejos 500 kV SS.	• System Reliability • Filed to ERC	• Castillejos 500 kV SS: 2x1,000 MVA, 500/230 kV Power Transformers 14-500 kV PCB and associated equipment. 2x90 MVAR, 500 kV Shunt Reactor, 2x60 MVAR, 500 kV Line Reactor • Castillejos 230 kV SS: 2x200 MVAR, 230 kV Shunt Capacitor, 4-230 kV PCB and associated equipment Bolo 500 kV SS: 5-500 kV PCB and associated equipment 4-230 kV PCB and associated equipment • Hermosa 500 kV SS: 4-500 kV PCB and associated equipment	• Castillejos–Bolo 500 kV TL: ST-DC, 4-410 mm^2 TACSR, 174 km	19,043M	Pangasinan, Zambales	Dec 2025
Pagbilao–Tayabas 500 kV Transmission Line The project aims to allow the connection of the 2x600 MW Atimonan CFPP Project of Atimonan One Energy Corporation to the Luzon Grid. It involves the construction of a 21 km, ST-DC, 4-795 MCM ACSR/AS Extra High Voltage (EHV) transmission facility. It also includes the transfer of the Dasmariñas/Ilijan 500 kV Line from Tayabas 500 kV SS to Pagbilao 500 kV SS.	• Generation Entry • Filed to ERC	• Pagbilao 500 kV SS: 4-500 kV PCB and 4-230 kV PCB and associated equipment, 1x30 MVAR Line Reactor and associated equipment	• Dasmarinas/Ilijan 500 kV TL Extension: ST-DC, 4-795 MCM ACSR, 21 km • Naga 230 kV TL Extension: ST-DC, 4-795 MCM ACSR, 1.5 km	7,706M	Quezon Province	Mar 2028



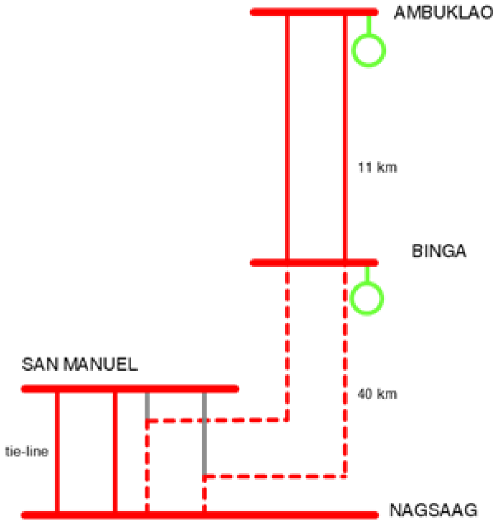


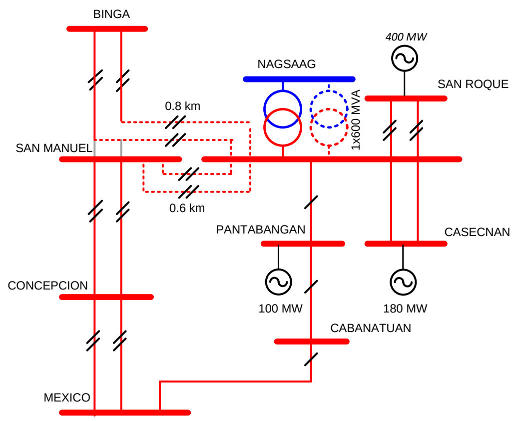
TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
230 kV PROJECTS						
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 several steel poles in 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 steel poles structures along the road 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.	• System Reliability • ERC-approved		• Hermosa–Duhat 230 kV TL: 230 kV, SP-SC, 2-795 MCM, 20 steel poles 	234M	Bataan	Dec 2023
Tuguegarao–Lal-lo 230 kV Transmission Line The project aims to address the imminent overloading of the Tuguegarao–Magapit 69 kV Line due to the forecasted load growth in the northern part of Cagayan Province. The project also aims to improve the power quality and reliability of supply in the area which is presently being served by a long 69 kV line. This project will 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 DC 230 kV TL from Tuguegarao to Lal-lo and the development of Lal-lo 230/69 kV SS with a capacity of 2x100 MVA.	• Power Quality and Load Growth • ERC-approved	• Lal-lo 230 kV SS: 2x100 MVA 230/69-13.8 kV Transformers, 6-230 kV PCB and associated equipment, 8-69 kV PCB and associated equipment • Tuguegarao 230 kV SS: 3-230 kV PCB.	• Tuguegarao–Lal-lo 230 kV TL: ST-DC, 1-795 MCM ACSR, 64 km. 	2,689M	Cagayan	Sep 2024
Ambuklao–Binga 230 kV Transmission Line Upgrading Project The project aims to upgrade the existing line to address its old age condition and 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, the project aims to prevent the overloading	• System Reliability • ERC-approved	• Ambuklao 230 kV SS: 7-230 kV PCB and associated equipment	• Ambuklao–Binga 230 kV TL: ST/SP-DC, 2-410 mm^2 TACSR, 11 km. 	791M	Benguet	Aug 2024

TRANSMISSION LINE

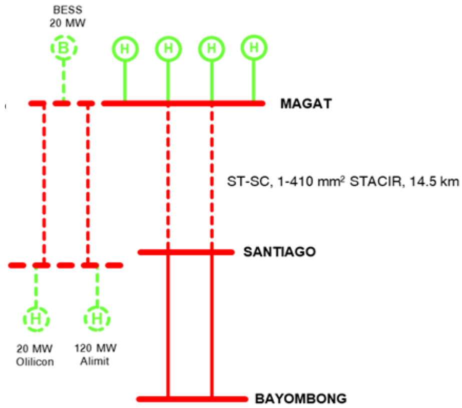
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
under N-1 contingency conditions, i.e, outage of one 230 kV circuit. The project involves the construction of 11 km, 230 kV, DC line, steel tower TL 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.						
Binga–San Manuel 230 kV Transmission Line The project upgrading aims to provide N-1 contingency during the maximum dispatch of the generating plants, particularly HEPPs, in north Luzon. The existing line, as well as the PCB at Binga SS, 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 DC Binga–San Manuel 230 kV TL using a new ROW, including the installation of switching facilities at Binga and San Manuel SS.	• System Reliability and Generation entry • ERC-approved	• San Manuel 230 kV SS: 2-230 kV PCB and associated equipment • Binga 230 kV SS: 1x50 MVA 230/69kV Transformer, 14-230 kV PCB and associated equipment	• Binga–San Manuel 230 kV TL: ST-DC, 2-410 mm^2 TACSR, 40 km.	2,636M	Benguet	Aug 2024
San Manuel–Nagsaag 230 kV TL The project aims to address the overloading of the San Manuel–Nagsaag 230 kV tie line, Pantabangan–Cabanatuan 230 kV Line, and the Nagsaag 500/230 kV transformer. During Maximum North condition and the hydro plants are maximized, outage of the San Manuel–Nagsaag 230 kV tie line will result in the overloading of the SC Pantabangan–Cabanatuan 230 kV line. Conversely, the outage of the Pantabangan–Cabanatuan 230 kV line will result in the overloading of the San Manuel–Nagsaag 230 kV tie line. Furthermore, during Maximum South	• System Reliability • ERC-approved	• Nagsaag 500 kV SS (Expansion): 1x600 MVA, 500/230-13.8 kV Transformers, 2-500 kV and 8-230 kV PCB and associated equipment, • San Manuel 230 kV SS (Expansion): 3-230 kV PCB and associated equipment.	• San Manuel–Nagsaag 230 kV Tie-Line Upgrading: SP-DC, 2-410 mm^2 TACSR/AS, 0.6 km • Binga 230 kV TL Extension: SP-DC, 2-795 MCM ACSR/AS, 0.8 km.	1,793 M	Pangasinan	Dec 2025



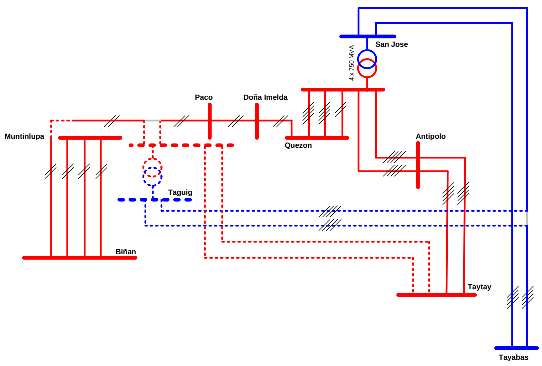


TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
condition and the hydro plants are minimized or completely not operating, the San Manuel 500/230 kV transformer will serve as a drawdown SS in central Luzon. The outage of one circuit of the Nagsaag–San Jose 500 kV line will result in the overloading of the 1x600 Nagsaag 500/230 kV transformer. The Project involves the installation of an additional 600 MVA 500/230-13.8 kV transformer at Nagsaag EHV SS and construction of the new San Manuel–Nagsaag 230 kV Tie-Line.						
Santiago-Magat 230 kV Transmission Line Reconductoring The project aims to upgrade the existing Santiago–Magat 230 kV TL to accommodate new generation plants that will be connected in Magat 230 kV Switchyard, such as the ±20 MW Magat BESS, 120 MW Alimit Hydro Plant and the 20 MW Olilicon HEPP. The project involves the reconductoring of Santiago-Magat 230 kV TL from ST-DC, 1-795 MCM ACSR to 1-410 mm2 Super Thermal Alloy Conductor Invar Reinforced (STACIR)	• Generation Entry • System Reliability and Security	• Santiago 230 kV SS: 3-230 kV PCB and associated equipment • Magat 230 kV SS: 6-230 kV PCB and associated equipment	• Santiago–Magat 230 kV TL, ST-DC, 1-410 mm^2 STACIR, 14.5 km	2,627M	Isabela	Jun 2025



Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Taguig–Taytay 230 kV Transmission Line The project aims to address the overloading of the Taguig-Paco 230 kV TL segment during N-1 contingency under maximum south generation condition specifically with the incoming generating plants in the provinces of Batangas and Quezon. The project involves the construction of a 230 kV line from the proposed Taguig SS to Taytay SS. Taytay SS will be expanded for up to two bays to allow the termination of the incoming lines from the proposed Taguig SS.	• Load Growth • System Reliability and Security • Filed to ERC	• Taytay 230 kV SS: 6-230 kV PCB and associated equipment	• Taguig–Taytay 230 kV TL: SP-DC, 2-610 mm^2 TACSR, 10 km	3,360M	Rizal	Dec 2030

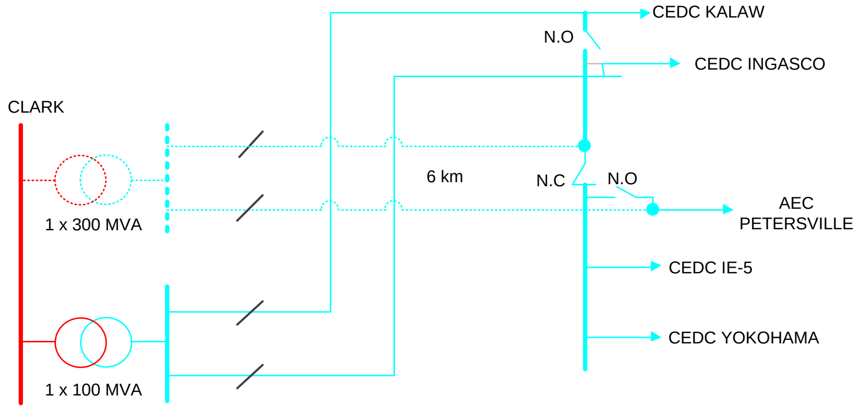


69 kV PROJECTS

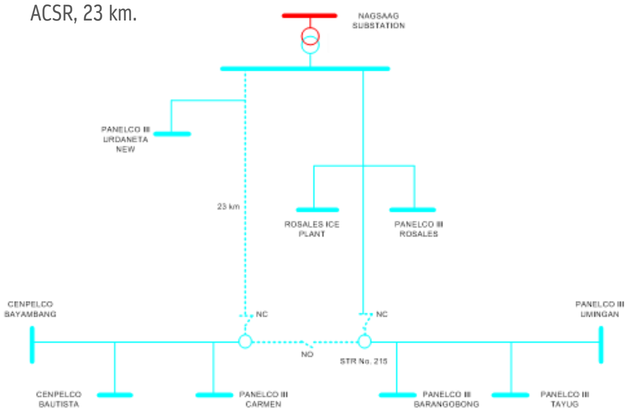
Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Clark–Mabiga 69 kV Transmission Line	• Load Growth • ERC-approved	• Clark 230 kV SS (Expansion): 1x300 MVA 230/69-13.8 kV Transformer, 1-230 kV PCB and associated equipment, and 3-69 kV PCB and associated equipment	• Clark-Mabiga 69 kV TL: 1,600 mm^2 Underground Cable System, UC-DC, 6.0 km.	549M	Pampanga	Feb 2025

TRANSMISSION LINE

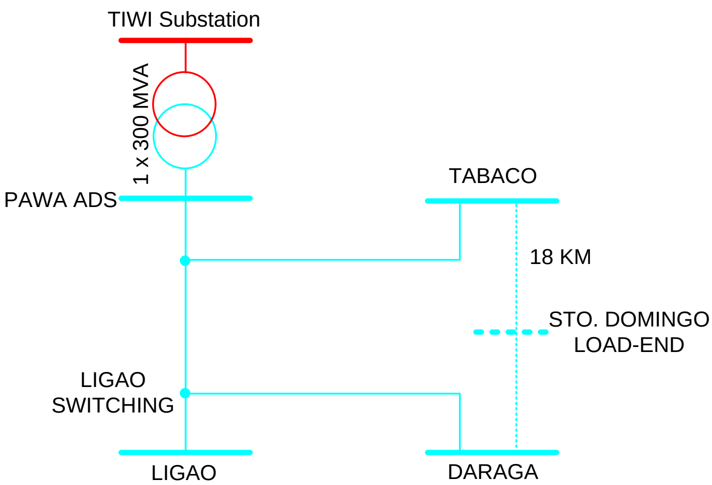
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
The project aims to provide transmission capacity reinforcement to the Mexico–Clark 69 kV Line which is serving Pampanga Rural Electric Service Cooperative, Inc. (PRESCO), Pampanga I Electric Cooperative, Inc. (PELCO I), Pampanga II Electric Cooperative, Inc. (PELCO II), Angeles Electric Corporation (AEC), Quanta Paper Corporation, and Clark Electric Development Corporation (CEDC). This addresses the load growth in 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 SS and the construction of a 69 kV line from the Clark SS up to the area of Mabiga in Pampanga.						



Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Nagsaag–Tumana 69 kV Transmission Line The project aims to cater to the growing demand of an area in Pangasinan. The existing Nagsaag–Umingan 69 kV TL which delivers power to the loads of Pangasinan III Electric Cooperative (PANELCO III) Urdaneta and Carmen, and Central Pangasinan Electric Cooperative (CENPELCO) Bautista and Bayambang will already be overloaded. This 69 kV TL Project involves the construction of a new line from Nagsaag SS going to the area of Tumana in Rosales, Pangasinan.	• Load Growth • Filed to ERC	• Nagsaag 69 kV SS: 1-69 kV PCB and associated equipment	• Nagsaag–Tumana 69 kV TL: 69 kV, ST/SP-DC1, 1-795 MCM ACSR, 23 km.	899M	Pangasinan	Mar 2024

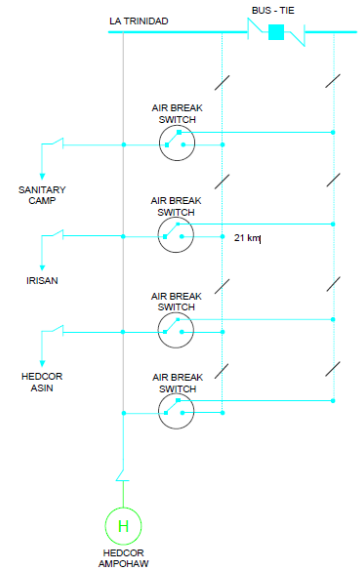


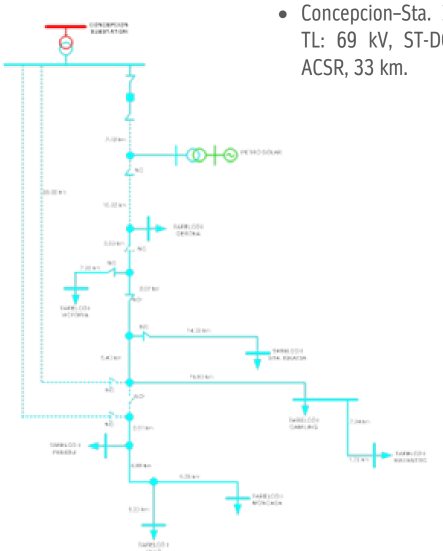
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Eastern Albay 69 kV Line Stage 2 The project aims to provide a more reliable transmission corridor in the eastern coast of Albay to serve the increasing eco-tourism developments in the area which include the Misibis Resort, Estate and Spa in Cagraray Island. The Eastern Albay 69 kV TL Project is divided into two stages. Stage 1 includes the development of the Sto. Domingo LES with a 10 MVA, 69/13.8 kV transformer and the Single-Circuit (SC) Daraga–Sto. Domingo 69 kV TL which will be 21 km long and composed 1-336.4 MCM ACSR/AS conductor. Stage 2 meanwhile includes the development of the SC Sto. Domingo-Tabaco 69 kV Line which will be 18 km long and composed of 1-336.4 MCM ACSR/AS conductor.	• System Reliability • ERC-approved	• Sto. Domingo SS: 2-69 kV PCB and associated equipment.	• Sto. Domingo–Tabaco 69 kV TL: ST-SC, 1-336.4 MCM ACSR, 18 km.	776M	Albay	Sep 2024

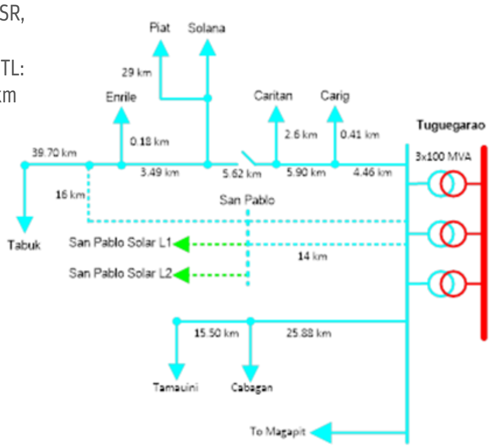


TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
La Trinidad–Calot 69 kV Transmission Line The La Trinidad–Calot 69 kV TL Project aims to improve the reliability and increase the transfer capacity of the 69 kV TL serving the loads of BENECO's Lamut, Sanitary Camp and Irisan LES, and power generations from HEDCOR's Asin and Ampohaw. The project involves the construction of a 17 km, 69 kV, double-circuit, steel tower/steel pole transmission line from La Trinidad SS to Calot, Sablan, Benguet. It also involves the expansion of the 69 kV switchyard for the termination of the new La Trinidad–Calot 69 TL.	• Load Growth • ERC-approved	• La Trinidad 69 kV SS: 1-69 kV PCB and associated equipment	La Trinidad–Calot 69 kV TL: ST/SP-DC, 1-795 MCM ACSR/AS, 17 km	1,726M	Benguet	Dec 2028
Concepcion–Sta. Ignacia 69 kV Transmission Line The project aims to cater to the growing demand in Tarlac. The existing Concepcion–Camiling 69 kV TL which delivers power to the loads of Tarlac I Electric Cooperative, Inc. (TARELCO I) will already be overloaded. The Concepcion–Sta. Ignacia 69 kV TL Project involves the construction of a new DC 69 kV TL from Concepcion SS up to Camiling, Tarlac. It will unload the existing Concepcion–Paniqui 69 kV TL by catering the loads of TARELCO Sta. Ignacia, Camiling, Mayantoc, Paniqui, Anao and Moncada.	• Load Growth • Filed to ERC		• Concepcion–Sta. Ignacia 69 kV TL: 69 kV, ST-DC, 1-795 MCM ACSR, 33 km.	1,083M	Tarlac	Phase 1 Mar 2024 Phase 2 Dec 2024
Tuguegarao–Enrile 69 kV Transmission Line The project aims to address the anticipated overloading of the Tuguegarao–Tabuk 69 kV TL brought by the continuous load growth in the franchise area of Cagayan 1 Electric Cooperative, Inc (CAGELCO I) and Kalinga-Apayao Electric Cooperative, Inc. (KAELCO). The project involves the development of a two (2) part segment, 69 kV TL from Tuguegarao SS to Enril. The first segment consists of a 14 km, 1-795	• Load Growth • Filed to ERC	• Tuguegarao 69 kV SS: 2-69 kV PCB and associated equipment • San Pablo 69 kV SY: 8-69 kV PCB and associated equipment	• Tuguegarao–San Pablo SWS 69 kV TL: SP-DC, 1-795 MCM ACSR, 14 km • San Pablo SWS–Enrile 69 kV TL: SP-SC, 1-795 MCM ACSR, 16 km	2,945M	Tuguegarao	Oct 2030







TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
MCM ACSR, DC Conductor from Tuguegarao SS to the New San Pablo SWS. While the second segment is planned to be a 16 km, 1-795 MCM ACSR, Single-Circuit Conductor from the New San Pablo SWS to the tapping point at Enrile.						
Daraga–Bitano 69 kV Transmission Line The project aims to cater to the load growth of Albay Electric Cooperative, Inc. (ALECO) and other directly connected industrial and commercial loads in Albay Province. It also seeks to address the overloading of the existing Daraga–Washington 69 kV TL. The project involves the development of a new single circuit, 6 km 1-795 MCM ACSR 69 kV TL from Daraga 69 kV SS to Bitano Load-End of ALECO.	• Load Growth • Filed to ERC	• Daraga SS: 2-69 kV PCB and associated equipment	• Daraga–Bitano 69 kV TL: SP-SC, 1-795 MCM ACSR, 6 km	760M	Albay	Dec 2030

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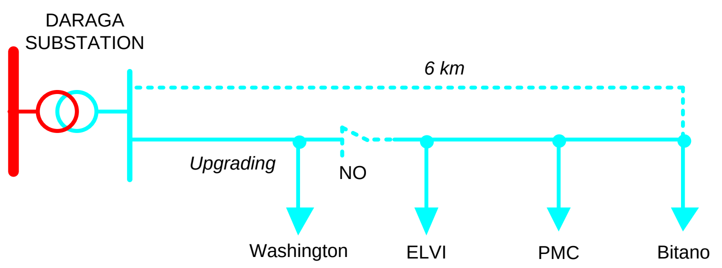
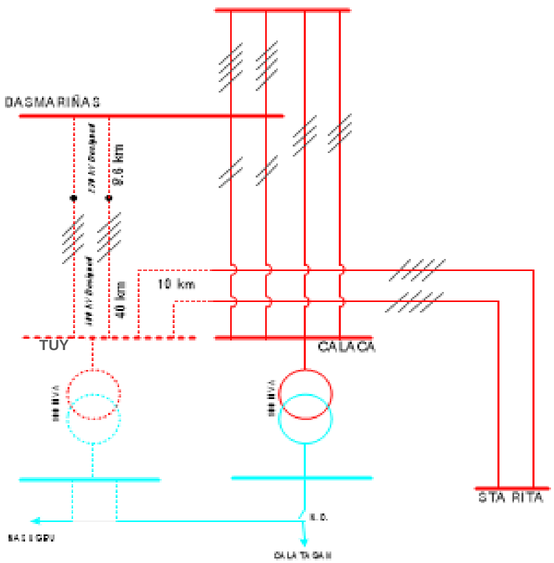


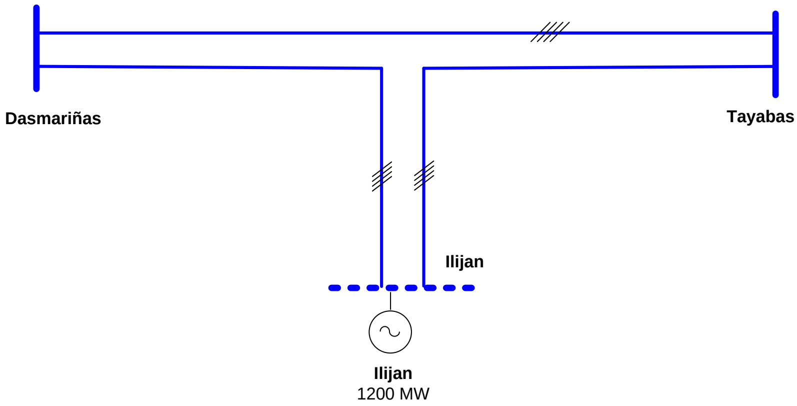
SUBSTATION

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
500/ 230 kV PROJECTS						
Tuy 500/230 kV Substation (Stage 1) The project aims to accommodate the connection of the 2x350 MW SRPGC Coal Plant and allows full dispatch of bulk generation capacity additions in Batangas. The generation capacity additions turn Calaca SS into a merging point of more than 2,000 MW of power generation. The existing outgoing 230 kV lines going to Dasmariñas and Biñan has capacity constraints to accommodate the full dispatch of the plants considering the single outage contingency criterion. It involves the development of Tuy 500 kV SS, which initially involves 230 kV facilities only. It also involves the development of Tuy–Dasmariñas 500 kV designed TL but to be initially energized at 230 kV. Furthermore, a new 100 MVA, 230/69-13.8 kV Power Transformer is to be installed to provide N-1 contingency to the existing 100 MVA Power Transformer at Calaca SS.	• Generation Entry • Filed to ERC	• Tuy SS: 1x100 MVA, 500/ 230-69 kV Transformer, 12-230 kV PCB and associated equipment, 3-69 kV PCB and associated equipment. • Dasmariñas SS Expansion: 2-230 kV PCB and associated equipment. • Sta. Rita Switchyard Expansion: Line Protection and Communication System. • Calaca SS: Replacement of Current Transformers and Bus works.	• 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.	6,375M	Batangas, Cavite	Dec 2024

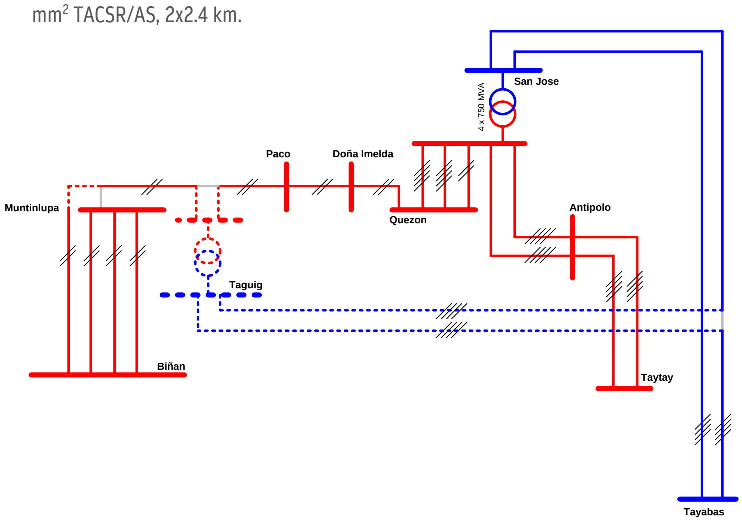


SUBSTATION

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Ilijan 500 kV Substation Upgrading The project aims to accommodate the connection of Excellent Energy Resources Inc.'s (EERI) 1,700 MW Combined-Cycle Gas Turbine Ilijan Expansion Power Plant Project to the switchyard. The facilities at Ilijan 500 kV SS is to be transferred to NGCP through the National Transmission Corporation (TransCo) upon the expiration of the build-operate-transfer (BOT) contract between KEPCO Ilijan Corporation (KEILCO) and Power Sector Assets and Liabilities Management Corporation (PSALM). In addition, it includes the upgrading of the existing 500 kV PCB at Ilijan 500 kV SS to a higher PCB rating due to various generation and network development in Batangas.	• System Reliability • For Filing	• Ilijan 500 kV SS: 4-500 kV PCB and associated equipment (GIS), 6-500 kV PCB and associated equipment (AIS)		1,908M	Batangas	Stage 1 Jan 2024 Stage 2 May 2025



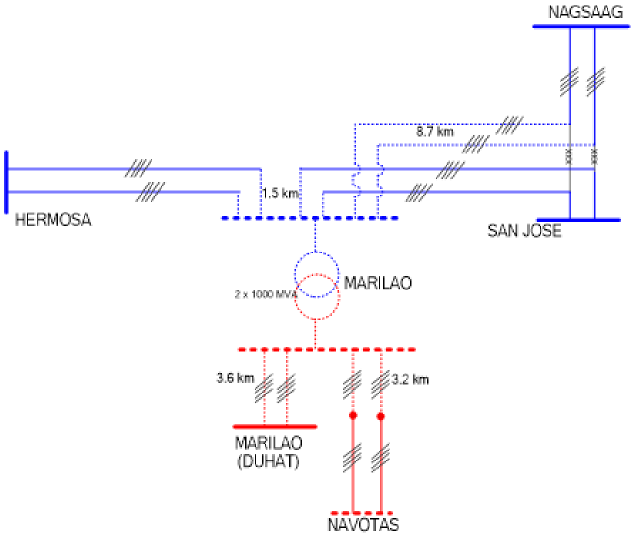
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Taguig 500 kV Substation The project aims to provide another 500/230 kV drawdown SS to decongest San Jose EHV Substation and to provide a higher level of reliability even during maintenance or prolonged outage of one of the existing transformers at San Jose EHV SS. It involves the construction of a new EHV (500/230 kV) drawdown SS in Taguig City including its associated TL to interconnect the SS to the 500 kV and 230 kV systems of the Luzon Grid through 'cut-in' connection to the existing San Jose–Tayabas 500 kV line and 'bus-in' connection to the existing Muntinlupa–Paco 230 kV line, respectively.	• Load Growth • ERC-approved	• Taguig 500 kV SS: 2x1,000 MVA, 500/230-13.8 kV Transformers, 1x90 MVAR, 500 kV Shunt Reactor, 3x100 MVAR, 230 kV Capacitor, 8-500 kV PCB (GIS) and associated equiptment,10-230 kV PCB (GIS) and associated equipment.	• Taguig Cut-in to San Jose–Tayabas 500 kV TL: 500 kV, ST-DC, 4-795 MCM ACSR/AS, 37 km. • Taguig bus-in to Muntinlupa–Paco 230 kV TL: 230 kV, SP-DC1, 2-410 mm^2 TACSR/AS, 2x2.4 km.	9,045M	Taguig	Dec 2024



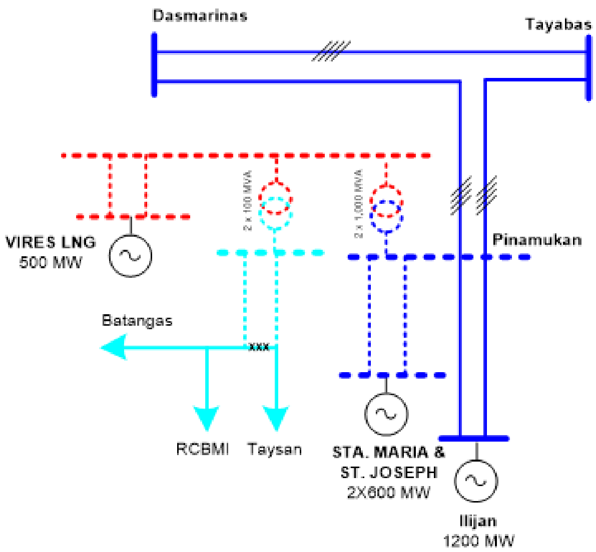
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Marilao 500 kV Substation The project aims to provide another 500/230 kV drawdown SS to support the increasing demand in Metro Manila along with the increase in bulk power injection to the 500 kV system coming	• Load Growth • Filed to ERC	• Marilao 500 kV SS: 2x1000 MVA, 500/230-13.8 kV Power Transformers and Accessories 2x90 MVAR, 500 kV Shunt Reactor and Accessories 2x100 MVAR, 230 kV Capacitor Banks and Accessories 16-500 kV PCB and Associated equipment 12-230 kV PCB and Associated equipment	• Nagsaag-San Jose 500 kV Line Extension to Marilao 500 kV SS, ST-DC, 4-795 MCM ACSR/AS, 8.7 km • Marilao Bus-in to Hermosa-San Jose 500 kV Line, ST-DC, 4-410 mm^2 TACSR/AS, 1.5 km • Marilao–Duhat 230 kV TL, SP-DC, • 2-795 MCM ACSR/AS, 3.2 km Navotas Line Extension to Marilao 230 kV TL, SP-DC, 4-795 MCM ACSR/AS, 3.6 km	6,714M	Bulacan	Phase 1 - Mar 2024 Phase 2 – Sep 2024

SUBSTATION

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
from the new power plants in the grid. It also aims to address the initial line by-pass scheme at San Jose SS under the project Hermosa–San Jose 500 kV TL which is brought about by the GIS expansion limitation at San Jose 500 kV SS. In addition, it reduces the criticality of the ring-bus configured San Jose 500 kV SS as the Marilao SS will now serve as the main node in the grid. It involves the construction of Marilao 500 kV SS to serve as a new corridor of generation supply in the northern region. It also includes the bus-in of the new SS along the Hermosa-San Jose 500 kV TL, transfer of Nagsaag 500 kV line from San Jose EHV SS to the new SS, and termination of 230 kV lines going to Duhat, Marilao, Navotas, Quezon, and Hermosa SS.						

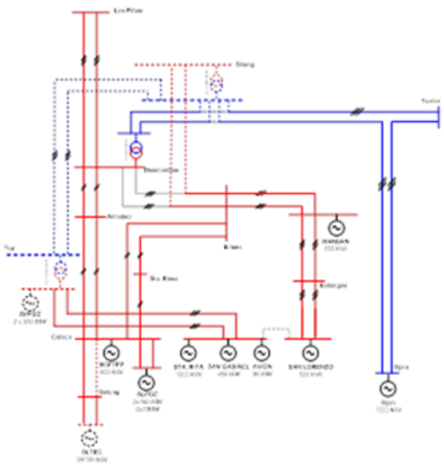
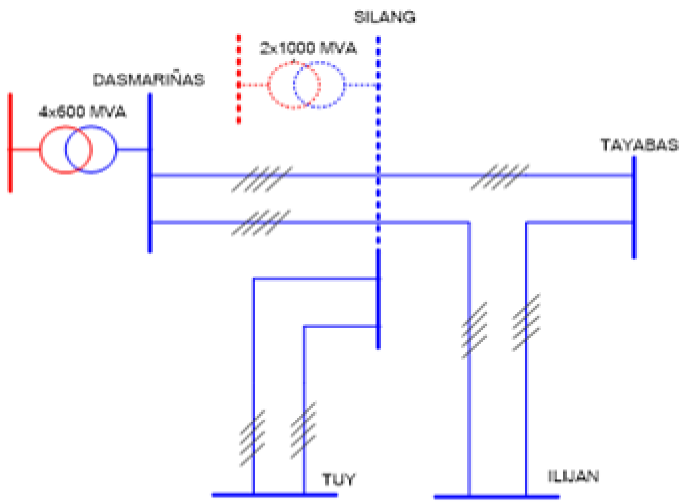


Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Pinamucan 500 kV Substation The project aims to accommodate the connection of new LNG Plants in Batangas City Area. It also provides a connection point of other proposed bulk capacity generation in Batangas. In addition, it will also serve as the connection point of Batangas–Mindoro Interconnection Project (BMIP). It involves the development of a new 500 kV SS in Pinamucan, Batangas with 2x1,000 MVA 500/230 kV transformer capacity. This SS is to be connected to the 500-kV system through bus-in along the Ilijan–Dasmariñas and Ilijan–Tayabas 500 kV TL. In addition, a 230/69 kV SS with 2x100 MVA transformer capacity is to be developed to serve the loads in the area.	• Generation Entry • Filed to ERC	• Pinamucan 500/230 kV SS: 2x1000 MVA, 500/230 kV Power Transformer, 2x100 MVA, 230/69 kV Power Transformer, 14-500 kV PCB and associated equipment, 10-230 kV PCB and associated equipment, 6-69 kV PCB and associated equipment	• Pinamucan 500 kV bus-in TL: ST-DC, 4-795 MCM ACSR/AS, 1 km • Pinamucan–Taysan 69 kV TL: SP/ST-DC, 1-795 MCM ACSR/AS, 10 km	5,601M	Batangas	Phase 1 Dec 2025 Phase 2 Dec 2027



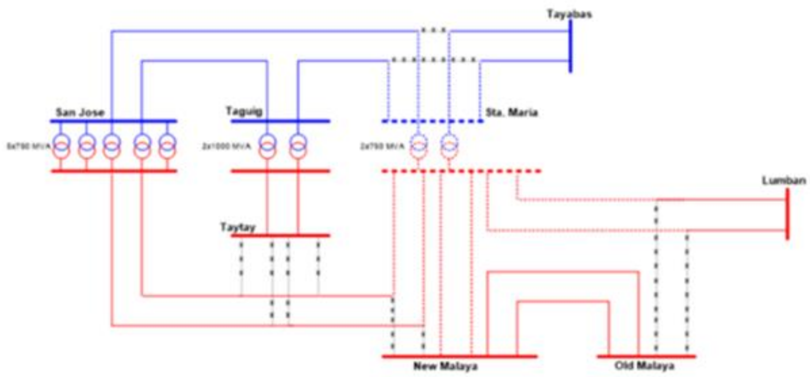
Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Tuy 500/230 kV Substation (Stage 2) The project aims to relieve the overloading of Tuy–Silang 230 kV Line due to the connection of bulk generation capacity additions in Batangas. The project will allow the full dispatch of bulk generations coming from Batangas.	• Generation Entry • Filed to ERC	• Tuy 500 kV SS: 3x1000 MVA 230/69-13.8 kV Power Transformer 8-500 kV PCB and associated equipment 1-230 kV PCB and associated equipment. • Silang 500 kV SS: 4-500 kV PCB and associated equipment		7,442M	Batangas	Oct 2030

SUBSTATION

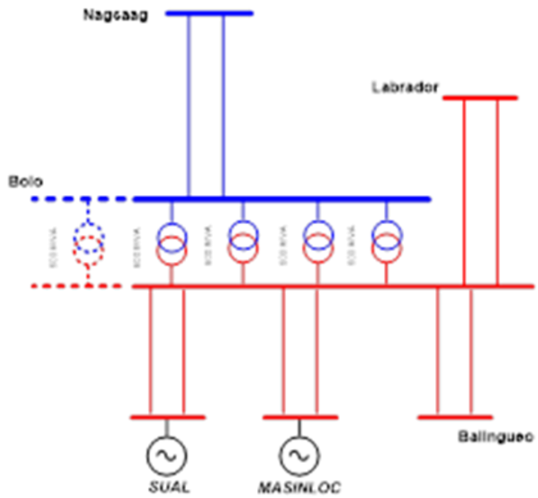
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
It involves the construction of 3x1,000 MVA 500/230 kV Transformer and the energization of the 500 kV designed Tuy–Silang 230 kV TL into 500 kV which is under the Tuy 500/230 kV SS Stage 1 .						
Silang 500 kV Substation The project aims to address the overloading of the Dasmariñas 500/230 kV SS. It also serves as the termination of the 500 kV line emanating from the proposed Tuy 500 kV SS, which supports the entry of additional generation capacities in Batangas Area. It involves the development of a new 500/230 kV SS in Silang, Cavite that decongests the Dasmariñas 500/230 kV SS. The new Silang 500 kV SS is to 'bus-in' along the Dasmariñas–Ilijan and Dasmariñas–Tayabas 500 kV TL and has an initial capacity of 2x1000 MVA transformers. To effectively decongest the Dasmariñas 500/230 kV SS, the Biñan–Dasmariñas 230 kV TL is to be diverted from Dasmariñas 230 kV SS going to the proposed new 230 kV SS under Silang 500 kV SS Project.	• Load growth • Filed to ERC	• Silang 500 kV SS: 2x1000 MVA 500/230 kV Power Transformer and accessories, 10-500 kV PCB and associated equipment, 17-230 kV PCB and associated equipment, 230 MVAR, 500 kV Line Reactor 3x100 MVAR, 230 kV Shunt Capacitor  	• Silang 500 kV bus-in TL: ST-DC, 4-795 MCM ACSR, 3 km • Tuy 500 kV TL Diversion: ST-DC, 4-410 mm^2 TACSR/AS, 4.5 km • Biñan 230 kV TL Diversion: ST-DC, • 4-410 mm^2 TACSR/AS, 4.5 km	9,737M	Cavite	Feb 2028
Sta. Maria 500 kV Substation The project aims to cater the upcoming Generation Potential in Quezon, Rizal and Laguna Area. Approximately 4,650 MW total potential generation is forecasted on the vicinity and it requires a hub to transmit their generation to the Grid. It involves the development of a new drawdown SS at Sta. Maria, Laguna	• Generation Entry • Filed to ERC	• Sta. Maria SS: 2x750 MVA, 500/230 kV, Power Transformers, 18-500 kV PCB and associated equipment 18-230 kV PCB and Associated equipment • New Malaya SS Expansion: 2-230 kV PCB and associated equipment	• Sta. Maria 'Bus-in' to Tayabas–San Jose 500 kV TL: 500 kV, 4-795 MCM ACSR, ST-DC, 2x 1.0 km • Sta. Maria–Antipolo 230 kV Line diversion through the Old Malaya–Taytay 230 kV Line and the portion Old Malaya–Lumban 230 kV TL: 230 kV, 4-795 MCM ACSR, ST-DC, 3 km Swinging of Lines in Malaya and Taytay SS, 230 kV: 4-795 MCM ACSR, ST-DC, 0.5 km • Sta. Maria–Lumban 230 kV Line diversion through the portion Old Malaya–Lumban 230 kV TL: 230 kV, 4-795 MCM ACSR, ST-DC, 3 km	15,850M	Laguna	Dec 2030

SUBSTATION

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
with a 2x750 MVA, 500/230 kV Power Transformer and that is to be linked to the Luzon Grid through a 'bus-in' connection to the Tayabas–San Jose 500 kV TL.			• Sta. Maria–New Malaya 230 kV TL: 230 kV, 4-410 mm^2 TACSR, ST-DC, 13.3 km			

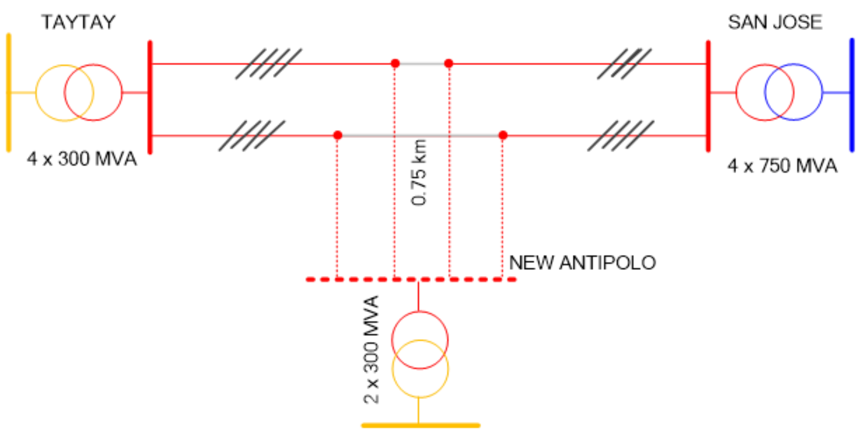


Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Bolo 5th Bank The project aims to accommodate the additional generation in the northwestern region of Luzon. It involves the construction of an additional 1x600 MVA in Bolo 500 kV SS. Presently, the Bolo 500 kV SS has 4x600 MVA 500/230 kV power transformers serving the bulk generation capacities in Pangasnan.	• Generation entry	• Bolo SS: 1x600 MVA 500/230 kV Transformer and Accessories 22-230 kV PCB and associated equipment		2,521M	Pangasinan	Jan 2029

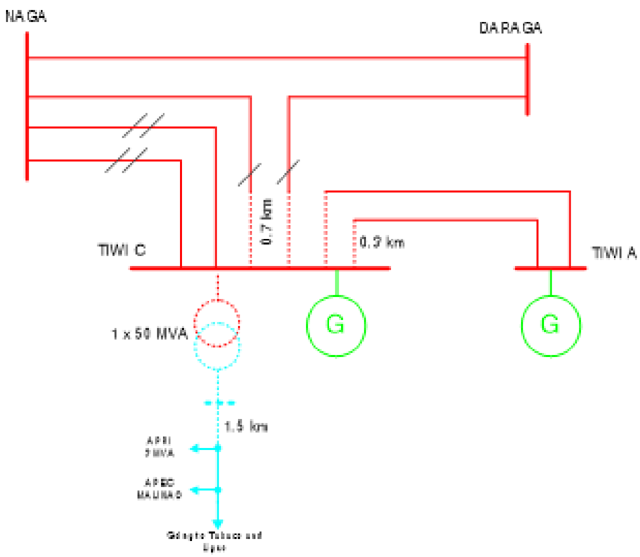


230 kV PROJECTS

Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Antipolo 230 kV Substation The project aims to decongest heavily loaded 230 kV delivery substations serving Meralco's 115 kV distribution Substations in Metro Manila. The SS caters to the load growth in the Sector 2 of MERALCO. The project involves the new 230 kV SS that will bus-in along the existing ST-DC San Jose-Taytay 230 kV line with 4-794 MCM ACSR conductors. Initially, the SS and also be installed with Capacitor for voltage support. To draw supply from Antipolo, MERALCO will be	• Load Growth • ERC-approved	• Antipolo 230 kV SS: 12-230 kV PCB and associated equipment, 2x100 MVAR 230 kV Capacitor Banks.	• Bus-in point along San Jose–Taytay 230 kV TL: ST-DC, 4-795 MCM ACSR/AS, 0.75 km.	919M	Rizal	Sep 2023



SUBSTATION						
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
installing 2x300 MVA 230/115 kV transformers and 115 kV SS. MERALCO will also put-up line connections to their existing 115 kV network in the area.						
Tiwi Substation Upgrading The project aims to upgrade the old and deteriorated SS equipment at Tiwi A and C Substations to improve the reliability of the system and augment the power requirement of Malinao/Ligao LES by the installation of additional power transformer at Tiwi C SS and clearly identify asset boundaries within the Tiwi Geothermal Power Plant Complex through the 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 SS. This project also involves the diversion of the Daraga/Naga 230 kV Line to Tiwi C SS and extension of the Malinao/Ligao 69 kV Line from Tiwi A to Tiwi C SS.	• Generation Entry and System Reliability • ERC-approved	• Tiwi A SS: 4-230 kV PCB and associated equipment (Replacement) • Tiwi C SS: 12-230 kV PCB and associated equipment (Replacement), 3-230 kV PCB and associated equipment (New), 1-69 kV PCB and associated equipment, 1x50 MVA, 230/69-13.8 kV Power Transformer and Accessories	• Daraga/Naga – Tiwi C Line Extension: 230 kV, ST-DC, 1-795 MCM ACSR/AS, 0.9 km • Tiwi A – Tiwi C Line Extension: 230 kV, ST-DC, 1-795 MCM ACSR/AS, 0.4 km • Malinao/Ligao – Tiwi C Line Extension 69 kV, SP-SC, 1-336.4 MCM ACSR/AS, 1.65 km	1,107M	Albay	Jun 2023

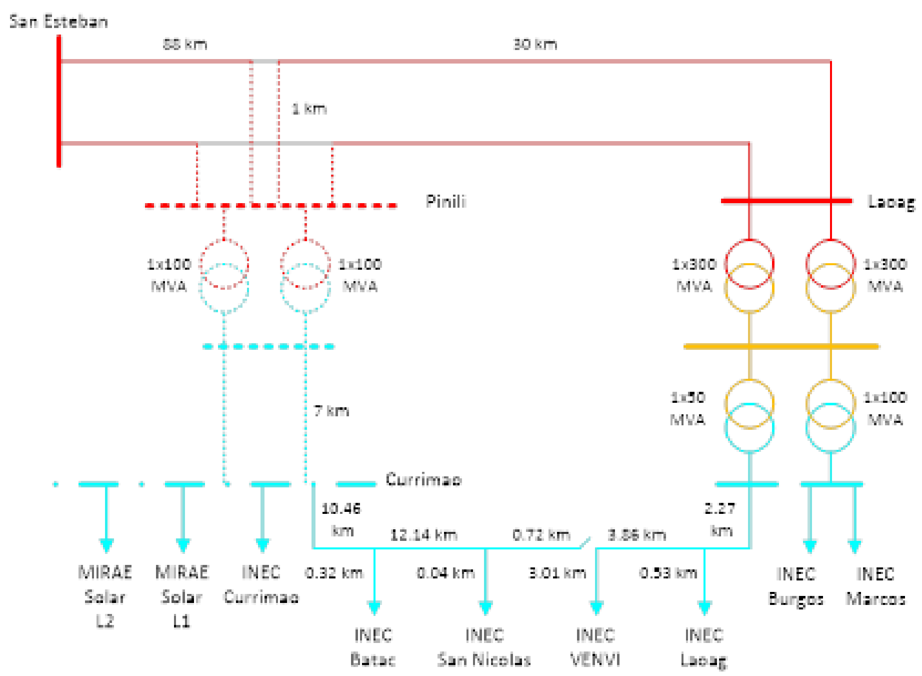


Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
North Luzon 230 kV Substation Upgrading The project aims to increase the reliability of the concerned Substations with old and obsolete PCB and associated equipment. The project also caters to the load growth and provides 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 PCB to ensure	• Load Growth and System Reliability • ERC-approved	Stage 1: • Bauang 230 kV SS (Replacement): 1x100 MVA 230/115/69-13.8 kV Transformer, 7-230 kV PCB and associated equipment • Gamu 230 kV SS: 10-230 kV PCB and associated equipment, 3-69 kV PCB and associated equipment • Bayombong 230 kV SS: 5-230 kV PCB and associated equipment., 2-69 kV PCB and associated equipment • Hermosa 69 kV SS: 11-69 kV PCB and associated equipment • Malaya 230 kV SS (Expansion), 1x300 MVA, 230/115-13.8 kV Transformer, 15-230 kV PCB and associated equipment, 1-115 kV PCB and associated equipment • Quezon 230 kV SS (Expansion): 3-230 kV PCB and associated equipment • San Jose 230 kV SS (Expansion): 1x300 MVA, 230/115-13.8 kV		4,659M	La Union, Isabela, Nueva Vizcaya, Bataan, Quezon, Pangasinan, Bulacan	Dec 2023 Apr 2024

SUBSTATION

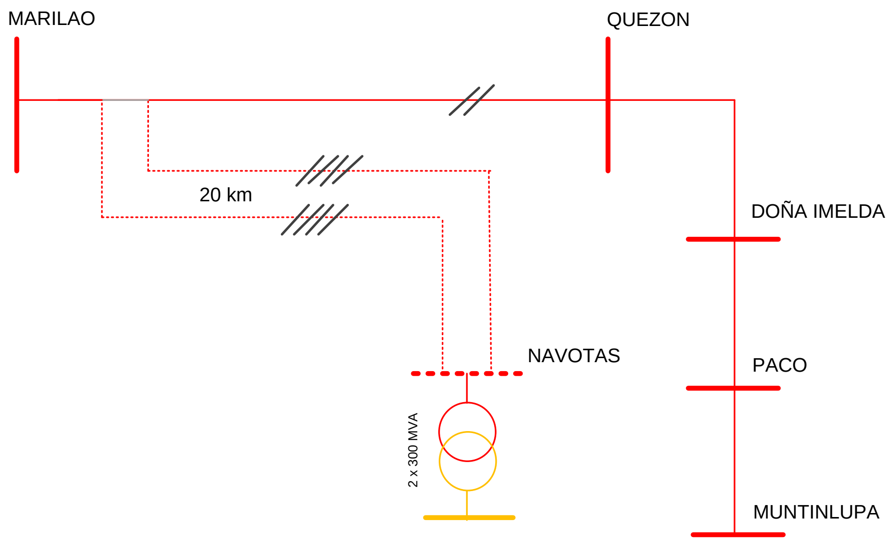
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
reliability and flexibility of operations on the concerned substations.		Transformer, 1-230 kV PCB and associated equipment, 10-115 kV PCB and associated equipment Stage 2: • Bacnotan 230 kV SS (Expansion): 1x100 MVA 230/69-13.8 kV Transformer, 2-230 kV PCB and associated equipment, 8-69 kV PCB and associated equipment • Balingueo 230 kV SS (Expansion): 1x100 MVA 230/69-13.8 kV Transformer, 5-230 kV PCB and associated equipment, 4-69 kV PCB and associated equipment • Labrador 230 kV SS (Replacement): 1x100 MVA 230/69-13.8 kV Transformer, 5-230 kV PCB, 2-69 kV PCB and associated equipment • San Rafael 230 kV SS (Expansion): 1x300 MVA 230/69-13.8 kV Transformer, 1-230 kV PCB and associated equipment, 2-69 kV PCB and associated equipment.				
Pinili 230 kV Substation	• Load Growth • Filed to ERC	• Pinili 230 kV SS (New): 2x100 MVA 230/69-13.8 kV Power Transformer, 10-230 kV PCB and associated equipment, 8-69 kV PCB and associated equipment • Currimao SS: 5-69 kV PCB and associated equipment	• Pinili Bus-in to San Esteban–Laoag 230 kV TL: ST-DC, 1-795 MCM ACSR/AS, 2x1.0 km • Pinili–Currimao 69 kV TL: ST-DC, 1-795 MCM ACSR/AS, 7.0 km	1,792M	Ilocos Norte	Aug 2024

The project aims to address the forecasted loa d growth in Ilocos region and to provide an alternate connection source for loads connected at Laoag SS during N-1 contingency condition. This SS aims to replace the existing Currimao 115 kV SS as it can no longer be expanded due to space constraints. This project also accommodates 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). Furthermore, the aforementioned serve as a connection point for new renewable energy plants.



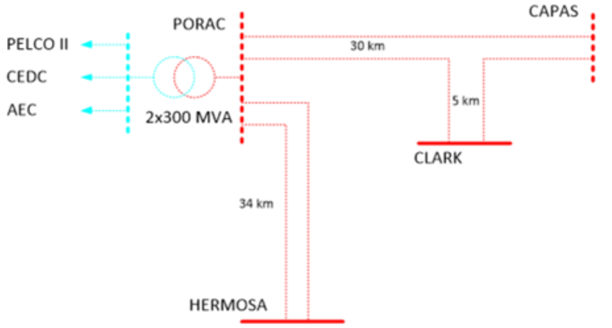
The project involves the construction of a new 230/69 kV SS connected 'bus-in' to the San Esteban–Laoag 230 kV line and be arranged in a breaker-and-a-half scheme. The project involves the installation of 2x100 MVA, 230/69-13.8 kV Power Transformer, 10-230 kV PCB, 5-69 kV PCB, and its associated equipment. The project also includes a 7 km, 69 kV, DC TL that aims to transfer loads of Currimao SS to Pinili SS.

SUBSTATION						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
South Luzon 230 kV Substation Upgrading The project aims to address overloading of the remaining transformer in service or load dropping during outage of one power transformer unit in each concerned SS. The project includes capacity additions, replacement of old obsolete PCB, and re-configuration of the existing SS to ensure reliability and flexibility of the concerned substations.	• Load Growth and System Reliability • ERC-tyapproved	Stage 1: • Las Piñas 230 kV SS: 1x300 MVA, 230/115-13.8 kV Power Transformer and Accessories • Lumban 230 kV SS (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 PCB and associated equipment • Naga 230 kV SS (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: • Daraga 230 kV SS, 1x100 MVA 230/69-13.8 kV Power Transformer and Accessories, 4-230 kV PCB and associated equipment, 2-69 kV PCB and associated equipment • Gumaca 230 kV SS (Replacement): 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 • Labo 230 kV SS: Busworks, Protection and Control Equipment		2,025M	Laguna, Batangas, Albay, Quezon, Camarines Norte	Dec 2024
South Luzon 230 kV Substation Upgrading 2 The project aims to caters the load growth and provides N-1 contingency to various Substations in NGCP's South Luzon Region in Lumban, Gumaca, Tuy, Labo, and Calaca Substations. Without the project, power interruption was experienced by customers during failure of existing transformers and PCB. This 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 the replacement and installation of PCB in areas such as Biñan, Dasmariñas, Naga, and Muntinlupa substations to ensure reliability and flexibility of operations on the concerned substations.	• Load Growth and Power Quality and Technology • Filed to ERC	• Lumban 230 kV SS (Replacement): 1x100 MVA 230/69-13.8 kV Power Transformer, 1-69 kV PCB and associated equipment • Gumaca 230 kV SS (Replacement): 1x100 MVA 230/69-13.8 kV Power Transformer; 1-69 kV PCB and associated equipment • Tuy 230 kV SS: 1x300 MVA, 230/69-13.8 kV Power Transformer, 2-230 kV PCB and associated equipment, 3-69 kV PCB and associated equipment • Calaca 230 kV SS (Replacement):, 2x300 MVA, 230/69-13.8 kV Power Transformer; 2-230 kV PCB and associated equipment, 7-69 kV PCB and associated equipment • Labo 230 kV SS (Replacement): 1x100 MVA 230/69-13.8 kV Power Transformer; 1-69 kV PCB and associated equipment • Daraga 230 kV SS (Replacement): 3-230 kV PCB and associated equipment • Taytay 230 kV SS: 3x100 MVAR, 230 kV Capacitor Banks, 4-230 kV PCB and associated equipment • Quezon 230 kV SS: 1x100 MVAR, 230 kV Capacitor Banks, 1-230 kV PCB and associated equipment • Biñan 230 kV SS: 5-230 kV PCB and associated equipment, 6-115 kV PCB and associated equipment		6,622M	Batangas, Laguna, Quezon, Camarines Norte, Albay, Rizal and Metro Manila	Jun 2024 Dec 2024

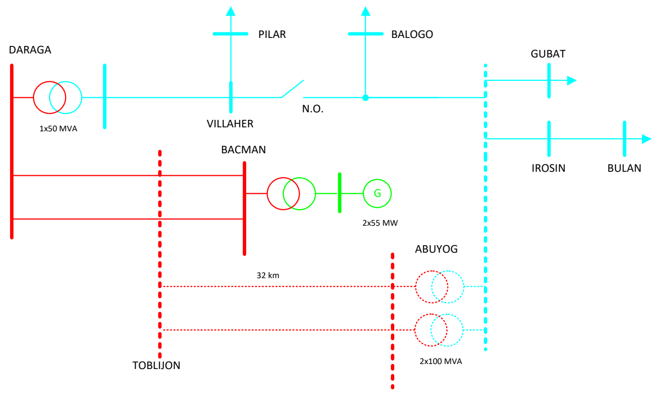
SUBSTATION						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
		• Dasmariñas 115 kV SS: 11-115 kV PCB and associated equipment • Naga 69 kV SS: 1-69 kV PCB and associated equipment • Muntinlupa 115 kV SS, 10-115 kV PCB and associated equipment • Daraga 230 kV SS: 3-230 kV PCB and associated equipment • Bay 69 kV SS: 2-69 kV PCB and associated equipment				
Navotas 230 kV Substation	• Load Growth and System Reliability and Security • ERC-approved	• Navotas 230 kV SS: 2x300 MVA, 230/115-13.8 kV Transformers, 9-230 kV PCB (GIS) and associated equipment, and 15-115 kV PCB (GIS) and associated equipment	• From Marilao–Quezon cut-in point to Navotas SS: 230 kV, ST/SP-DC, 4-795 MCM ACSR/AS, 20 km	6,167M	Navotas	Dec 2024
The project aims to cater the load growth in Sector 1 of MERALCO and serves 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 serving MERALCO Sector 1 will become heavily loaded and will lose the provision for N-1 contingency. This will expose the Metro Manila loads to supply reliability risk as well as po were quality concerns during system peak load conditions. The project involves the construction of a new 230 kV drawdown SS to address the growing demand in Metro Manila, provide high level of reliability as well as improvement of voltage regulation to the underlying 115 kV Meralco Substations. The proposed Navotas 230 kV SS will initially linked to the grid through cut-in connection along the existing Marilao–Quezon 230 kV TL and will ultimately terminate in the future Marilao 500 kV SS. The project will be a Gas Insulated Switchgear (GIS) SS due to the space constraints for an outdoor SS.						
Porac 230 kV Substation	• Load Growth • Filed to ERC	• Porac 230 kV SS: 2x300 MVA 230/69 kV Transformers, 3x100 MVAR, 230 kV Shunt Capacitor, 13-230 kV PCB, 19-69 kV PCB and associated equipment. • Hermosa 230 kV SS (Expansion): 2-230 kV PCB and associated equipment • Clark 230 kV SS (Expansion): 2x100 MVAR, 230 kV Shunt Capacitor, 8-230 kV PCB and associated equipmentCapas 230 kV SS (Expansion), 4-230 kV PCB and associated equipment	• Hermosa–Porac 230 kV TL: ST-DC, 4-95 MCM ACSR, 34 km. • Capas-Porac SS: ST-DC 4-795 MCM ACSR, 30 km • Clark 230 kV TL Extension: ST-DC, 4-795 MCM ACSR, 5 km.	6,384M	Pampanga	Jun 2024
The project aims to support the load growth in Pampanga specifically the development of major loads such as Alviera. This project also aims to establish the 230 kV backbone loop from Hermosa in Bataan to Concepcion in Tarlac. This will provide more direct access to the generation hub in Bataan.						

SUBSTATION

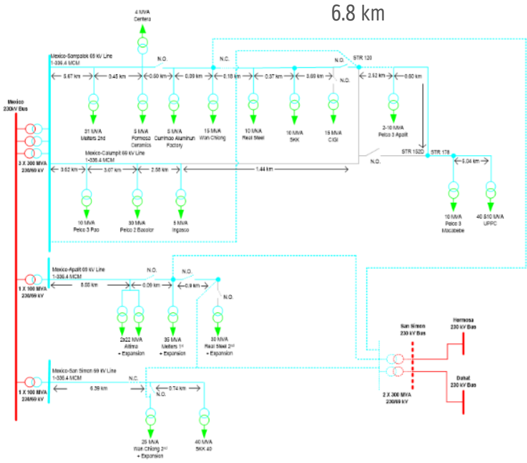
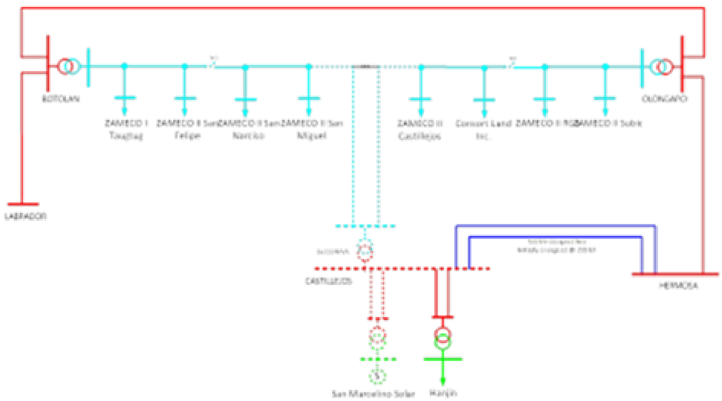
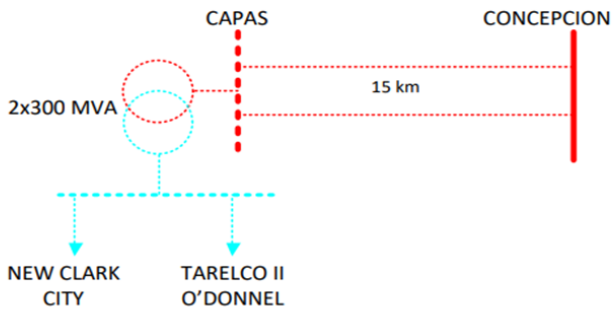
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
The Porac 230 kV SS will draw its power from the Hermosa and Capas 230 kV SS through the proposed Hermosa–Porac–Capas 230 kV Lines. The 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 DC Hermosa– Porac-Capas 230 kV Line.						



Abuyog 230 kV Substation The project aims to establish a 230 kV drawdown SS 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 LES. Presently, the whole province of Sorsogon is solely relying on a SC 69 kV line being supplied from Daraga SS which located in Albay. The proposed Abuyog 230 kV SS will connect to a new switching station in Toblijon, Sorsogon through a 25.4 km ST-DC, 2-795 MCM ACSR TL. The SWS will bus-in along Daraga–Bacman 230 kV Line. The Abuyog SS involves the installation of a 2x100 MVA, 230/69-13.8 kV Power Transformer.	• Load Growth and Generation Entry • Filed to ERC	• Abuyog 230 kV SS: 2x100 MVA 230/69-13.8 kV Transformer, 3x25 MVAR, 230 kV Shunt Capacitor, 3x25 MVAR, 230 kV Shunt Reactor, 12-230 kV PCB and associated equipment, 8-69 kV PCB and associated equipment • Toblijon 230 kV SWS: 10-230 kV PCB and associated equipment	• Toblijon-Abuyog 230 kV TL: 2-795 MCM ACSR/AS, ST-DC, 25.4 km. • Toblijon-Daraga 230 kV Bus-in TL: 2-795 MCM ACSR/AS, ST-DC, 0.86 km. • Toblijon-BacMan 230 kV Bus-in TL: 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.	3,855M	Sorsogon	Mar 2025

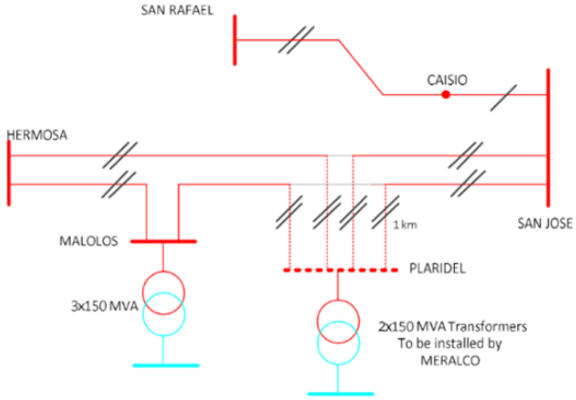


San Simon 230 kV Substation The project aims to accommodate the growing demands of the existing steel mills and directly connected d industries, as well as to support the entry of new steel mills and industrial loads in San Simon, Pampanga southeastern part of the province of Pampanga which is presently being served by the existing Mexico 230 kV SS and underlying 69 kV facilities. Also, the project aims to address the	• Load Growth • Filed to ERC	San Simon 230 kV SS: 2x300 MVA 230/69 kV Transformer, 2x100 MVAR 230 kV capacitor, 14-230 kV PCB and associated equipment, 12-69 kV PCB and associated equipment • Mexico 230 kV SS: 8-69 kV PCB and associated equipment	• San Simon cut-in connection to Hermosa–Duhat-Balintawak 230 kV Line: 2-795 MCM ACSR/AS, SP-DC, 1.5 km. • Mexico–STR 120D (Calumpit Line Segment) 69 kV Line: SP-SC, 1-410 mm² TACSR/AS, 12.3 km STR 120D–PELCO 3 (Apalit Tap) 69 kV Line: SP-SC, 1-410 mm² TACSR/AS, 2.52 km • 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.	3,793M	Pampanga	Phase 1 Jun 2024 Phase 2 Sep 2024

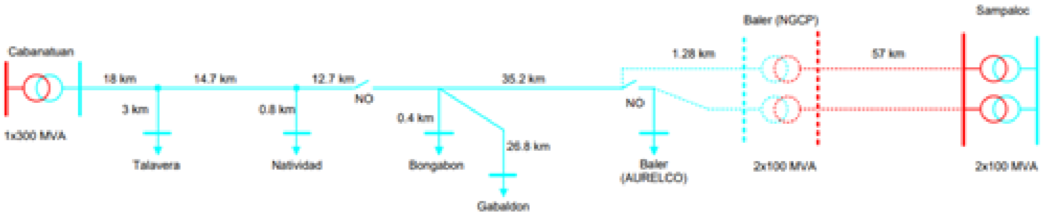
SUBSTATION						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
overloading of the 69 kV transmission facilities and serve as an alternate source SS for the loads connected at Mexico SS. The project involves the development of San Simon 230 kV SS with an initial capacity of 2x300 MVA and will be linked to the Luzon Grid through 'cut-in' connection to the existing Hermosa–Marilao–Quezon 230 kV TL. The project also involves the construction of 69 kV TL to supply various industrial loads.			• San Simon–Wan Chiong 69 kV Line: SP-SC, 1-795 MCM ACSR/AS, 6.8 km			
Castillejos 230 kV Substation The project aims to caters the load growth in Zambales and to provide N-1 contingency for Botolan-Castillejos and Olongapo-Cawagan 69 kV TL, as well as for Botolan 50 MVA Transformer the Castillejos SS 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 project will also serve as the connection point of San Marcelino Solar and other future bulk generation development in the area. The new SS will connect to the Hermosa 230 kV SS thru the Castillejos–Hermosa 500 kV TL (initially energized at 230 kV).	• Load Growth and System Reliability and Security • Filed to ERC	• Castillejos 230 kV SS: 2x100 MVA, 230/69 kV Transformer, 18-230 kV PCB, 6-69 kV PCB and associated equipment. 	▪ Hermosa–Castillejos 500 kV Line Extension: 4-410 mm^2 TACSR/AS, ST-DC, 6 km ▪ Hanjin 230 kV Line Extension: 1-795 MCM ACSR, ST-DC, 7 km ▪ Castillejos 69 kV Line Extension: 1-410 mm^2 TACSR/AS, SP/ST-DC, 3km.	2,596M	Zambales	Dec 2025
Capas 230 kV Substation The project aims to address the overloading of 230/59 kV transformers in Concepcion SS. The project target is to accommodate the connection of New Clark City (NCC) and supply to loads of TARELCO I, and Tarlac Electric Cooperative II (TARELCO II),. This project involves the installation of 2x300 MVA 230/69 kV transformers,	• Load growth and Generation Entry • Filed to ERC	• Concepcion 230 kV SS: 4-230 kV PCB and associated equipment. • Capas 230 kV SS: 2x300 MVA 230/69-13.8 kV power transformers 3x100 MVAR 230 kV capacitors 11-230 kV PCB and associated equipment 14-69 kV PCB and associated equipment	• Concepcion–Capas 230 kV TL ST-DC, 4-795 MCM ACSR, 15 km  	6,954M	Tarlac	Dec 2029

SUBSTATION

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
expansion of Concepcion 230 kV SS and a 15 km DC 230 kV TL connecting Concepcion and proposed Capas 230 kV substations. The project will address the load growth in the franchise area of TARELCO I, TARELCO II, Tarlac Electric Inc. (TEI) and Shin Clark Power Corporation for the connection of the NCC.						
Plaridel 230 kV Substation The project aims to address the continues load growth in MERALCO's Bulacan and provides N-1 contingency provision to the 230/69 kV transformers at San Rafael and Malolos Substations. This project involves the development of a new 230 kV drawdown SS in Plaridel, Bulacan that will bus-in along the Hermosa–Malolos/San Jose 230 kV TL. The project consists of a 1 km, DC, 2-795 MCM ACSR TL. Meanwhile, the installation of a 2x150 MVA, 230/69 kV transformers and 69 kV switchyard will be implemented by MERALCO	• Load Growth and System Reliability and Security • Filed to ERC	• Plaridel 230 kV SS: 2x100 MVAR 230 kV capacitors 12-230 kV PCB and associated equipment	• Plaridel 230 kV bus-in 230 kV TL: ST-DC, 2-795 MCM ACSR, 1.0 km	3,777M	Nueva Ecija	Feb 2030

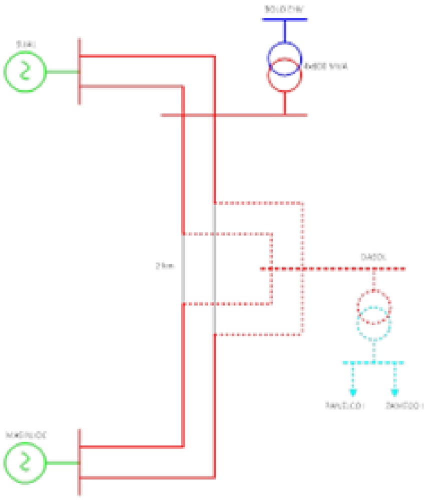
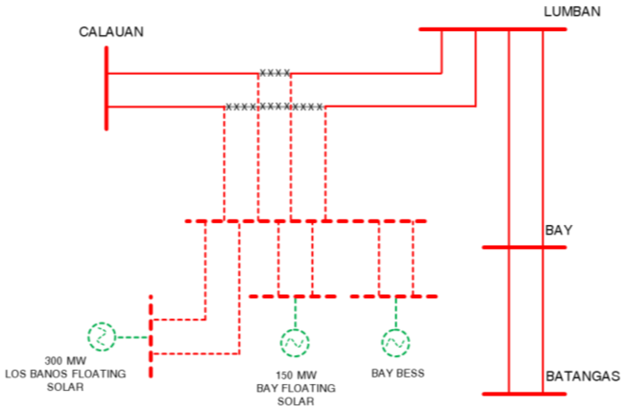
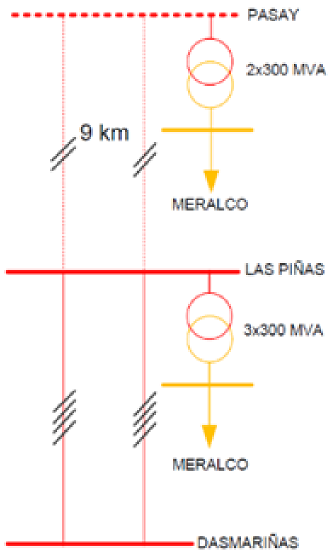


Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Baler 230 kV Substation The project aims to address the forecasted overloading of the Cabanatuan–Baler 69 kV TL. The Baler 230 kV SS Project involves the development of a new SS in Baler, Aurora Province with 2x100 MVA Transformer capacity and a 57 km 2-795 MCM ACSR 230 kV Sampaloc–Baler 230kV TL.	• Load Growth • Filed to ERC	• Baler kV SS: 2x100 MVA 230/69 kV Power Transformer, 11-230 kV PCB and associated equipment, 4-69 kV PCB and associated equipment, 3x25 MVAR Shunt Capacitor, 2x25 MVAR Shunt Reactor • Sampaloc 230 kV SS: 2-230 kV PCB and associated equipment	• Sampaloc–Baler (NGCP) 230 kV TL: ST-DC, 2-795 MCM ACSR, 57 km. • Baler (NGCP) – Baler (AURELCO) 69 kV TL: SP-DC, 1-795 MCM CSR, 1.78 km	10,128M	Nueva Ecija, Aurora	Apr 2030



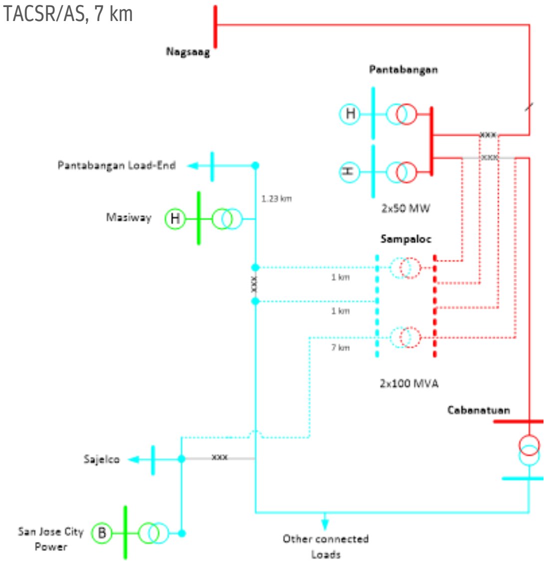
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Dasol 230 kV Substation The project aims to cater to load growth in Pangasinan I Electric Cooperative (PANELCO I) and Zambales I Electric Cooperative	• Load Growth • Filed to ERC	• Dasol 230 kV SS: 2x100 MVA, 230/69 kV Power Transformers, 10-230 kV PCB and associated equipment, 4-69 kV PCB and associated equipment	• Dasol 'Bus-in' to Masinloc–Kadampat 230 kV TL: ST-DC, 4-795 MCM ACSR, 1x2 km. • Dasol–Dasol (PANELCO I) 69 kV TL: SP-SC, 1-795 MCM, 17.7 km. • Dasol–Sta. Cruz 69 kV TL: SP-SC, 1-795 MCM, 17.3 km	5,240M	Zambales	Dec 2030

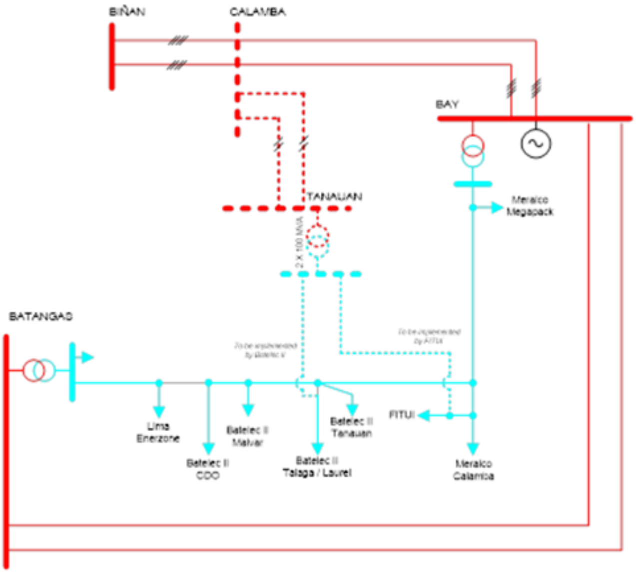
SUBSTATION

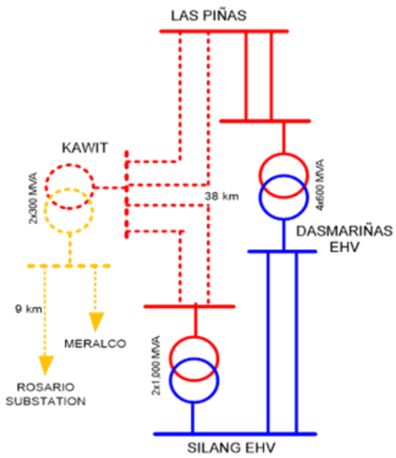
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
(ZAMECO I) franchise areas. The project is strategically located in Dasol, Pangasinan to relieve the projected overloading of the Labrador–Bolinao and Botolan–Candelaria 69 kV TL along with the overloading of the transformers in Labrador and Botolan 230 kV substations. The project involves the development of a new 230 kV SS in Dasol, Pangasinan to address the increasing load growth in both PANELCO I and ZAMECO I franchise areas. The new 230 kV drawdown SS will have a 2x100 MVA transformer capacity and will be linked to the Luzon Grid through 'bus-in' connection to the existing Masinloc–Bolo 230 kV TL.						
Masiit 230 kV Collector Station	• Load Growth and System Reliability • Filed to ERC	• Masiit 230 kV Collector Station: 16-230 kV PCB and associated equipment	• Masiit 'bus-in' along Lumban–Calauan 230 kV TL: 1-795 MCM ACSR, ST-DC, 2x1 km Reconductoring of Masiit-Calauan 230 kV TL: 230 kV 1-410 mm^2 TACSR, ST-DC, 0.1 km	2,792M	Laguna	Dec 2030
This project involves the development of new collector SS in Masiit, Calauan, Laguna that will bus-in along the Lumban–Calauan 230 kV Line to accommodate the generation capacities in the province. These generation capacities include the proposed Floating Solar Power plants in Laguna Bay, including BESS. The development of new Masiit 230 kV Collector Station is being proposed due to the unavailability of termination connection at the existing San Juan and Lumban 230 kV SS.						
Pasay 230 kV Subsation	• Load Growth • ERC Approved	• Pasay 230 kV S/S: 11-230 kV PCB and associated equipment (GIS)	• Las Piñas–Pasay 230 kV TL: DC Underground Cable: 2x2,500 mm^2 XLPE (1-core), 9 km	19,073M	Las Pinas, Pasay	Dec 2029
The project aims to cater the load growth of MERALCO's load sector 3 which is presently being served by Las Piñas and Muntinlupa substations. The project involves the construction of a new drawdown SS in Metro Manila to support the increasing power consumption in the cities of Pasay, Parañaque, Makati and Taguig. The project will have an initial capacity of 2x3001 MVA transformers and it will be connected to the Las Piñas 230 kV SS through a 9.0 km, 2x2,500 mm^2 XLPE (1-core)-DC underground cable, 230 kV TL.						

SUBSTATION

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
Sampaloc 230 kV Substation The project aims to address the forecasted load growth in Nueva Ecija. The project also aims to relieve the heavy loading of the existing 69 kV line from Cabanatuan going to Fatima (Pantabangan Load End) and addressed the voltage issues in the said area. The project involves the construction of a new 230 kV drawdown SS in Nueva Ecija which 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. The proposed SS will have an initial capacity of 2x100 MVA, 230/69 kV Power Transformers with 2x50 MVA 230 kV capacitors. Furthermore, a new 69 kV TL going to San Jose City will be developed using 1-410 mm^2 TACSR/AS.	• Load Growth • Filed to ERC	• Sampaloc 230 kV SS: 2x100 MVA, 230/69 kV Power Transformers, 12-230 kV PCB and associated equipment, 5-69 kV PCB and associated equipment, 2x50 MVAR Shunt Capacitor	• Sampaloc 'Bus-in' to Cabanatuan–Pantabangan and Nagsaag–Pantabangan 230 kV TL: 1-795 MCM ACSR/AS, 2 km • Sampaloc 'cut-in' to Cabanatuan–Fatima 69 kV TL: ST-DC, 1-336 MCM, 1 km • Sampaloc–SAJELCO 69 kV TL: SP-SC, 1-410 mm^2 TACSR/AS, 7 km	3,777M	Nueva Ecija	Dec 2028
Luzon Primary Equipment Substation Upgrading The project aims to accommodate various incoming Generating Power Plants on the Luzon Grid. Additionally, this project replace the existing Under-rated PCB and Power Transformers installed on various Luzon Substations. Luzon Primary Equipment Substation Upgrading Project (LPESUP) aims to upgrade the existing HVE at various substations in the Luzon Grid. These include the installation of new, and/or Replacement of Transformers and PCB to a higher rating to accommodate the projected demand of the Luzon Grid to sustain System Reliability.	• Generation entry and System reliability and security	• Cabanatuan 230 kV SS: 4-230 kV PCB and associated equipment • Magat 230 kV SS: 1-230 kV Compact Air Insulated Switchgear (CAIS) PCB and associated equipment • Pantabangan 230 kV SS: 2-230 kV PCB and associated equipment • Quezon 230 kV SS: 7-230 kV PCB and associated equipment • Doña Imelda 230 kV SS: 7-230 kV Gas Insulated Substation (GIS) PCB and associated equipment 12-115 kV GIS PCB and associated equipment • Malaya Collector Station: 4-230 kV PCB and associated equipment • Salong 230 kV SS: 2-230 kV PCB and associated equipment • San Rafael 230 kV SS: 1x300 MVA, 230/69 kV Power Transformer 2-69 kV PCB and associated equipment • Tuguegarao 69 kV SS: 2-69 kV PCB and associated equipment • Daraga 69 kV SS: 2-69 kV PCB and associated equipment • Bay 69 kV SS: 3-69 kV PCB and associated equipment • Clark 69 kV SS: 3-69 kV PCB and associated equipment • Bacnotan 69 kV SS: 1-69 kV PCB and associated equipment • Lal-lo 69 kV SS: 3-69 kV PCB and associated equipment	• Tiwi-A 'Cut-in' to Tiwi-C–Tabaco 69 kV TL: 69 kV, 1-795 MCM ACSR/AS, SP-DC, 2x1 km • Hermosa–BPPI/Calaguiman 69 kV TL: 69 kV, 1-795 MCM ACSR/AS, SP-SC, 1.5 km	15,285M	Various Provinces in Luzon Grid	Nov 2026



SUBSTATION						
Project Name and Description	**Project Driver and Status**	**Project Components**		**Project Cost (Million Pesos)**	**Location**	**ETC**
		Substation	**Transmission Line**			
		• Bolo 230 kV SS: 4-230 kV PCB and associated equipment • Laoag 230 kV SS: 2x300 MVA, 230/115 kV Power Transformer 4-230 kV PCB and associated equipment 1-115 kV PCB and associated equipment 3-69 kV PCB and associated equipment • Hermosa 69 kV SS: 1x300 MVA, 230/69 kV Power Transformer 3-69 kV PCB and associated equipment • Tiwi-C 69 kV SS: 2-69 kV PCB and associated equipment • Limay 69 kV SS: 1-69 kV PCB and associated equipment • Tiwi-A SS: 1x100 MVA, 230/69 kV Power Transformer 3-69 kV PCB and associated equipment • Calamba 230 kV SS: 2-230 kV PCB and associated equipment				
Tanauan 230 kV Substation The project aims to cater the load growth and improve the power quality in Batangas and Laguna, particularly the loads of MERALCO in Calamba, Batangas II Electric Cooperative, Inc. (BATELEC II) and First Industrial Township Utilities, Inc. (FITUI). The project involves the construction of a new 230 kV drawdown SS in Tanauan City, Batangas which will be connected to the Luzon Grid through the proposed Calamba 230 kV SS via a 12 km, ST/SP-DC, 2-795 MCM ACSR/AS, 230 kV transmission line. The new 230 kV SS shall be conventional-type with the 230 kV and 69 kV switch bays arranged in breaker-and-a-half scheme. The major SS equipment to be installed includes 2X100 MVA, 230/69-13.8 kV Power Transformers, 8-230 kV PCB and 4-69 kV PCB, including associated SS equipment.	• Load growth • Filed to ERC	• Tanauan SS: 2x100 MVA, 230/69-13.8 kV 8-230 kV PCB and associated equipment 4-69 kV PCB + associated equipment • Calamba SS: 2-230 kV PCB and associated equipment	• Calamba–Tanauan 230 kV TL: T/SP-DC, 2-795 MCM ACSR, 12 km 	5,565M	Batangas	Jan 2028
Kawit 230 kV Substation The project aims to cater the load growth in MERALCO's Cavite Sector, to improve the reliability of the Rosario 115 kV SS by upgrading to a doule-bus	• Load Growth and System Reliability and Security • Filed to ERC	• Kawit 230 kV SS: 2x300 MVA 230/115 kV Power Transformers, 12-230 kV PCB and associated equipment, 6-115 kV PCB and associated equipment, 2x100 MVAR, 230 kV Shunt Capacitor • Las Piñas 230 kV SS (Expansion): 4-230 kV PCB and associated equipment • Silang 230 kV SS (Expansion): 4-230 kV PCB and associated equipment • Rosario 115 kV SS Upgrading: 2x100 MVA 115/34.5 kV Power	• Silang–Kawit–Las Piñas 230 kV TL: SP-DC, 4-795 MCM ACSR, 38 km • Kawit–Rosario 115 kV TL SP/ST-SC, 2-795 MCM ACSR, 9 km	15,152M	Cavite, Las Piñas	May 2028

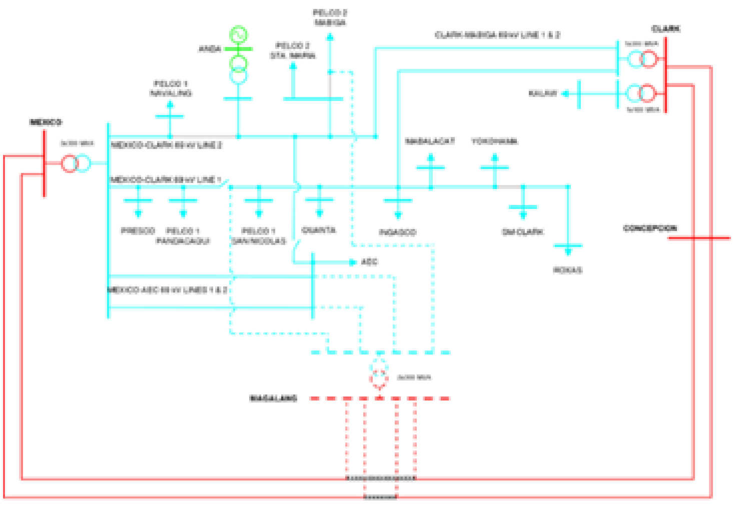
SUBSTATION						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
GIS substation and a well as addressing the overloading of Rosario 115/34.5 kV transformers during N-1 contingency. The project involves the development of a new drawdown SS in Kawit, Cavite with a 2x300 MVA transformer capacity to cater the load growth in the Cavite Sector of MERALCO. The project will relieve the overloading of Dasmariñas 3x300 MVA 230/115 kV transformers. The project involves the construction of 38 km DC 230 kV Line from Las Piñas to Kawit and to Silang, as well as the upgrading of the Rosario 115 kV SS to double-bus GIS SS.		Transformers, 8-115 kV PCB (GIS) and associated equipment, 10-34.5 kV PCB (GIS) and associated equipment.				
North Luzon 230 kV Substation Upgrading 2 The North Luzon Substation Upgrading Project 2 aims to cater the load growth and provide N-1 contingency to Substations in NGCP's North Luzon Region. Without the project, power interruptions will be experienced by customers during failure of existing transformers and PCB The project includes capacity additions to the substations, replacement and rearrangements of PCB to ensure reliability and flexibility of operations on the various substations.	• Load Growth and System Reliability and Security • Filed to ERC	• Laoag SS: 1x100 MVA 115/69 kV Power Transformer and Accessories, 1-115 kV PCB and associated euipment, 10-69 kV PCB and associated equipment • Mexico SS: 18-69 kV PCB and associated equipment • San Manuel SS: 2x300 MVA, 230/69 kV Power Transformer and Accessories, 14-69 kV PCB and associated equipment Nagsaag SS: 1-69 kV PCB and Associated equipment • Pantabangan SS: 4-230 kV PCB and associated equipment • Tuguegarao SS: 1x100 MVA 230/69 kV Power Transformer and Accessories, 1-230 kV PCB and associated equipment, 1-69 kV PCB and Associated equipment • Balingueo SS: 1x100 MVA 230/69 kV Power Transformer and Accessories, 2-230 kV PCB and associated equipment, 1-69 kV PCB and associated equipment • Bauang SS: 1x100 MVA 230/69 kV Power Transformer and Accessories • Bayombong SS: 2x100 MVA, 230/69 kV Power Transformer and Accessories, 5-230 kV PCB and associated equipment, 14-69 kV PCB and associated equipment • Concepcion S/S: 6-69 kV PCB and associated equipment, 2x300 MVA 230/69 kV Power Transformer and Accessories • Santiago SS: 1x100 MVA, 230/69 kV Power Transformer and Accessories, 5-69 kV PCB and associated equipment • Subic SS: 1-230 kV PCB and associated equipment • San Jose SS: 29-230 kV PCB and associated equipment, 12-115 kV PCB and associated equipment		9,152M	La Union, Ilocos Norte, Nueva Vizcaya, Isabela, Ilocos Sur, Pangasinan, Cagayan, Tarlac, Pampanga, Zambales, Nueva Ecija, Bataan	Phase 1 - Jul 2024 Phsae 2 - May 2027

SUBSTATION

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
		• San Esteban SS: 2x100 MVA 115/69 kV Power Transformer and Accessories, 1-69 kV PCB and associated equipment, 1-115 kV PCB and associated equipment • Masinloc SS: 2-230 kV PCB and associated equipment • Bolo SS: 2-230 kV PCB and associated equipment • Hermosa SS: 19-230 kV PCB and associated equipment.				
Magalang 230 kV Substation	Generation Entry	• Magalang SS: 2x300 MVA 230/69 kV Power Transformer, 12-230 kV PCB and associated equipment, 10-69 kV PCB and associated equipment, 2x100 MVAR, 230 kV Shunt Capacitor	• Magalang 'bus-in' along Mexico–Concepcion 230 kV TL: 230 kV, 2-410 mm^2 TACSR, ST-DC, 3 km	3,516M	Pampanga	Dec 2027

The project aims to provide an additional drawdown SS in the province of Pampanga. This will improve the reliability of the supply of loads in Pampanga to act as another connection point of DU in the area. To accommodate the connection of 96.236 MWac Sapang Balen 1 Solar Power Plant Project and 463.995 MWac Sapang Balen 2 Solar Power Plant Project of Sapang Balen Solar Sustainable Energy Corporation (SBSSEC). Additionally, the project addresses the anticipated load growth of AEC, PELCO I, and PELCO II.

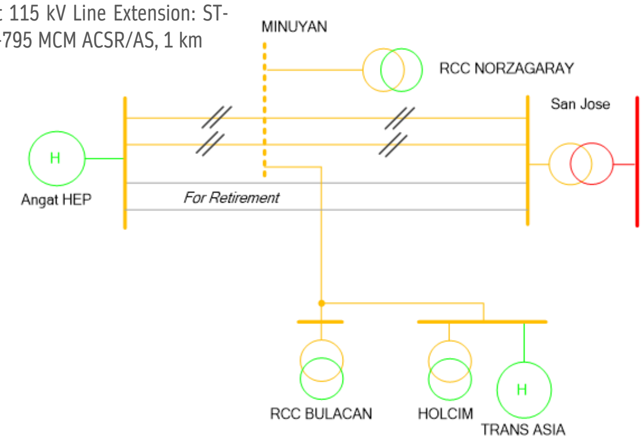
The project involves the development of a new 230 kV SS to accommodate the connection of proposed solar plants in Pampanga. Additionally, a 2x300 MVA, 230/69 kV transformer capacity will be installed to address the anticipated demands in the area. This SS will 'bus-in' along the existing Mexico–Concepcion 230 kV Line.



115 kV PROJECTS

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Minuyan 115 kV Switching Station	• System Reliability • Filed to ERC	• Minuyan SWS: 11-115 kV PCB and associated equipment • Las Piñas 230 kV SS (Expansion): 4-230 kV PCB and associated equipment.	• San Jose 115 kV Line Extension: ST-DC, 2-795 MCM ACSR/AS, 0.5 km • Angat 115 kV Line Extension: ST-DC, 2-795 MCM ACSR/AS, 1 km	1,895M	Bulacan	Feb 2030

The project aims to provide reliable connection of the industrial loads (cement plants) in the area of Bulacan. The SWS aims to provide flexibility and enables to isolate the fault to prevent power interruption to the other connected customers. This project involves the construction of a new SWS that will bus-in along the San Jose–Angat 115 kV Line.



VOLTAGE IMPROVEMENT						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
230 kV PROJECTS						
Luzon Voltage Improvement Project 3 The project 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 LES 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 Bautista substations.	• System Reliability • ERC-approved	• Baler 69 kV LES: 3x2.5 MVAR, 69 kV Capacitor, 3-69 kV PCB and associated equipment • Pantabangan 69 kV LES: 1x5 MVAR, 69 kV Capacitor, 1-69 kV PCB • Umingan 69 kV LES: 3x5 MVAR 69 kV Capacitor, 3-69 kV PCB and associated equipment • Camiling 69 kV LES: 3x5 MVAR 69 kV Capacitor, 3-69 kV PCB and associated equipment • Mexico SS: 3x100 MVAR, 230 kV Shunt Capacitor, 1-230 kV PCB and associated equipment • San Jose SS: 1x100 MVAR, 230 kV Shunt Capacitor, 1-230 kV PCB and associated equipment • Cabanatuan SS: 2x50 MVAR, 230 kV Capacitor Bank, 1-230 kV PCB and associated equipment, 1-69 kV PCB and associated equipment • Laoag SS: 2x25 MVAR, 230 kV Capacitor Bank, 1x25 MVAR, 230 kV Shunt Reactor, 1x35 MVAR, 230 kV Shunt Reactor, 3-230 kV PCB and associated equipment • Nagsaag SS: 1x90 MVAR, 500 kV Shunt Reactor, 1-500 kV PCB and associated equipment • Tuguegarao SS: 1x25 MVAR, 230 kV Capacitor Bank, 2-230 kV PCB and associated equipment, 1-69 kV PCB and associated equipment, 1x25 MVAR, 230 kV Shunt Reactor • Bantay SS: 1x7.5 MVAR, 115 kV Capacitor Bank, 1-115 kV PCB and associated equipment • San Esteban 230 kV SS: 2x25 MVAR, 230 kV Capacitor, 2-230 kV PCB and associated equipment • Botolan 230 kV SS: 1x25 MVAR 230 kV Shunt Reactor, 6-230 kV PCB and associated equipment, 3-69 kV PCB and associated equipment • Itogon 69 kV LES: 1x7.5 MVAR, 69 kV Capacitor, 1-69 kV PCB and associated equipment • Antipolo 230 kV SS: 2x100 MVAR, 230 kV Capacitor, 2-230 kV PCB and associated equipment • Bayamban SS: 3x5 MVAR, 69 kV Capacitor Bank, 4-69 kV PCB and associated equipment		2,566M	Aurora, Nueva Ecija, Pangasinan, Tarlac, Ilocos Sur, Zambales, Benguet	Apr 2024
Luzon Voltage Improvement Project 4	• Power Quality and Technology • ERC Approved	• Dasmariñas SS: 2x100 MVAR, 230 kV Capacitor Bank, 2-230 kV PCB and associated equipment • Biñan SS: 2x100 MVAR, 230 kV Capacitor Bank, 2-230 kV PCB and associated equipment		1,102M	Sorsogon, Camarines Sur, Batangas, Albay, Cavite	Phase 1 -Apr 2024

VOLTAGE IMPROVEMENT						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
The project aims to address the anticipated undervoltage problem during peak load condition at various 69 kV LES in the South Luzon Grid. This project involves the installation of capacitor banks to various substations in the South Luzon Region.		• Ligao SS: 3x5 MVAR Capacitor Bank, 3-69 kV PCB and associated equipment • Nabua (formerly Iriga) SS: 2x5 MVAR Capacitor, 2-69 kV PCB and associated equipment Irosin (formerly Cuenca) SS: 2x5 MVAR, 69 kV Capacitor Bank, 2-69 kV PCB and associated equipment • Malvar (formerly San Juan) SS: 3x5 MVAR, 69 kV Capacitor Bank, 3-69 kV PCB and associated equipment • Rosario (formerly Taysan) SS: 3x7.5 MVAR, 69 kV Capacitor Bank, 3-69 kV PCB and associated equipment • Tigaon (formerly Lagonoy) SS: 3x5 MVAR, 69 kV Capacitor Bank, 3-69 kV PCB and associated equipment				Phase 2 - Dec 2026
Luzon Voltage Improvement Project 5 The project aims to address the anticipated undervoltage problem during peak load condition at various LES in Cagayan, Tarlac, Nueva Ecija, Pampanga, Zambales, Pangasinan, Batangas, Quirino, Isabela, Nueva Viscaya, and Benguet. The project intends to provide additional reactive power support in the network to maintain the system voltage within ±5% of the nominal value during normal and single outage contingencies as prescribed under the PGC. LVIP 5 involves the installation of capacitors to various 69 kV load end substations in the North Luzon Region.	• Power Quality and Technology • ERC Approved	• Solana LES: 4x7.5 MVAR 69 kV Capacitor Bank, 5-69 kV PCB and associated equipment • Bongabon LES: 4x5 MVAR 69 kV Capacitor Bank, 5-69 kV PCB and Associated equipment • Candelaria LES: 4x2.5 MVAR 69 kV Capacitor Bank, 5-69 kV PCB and Associated equipment • Bani LES: 4x5 MVAR 69 kV Capacitor Bank, 5-69 kV PCB and Associated equipment • San Fabian LES: 4x5 MVAR 69 kV Capacitor Bank, 5-69 kV PCB and associated equipment. • Aglipay LES: 4x5 MVAR 69 kV Capacitor Bank, 5-69 kV PCB and Associated equipment • Cauayan LES: 4x5 MVAR 69 kV Capacitor Bank, 5-69 kV PCB and associated equipment • Ilagan LES: 4x2.5 MVAR 69 kV Capacitor Bank, 5-69 kV PCB and associated equipment		5,554M	Cagayan, Nueva Ecija, Zambales, Pangasinan, Quirino, Isabela	Dec 2030
Luzon Voltage Improvement Project 6 The project addresses the anticipated undervoltage problem during peak load condition at various 69 kV LES in the north and South Luzon Grid. The project intends to provide additional reactive power support in the network to maintain the system voltage within ±5% of the nominal value during normal and single outage contingencies as prescribed under the PGC. LVIP 6 involves the installation of capacitors to substations in the North and South Luzon Region.	• Power Quality • Filed to ERC	• Lal-lo 69 kV SS: 3x5 MVAR Shunt Capacitor, 3-69 kV PCB and associated equipment • Tabuk 69 kV SS: 4x2.5 MVAR Shunt Capacitor, 5-69 kV PCB and associated equipment • Libmanan 69 kV SS: 4x2.5 MVAR Shunt Capacitor, 5-69 kV PCB and associated equipment • San Rafael 230 kV SS: 2x100 MVAR Shunt Capacitor, 2-230 kV PCB and associated equipment • Calamba 230 kV SS: 2x100 MVAR Shunt Capacitor, 2-230 kV PCB and associated equipment • San Jose 230 kV SS: 1x100 MVAR Shunt Capacitor, 1-230 kV PCB and associated equipment		1,620M	Pangasinan, Cagayan, Tarlac, Zambales, Bulacan, Laguna, Camarines Sur	Mar 2029

VOLTAGE IMPROVEMENT						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			

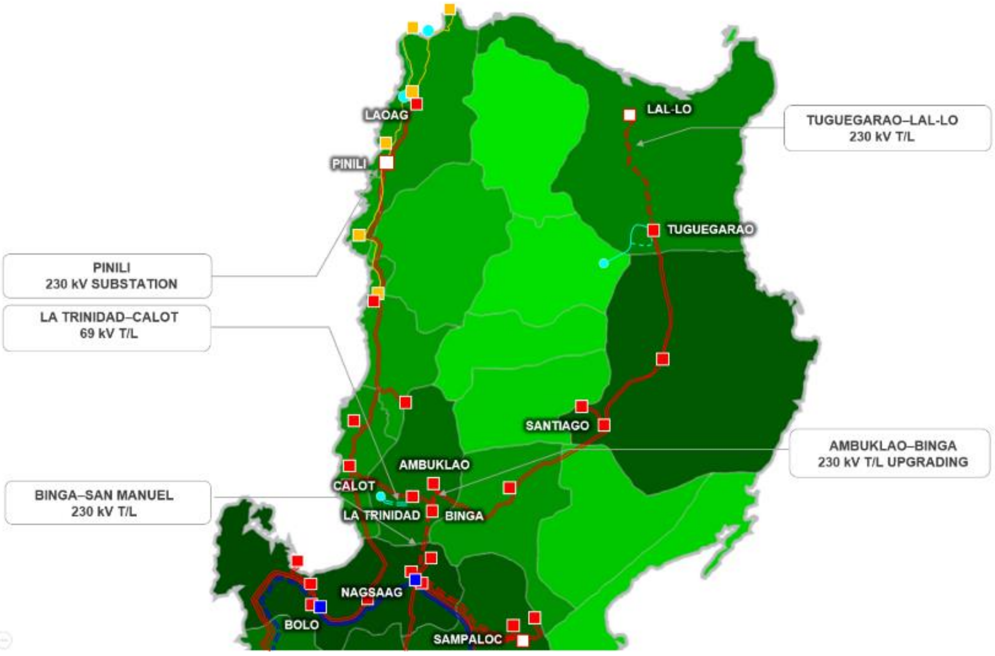


Figure 8.1: North Luzon Transmission Outlook for 2025

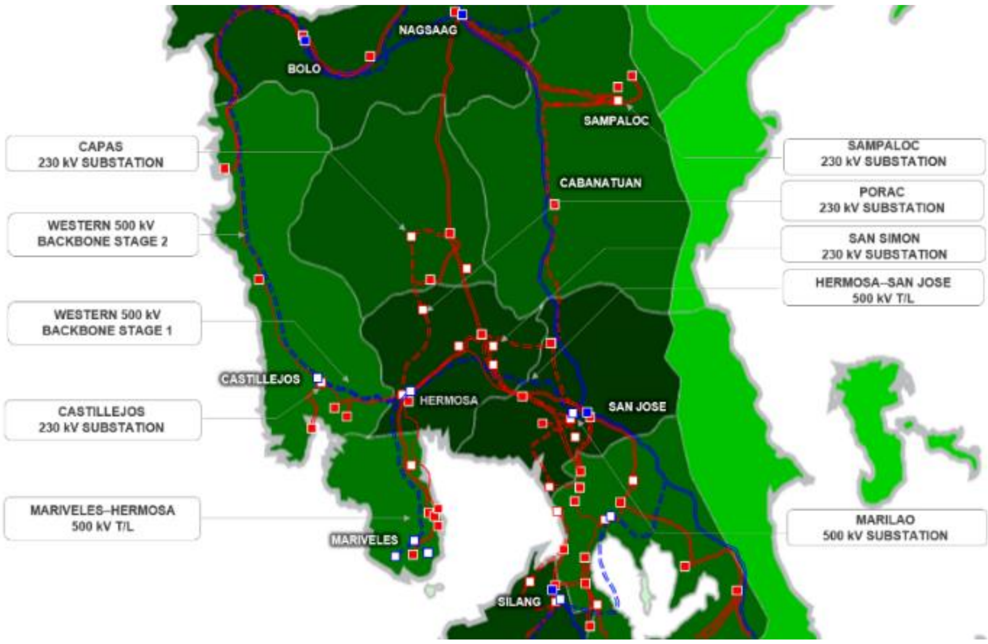


Figure 8.2: Central Luzon Transmission Outlook for 2025

Figure 8.3: Metro Manila Transmission Outlook for 2025

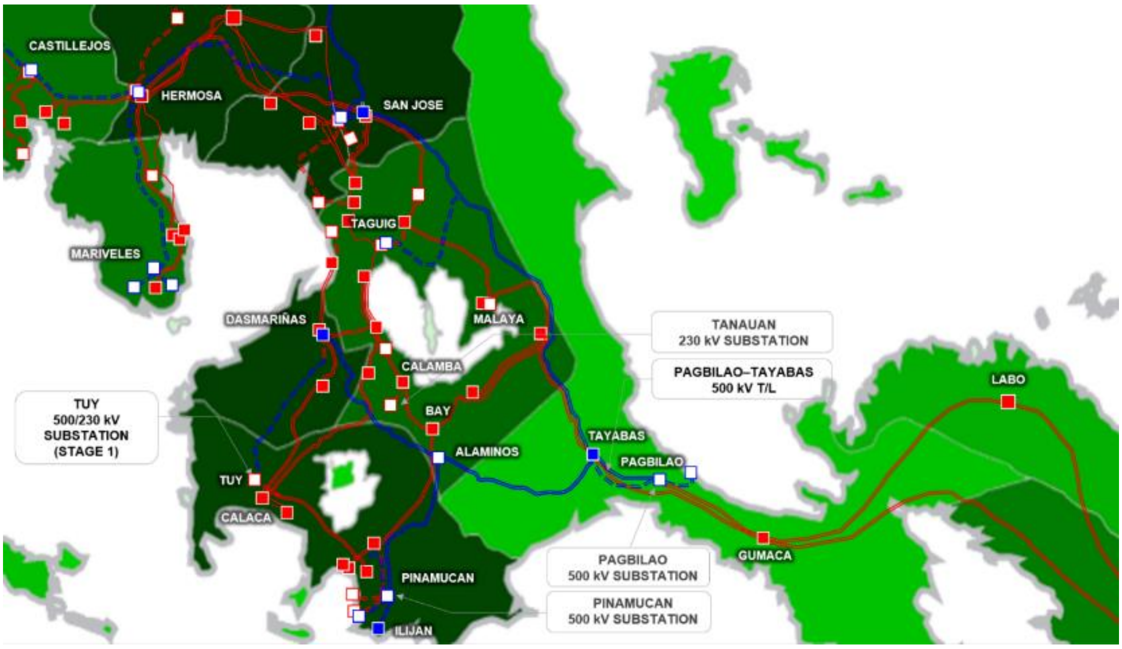


Figure 8.4: South Luzon Transmission Outlook for 2025

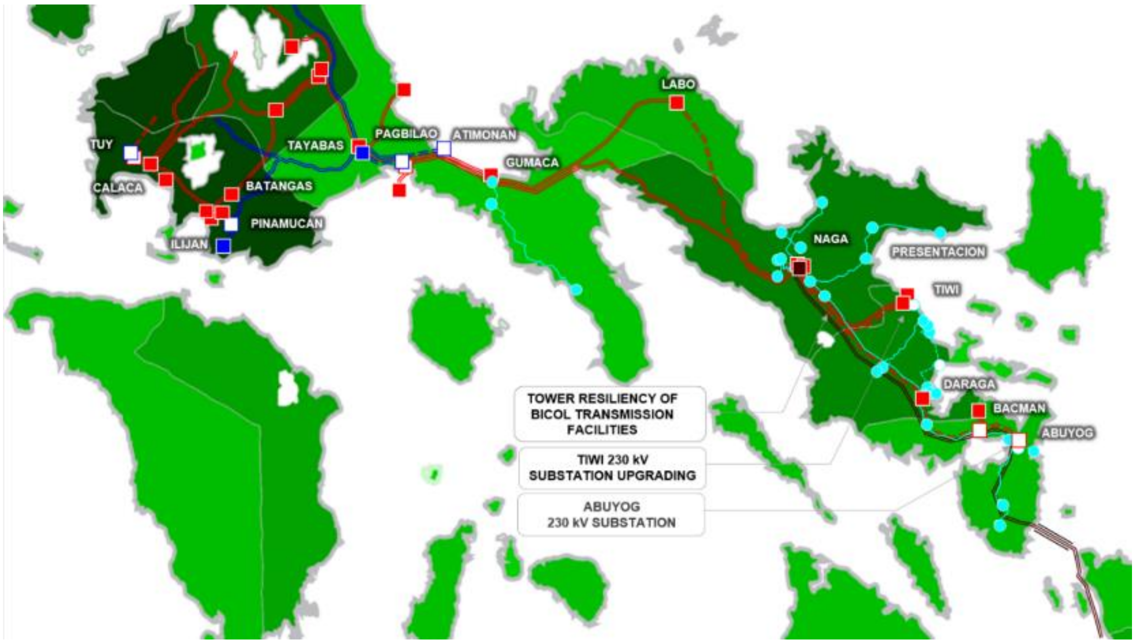


Figure 88.5: Bicol Region Transmission Outlook for 2025

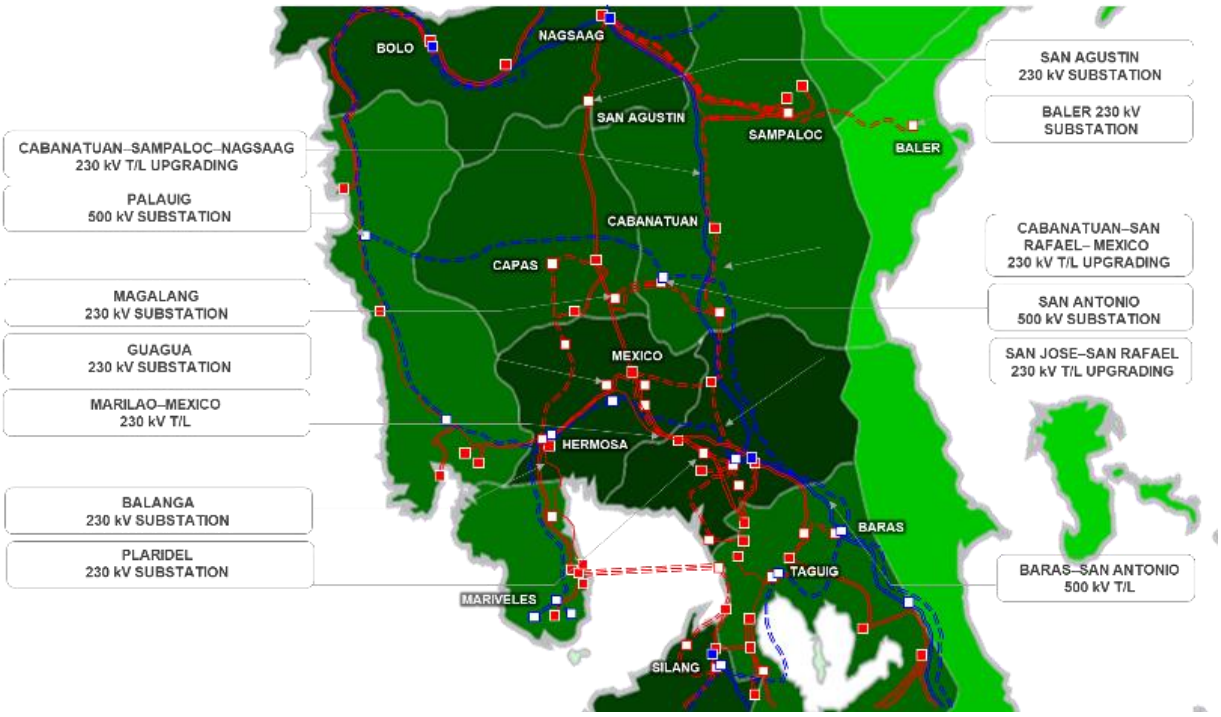


Figure 8.6: Central Luzon Transmission Outlook for 2030

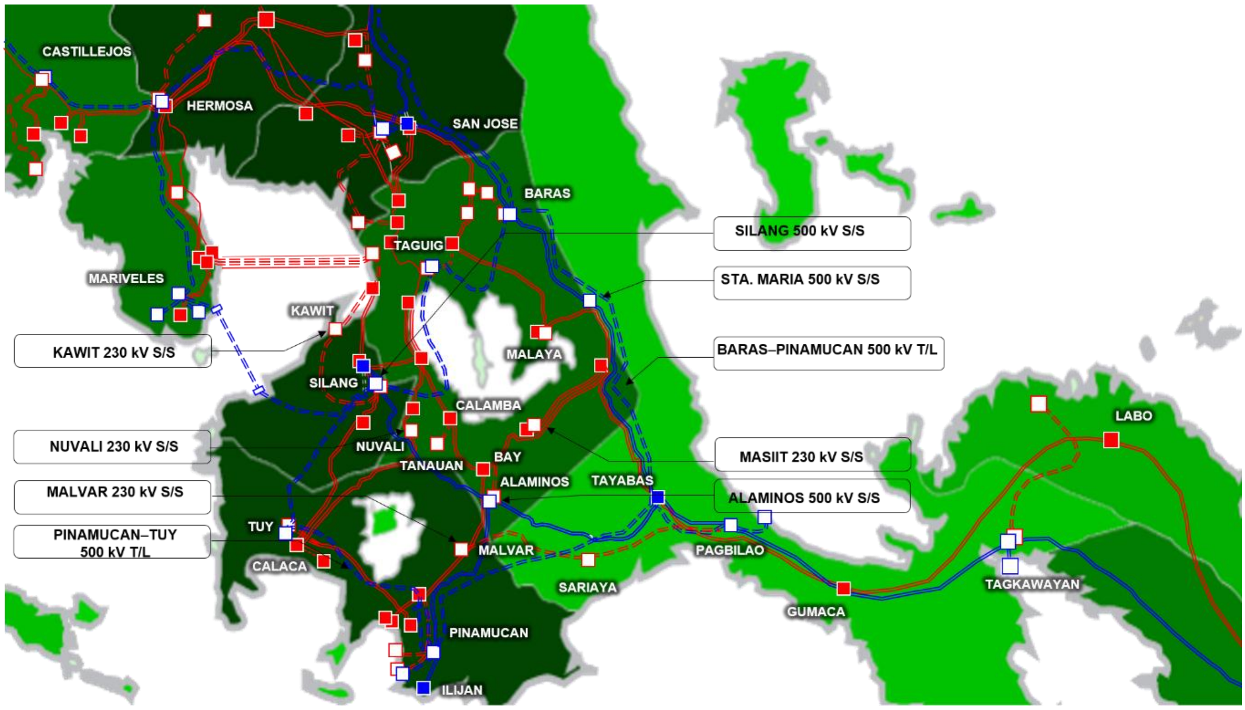


Figure 8.7: Metro Manila Transmission Outlook for 2030

Figure 8.8: South Luzon Transmission Outlook for 2030

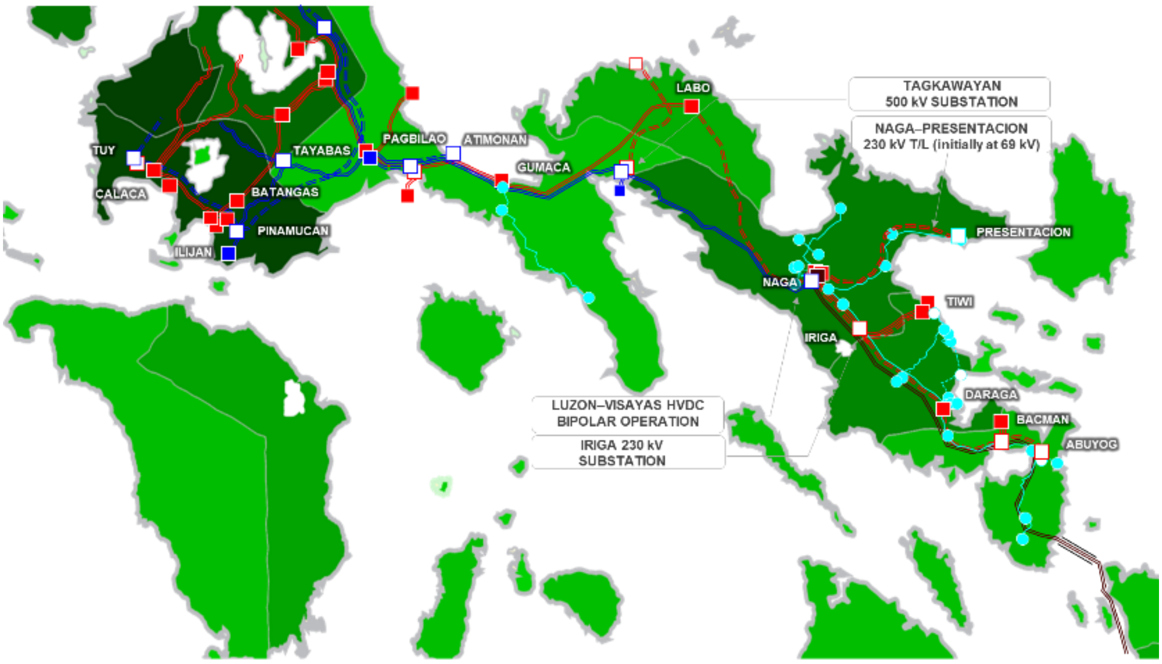


Figure 8.9: Bicol Region Transmission Outlook for 2030

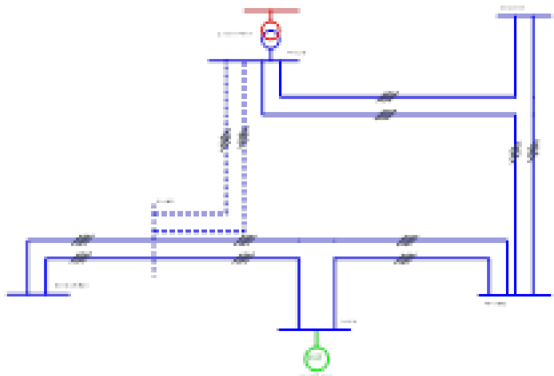
8.2 *Transmission Outlook for 2031-2040*

Projects filed from 2031 to 2040 focus on the generation capacities in Northern Luzon that will be accommodated by the implementation of the Northern Luzon 230 kV Loop to provide the needed transmission capacity augmentation.

The proposed hydro and wind farms in the Mountain Province will be connected to the grid through the La Trinidad–Sagada 230 kV TL Project. In addition, Ilocos Norte being within one of the CREZ in Northern Luzon, any additional generation will be accommodated by both Bolo–Balaoan 500 kV TL and the Balaoan–Laoag 500 kV TL Projects.

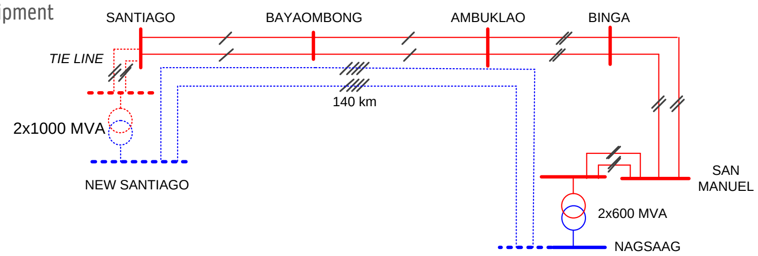
Another bulk generation location for Renewable Energy and Coal Plants is the province of Zambales. These generation capacities will be accommodated by the Palauig 500 kV SS and the development of new 500 kV transmission corridor from Palauig to San Antonio in Nueva Ecija and eventually to Baras, Rizal.

Table 8.2 List of Luzon transmission projects for the period **2031-2040**

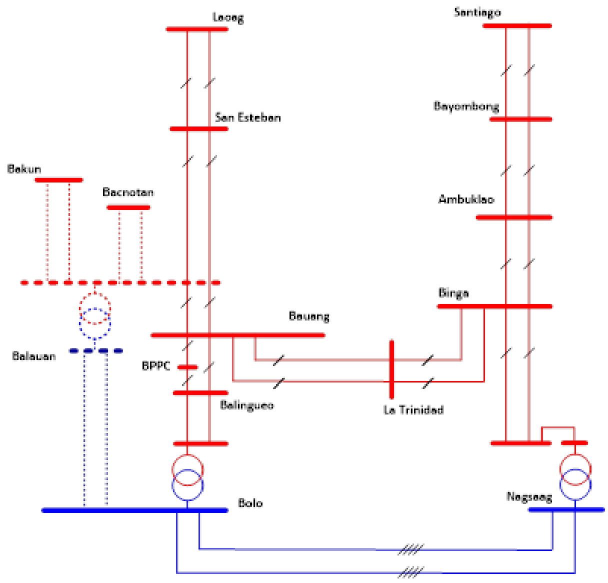
TRANSMISSION LINE						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
500 kV PROJECTS						
Taguig–Silang 500 kV Transmssion Line The project addresses the overloading of San Jose–Tayabas 500 kV TL and provides new transmission corridor that supplies the loads in Metro Manila It involves the development of a new 500 kV transmission corridor that will strengthen the power supply in Metro Manila. The 500 kV ST-DC, 4-410mm2 TACSR, 72 km TL links the Taguig and Silang 500 kV Substations to increase and strengthen the 500 kV backbone supplying Metro Manila	• Load Growth • Filed to ERC	• Silang 500 kV SS: 4-500 kV PCB and associated equipmen 	• Taguig–Silang 500 kV TL: ST-DC, 4-410 mm^2 TACSR, 72 km	13,689M	Cavite, Metro Manila	Feb 2031

TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Nagsaag–Santiago 500 kV Transmssion Line The project aims to cater the incoming hydro, geothermal, and solar power plant generation capacities in the Provinces of Ifugao, Kalinga, and Apayao and to address the overloading of Santiago–Bayombong–Ambuklao 230 kV TL. It involves the development of a Santiago 500 kV SS with 2x1,000 MVA 500/230 kV Transformer capacity and a 140 km, ST-DC, 4-410 mm2 TACSR/AS 500 kV TL from Nagsaag to Santiago 500 kV SS.	• Generation Entry • Filed to ERC	• Santiago 500 kV SS: 2x1000 MVA 500/230 kV power transformers, 2x60 MVAR 500 kV line reactors, 2x90 MVAR 500 kV shunt reactors, 2x100 MVAR 230 kV capacitors, 10-500 kV PCB and associated equipment, 22-230 kV PCB and associated equipment • Nagsaag 500 kV SS: 4-500 kV PCB and associated equipment • Old Santiago 230 kV SS, 2-230 kV PCB and associated equipment	• Nagsaag–Santiago 500 kV TL: ST-DC, 4-410 mm^2 TACSR, 140 km • New Santiago SS 230 kV tie-line: ST-DC, 4-795 MCM ACSR, 1km	30,956M	Isabela, Pangasinan	Oct 2031



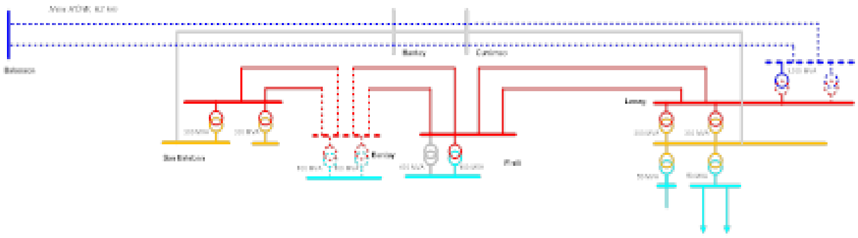
Bolo–Balaoan 500 kV Transmssion Line The project aims to accommodate the entry of the proposed 1,200 MW Luna CFPP in La Union and the 500 MW COHECO Badeo Pumped-Storage HEPP in Benguet. It also aims to address the forecasted load growth in Ilocos Region. It involves the development of a new 500 kV transmission corridor in Northwestern part of the Luzon Grid and a new 500/230 kV collector SS in Balaoan, La Union.	• Generation Entry • Filed to ERC	• Balaoan 500 kV SS: 2x750 MVA 500/230 kV Power Transformers, 20-500 kV PCB and associated equipment, 21-230 kV PCB and associated equipment, 4x90 MVAR, 500 kV Shunt Reactor, 2x60 MVAR, 500 kV Line Reactor, 3x100 MVAR, 230 kV Capacitor • Bolo 500 kV SS: 3-500 kV PCB and associated equipment	• Bolo–Balaoan 500 kV TL: ST-DC, 4-410 mm^2 TACSR/AS, 89 km • Balingueo–Balaoan 500 kV TL: ST-DC, 4-410 mm^2 TACSR/AS, 41 km • Bacnotan–Balaoan 230 kV TL: ST-DC, 4-795 MCM, ACSR, 11 km • Balaoan–Bakun 230 kV TL: ST-DC, 1-795 MCM, ACSR, 13.7 km • Balaoan Bus-in Bauang–San Esteban 230 kV TL: ST-DC, 1-795 MCM, ACSR, 2x0.6 km	33,903M	La Union, Pangsinan	Apr 2032



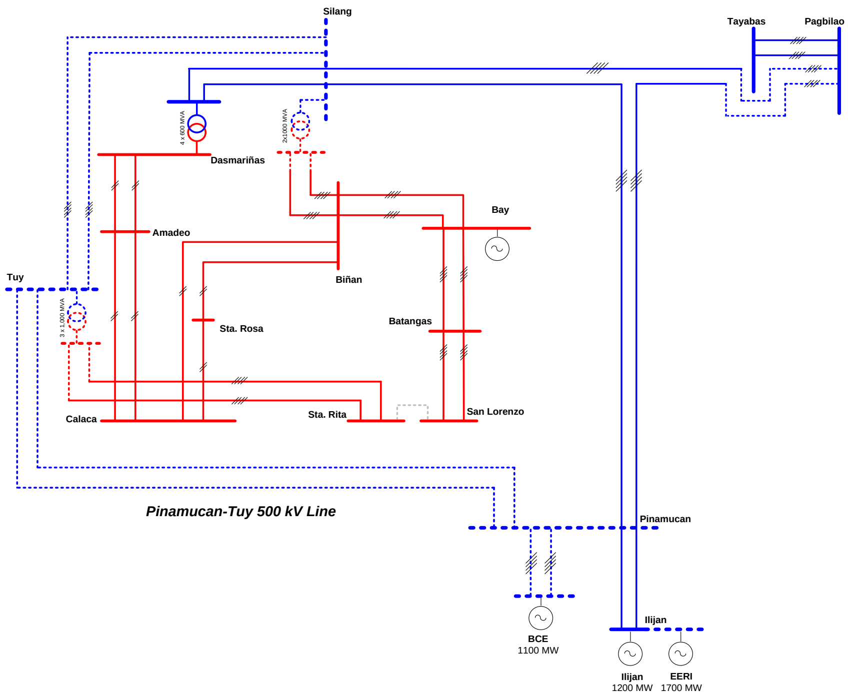
Balaoan–Laoag 500 kV Transmssion Line	• Generation Entry • Filed to ERC	• Laoag EHV SS: 2x1,000 MVA, 500/230 kV Power Transformer, 3x90 MVAR 500 kV Shunt Reactor,	• Balaoan–Laoag 500 kV TL: ST-DC, 4-410 mm^2 TACSR, 175 km	40,195M	La Union, Ilocos Norte	Apr 2034

TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
The project aims to accommodate the entry of wind farm and Solar PV projects in the Province of Ilocos Norte. The existing 230kV transmission facilities in the grid have capacity constraints to accommodate these incoming Renewable Energy (RE) plants. It involves the development of a new 500 kV transmission corridor in Northwestern part of the Luzon Grid and a new 500kV SS in Laoag with a transformer capacity of 2x1,000 MVA.		2x60 MVAR 500 kV Line Reactor, 9-500 kV PCB and associated equipment, 8-230 kV PCB and associated equipment • Laoag 230 kV SS: 2-230 kV PCB and associated equipment • New Bantay 230 kV SS: 2x100 MVA, 230/69 kV Power Transformer, 10-230 kV PCB and Associated equipment, 7-69 kV PCB and associated equipment	• Laoag 230 kV Tie Line: ST-DC, 4-795 MCM ACSR, 1 km • Bantay bus-in 230 kV Line: ST-DC, 1-795 MCM ACSR, 2 km			



Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Pinamucan–Tuy 500 kV Transmssion Line The project aims to provide a new transmission corridor that will deliver the bulk generation of power from Batangas to Metro Manila. It also aims to accommodate the entry of new generation plants that will connect to Pinamucan 500/230 kV SS. It involves the construction of a 60 km, 500 kV, 4-795 MCM ACSR, ST-DC TL from Pinamucan 500 kV SS to Tuy 500 kV SS.	• Generation Entry • Filed to ERC	• Pinamucan 500 kV SS: 4-500 kV PCB and associated equipment • Tuy 500 kV SS: 3-500 kV PCB and associated equipment	• Pinamucan–Tuy 500 kV TL: ST-DC, 4-795 MCM ACSR, 60 km	16,234M	Batangas	Dec 2031

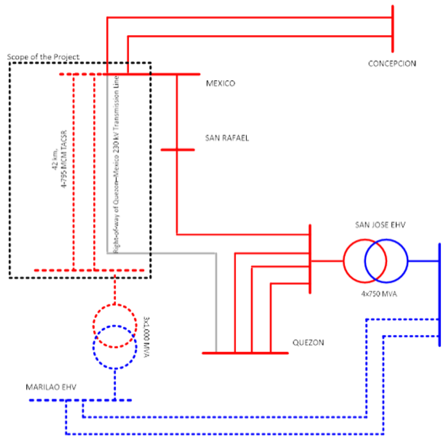


230 kV PROJECTS

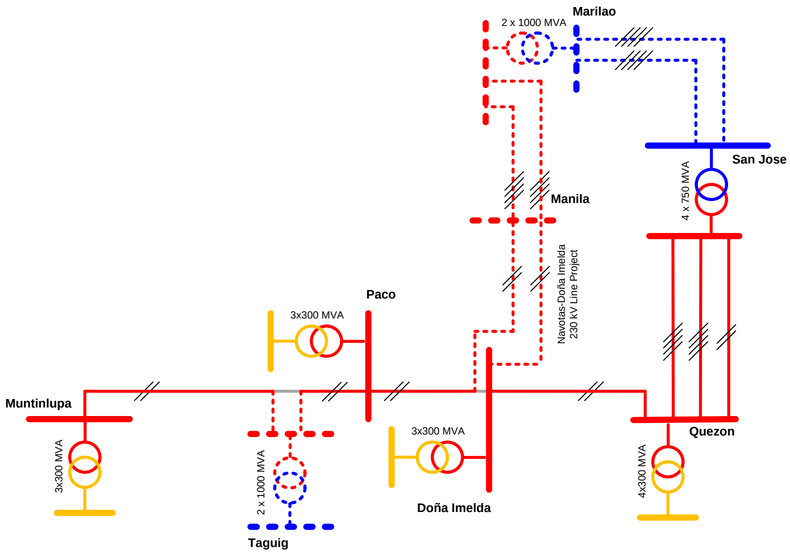
Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Marilao–Mexico 230 kV Transmission Line The project aims to address the overloading of Quezon–Mexico 230 Line during N-1 contingency and maximum generation dispatch and avoid the generation curtailment.	• System Reliability and Security • Filed to ERC	• Marilao 230 kV SS: 4-230 kV PCB and associated equipment • Mexio 230 kV SS: 4-230 kV PCB and associated equipment	• Marilao–Mexico 230 kV TL: ST-DC, 4-795 MCM ACSR, 42 km	5,988M	Pampanga, Bulacan	Aug 2032

TRANSMISSION LINE

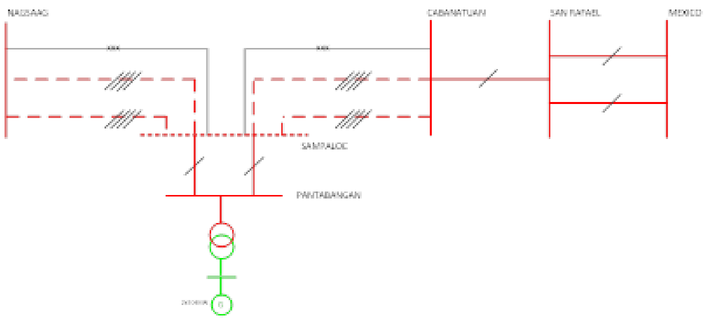
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
The project involves the development of Mexico–Marilao 230 kV TL utilizing the existing ROW of Quezon–Mexico 230 kV Transmission Line. This also includes the swinging of Mexico–Hermosa 230 kV Transmission Line on Mexico 230 kV Substation to allow the termination of two additional circuits and the construction of proposed TL project.						



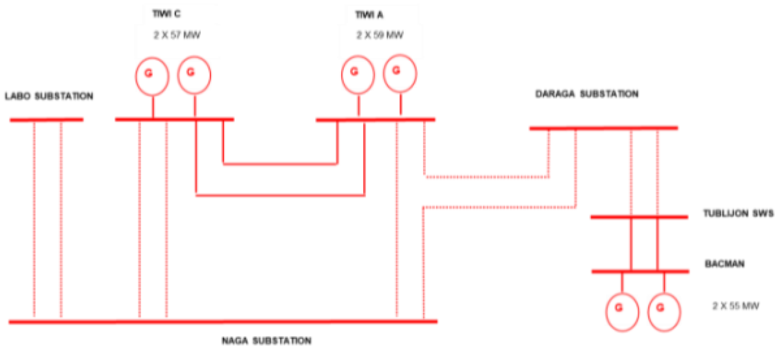
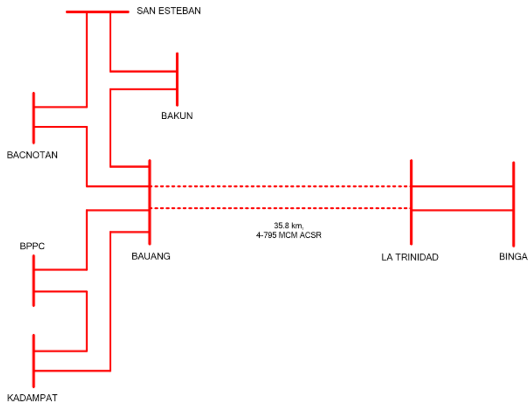
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Navotas–Doña Imelda 230 kV Transmission Line The project aims to address overloading of Quezon-Doña Imelda 230 kV TL during single outage contingency and to improve voltage regulation within Metro Manila. The project involves the construction of the 10 km SP-DC, 2-410 mm² TACSR/AS, 230 kV Line from Navotas to Doña Imelda 230 kV SS. This project will provide additional transmission corridor that will complement the existing single-circuit Quezon (Balintawak)–Doña Imelda (Araneta)–Paco–Muntinlupa (Sucat) 230 kV TL.	• Load Growth and Generation Entry • Filed to ERC		• Navotas–Doña Imelda 230 kV TL: SP-DC, 2-410 mm² TACSR/AS, 10.0 km	3,359M	Metro Manila	May 2033



Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Cabanatuan–Sampaloc–Nagsaag 230 kV Transmission Line The project aims to address the overloading of the existing single circuit, Cabanatuan-Sampaloc and Sampaloc-Nagsaag 230 kV TL. Also, aims to address the reliability issues on the Sampaloc-Nagsaag 230 kV TL and Cabanatuan-Sampaloc 230 kV TL due to old age. The project involves the upgrading of the existing Sampaloc–Nagsaag 230 kV TL and the Sampaloc–Cabanatuan 230 kV TL from a single	• System Reliability and Security • Filed to ERC	• Sampaloc SS: 4-230 kV PCB and associated equipment • Nagsaag SS: 6-230 kV PCB and associated equipment • Cabanatuan SS: 2-230 kV PCB and associated equipment	• Sampaloc–Nagsaag 230 kV TL: ST-DC, 4-795 MCM ACSR /AS, 68 km • Cabanatuan–Sampaloc 230 kV TL: ST-DC, 4-795 MCM ACSR/AS, 53 km	11,216M	Nueva Ecija, Pangasinan	Jul 2033



TRANSMISSION LINE

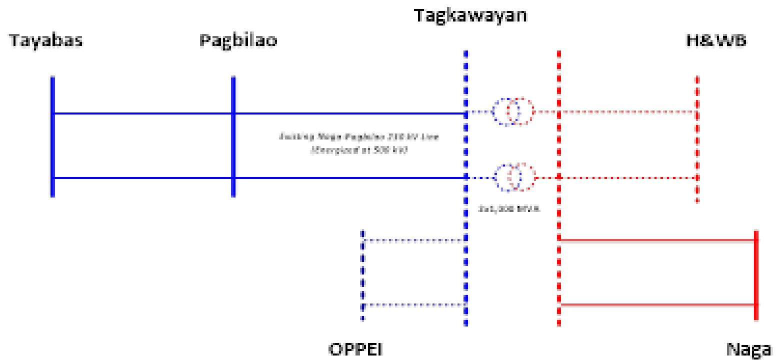
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
circuit, 1-795 MCM ACSR conductor to a DCt, 4-795 MCM ACSR conductor.						
Tower Resiliency of Bicol Transmission Facilities	• System Reliability and Security • Filed to ERC		• Naga–Tiwi A–Daraga 230 kV TL: ST-DC, 1-410 mm² STACIR, 105 km • Naga–Tiwi C 230 kV TL: ST-DC, 1-410 mm² STACIR, 60 km • Daraga–Tublijon 230 kV TL: ST-DC, 1-410 mm² STACIR, 35 km • Naga–Labo 230 kV TL: ST-DC, 1-410 mm² STACIR, 98.5 km	10,730M	Camarines Sur, Camrines Norte, Albay, Sorsogon	Apr 2034
The project aims to replace all existing steel tower structure of Naga–Tiwi– Daraga, Daraga–Tublijon and Naga–Labo TL which has a 180 kilometer-per-hour windspeed design that cannot withstand strong typhoons. The project will involve the construction of new TL towers that able to withstand a wind speed of 300 kilometer-per-hour. The resiliency of these tower structures will ensure the continuity of power supply in Bicol Region even during typhoons.	 					
Bauang–La Trinidad 230 kV Transmission Line Upgrading	• Load growth and System Reliability and Security • Filed to ERC	• La Trinidad 230 kV SS: 9-230 kV PCB and associated equipment, 3-69 kV PCB and associated equipment.	• Bauang–La Trinidad 230 kV TL, ST-DC, 4-795 MCM ACSR, 35.8 km	5,620M	La Union Benguet	Dec 2031
The project aims to address the overloading of the old Bauang-La Trinidad 230 kV TL during N-1 Contingency. The project target is to resolve the reliability issue of the old Bauang-La Trinidad 230 kV TL which had already exceeded its asset life and as well as the reliability issue of the old and underrated PCB at La Trinidad SS. The project involves the construction of 35.8 km 230 kV TL that will utilize the ROW of the existing Bauang–La Trinidad 230 kV TL. Included also in the project the replacement of 230 kV PCB due to end of economic life and replacement of underrated 69 kV PCB at La Trinidad SS.	 					
Northern Luzon 230 kV Loop	• Generation Entry • Filed to ERC	• Laoag 230 kV SS: 4-230 kV PCB and associated equipment • Bangui 230 kV SS: 2x300 MVA 230/115 kV Power Transformers and Accessories, 14-230 kV PCB and associated equipment, 18-115 kV PCB and associated equipment, 4x50 MVAR	• Laoag–Bangui 230 kV TL: ST-DC, 2-795 MCM ACSR/AS, 50 km • Lal-lo–Pudtol 230 kV TL: ST-DC, 2-795 MCM ACSR/AS, 38 km	34,069M	Ilocos Norte, Apayao, Cagayan	Dec 2031

TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
The project provides a new transmission corridor to accommodate renewable energy and other power plants in the Northern part of Luzon. The Ilocos Region has been identified as among the areas with huge wind power generation potential. Also, Hydro generation potential is also identified in the Provinces of Kalinga, Apayao and Ifugao. This project ensures the system reliability and operational flexibility in the Ilocos Region and Cagayan Valley through the 230 kV looping. The loads can continuously be served due to supply line redundancy and will ensure that any available generation capacity in the area can be delivered to the rest of the grid. Project involves the development of three 230 kV substations in the northern part of the Luzon Grid to connect the generation development and local loads in the area. These Substations are Bangui in Ilocos Norte, Sanchez Mira in Cagayan and Pudtol in Apayao. The project will also include expansion of Laoag and Lal-lo (Magapit) 230 kV SS for the termination of the new 230 kV lines. Additional 230 kV lines, Laoag-Bangui, Bangui-Sanchez Mira, Sanchez Mira-Pudtol and Pudtol-Lal-lo 230 Line will be constructed to complete the 230 kV Loop.		115 kV Shunt Reactor, 4x25 MVAR, 230 kV Capacitor • Sanchez Mira 230 kV SS: 2x300 MVA • 230/69 kV Power Transformers and Accessories, 18-230 kV PCB and associated equipment, 8-69 kV PCB and associated equipment, 4x25 MVAR 230 kV Shunt Reactor, 4x25 MVAR 230 kV Capacitor • Pudtol 230 kV SS: 10-230 kV PCB and associated equipment • Lal-lo 230 kV SS: 4-230 kV PCB and associated equipment	• Bangui–Sanchez Mira 230 kV TL: ST-DC, 2-795 MCM ACSR/AS, 70 km • Pudtol–Sanchez Mira 230 kV TL: ST-DC, 2-795 MCM ACSR/AS, 57 km			

SUBSTATION

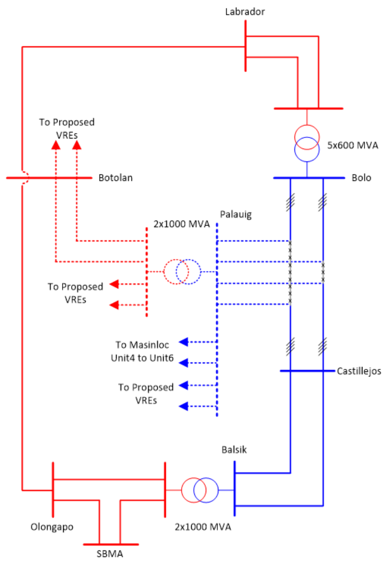
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
500 kV PROJECTS						
Tagkawayan 500 kV Substation The project aims to accommodate the proposed Coal-Fired Power Plant projects in the Provinces of Camarines Norte and Quezon. It also includes replacement of Tayabas 230 kV SS PCB to address the increase in fault level due to the entry of generating plants in Camarines Norte and Quezon Province. It involves the development of a new 500/230 kV SS in Tagkawayan, Quezon with 2x1,000 MVA transformers. The SS is to be connected to the 500 kV system by utilizing the portion of the 500 kV-designed Pagbilao–Naga 230 kV Line.	• Generation Entry • Filed to ERC	• Tagkawayan 500kV SS: 2x1,000MVA, 500/230kV Power Transformers 2x90 MVAR, 500 kV Shunt Reactor and Accessories 12-500kV PCB and associated equipment 10-230 kV PCB and associated equipment • Pagbilao 500 kV SS: 2-500 kV PCB and associated equipment • Tayabas 230 kV SS: 14-230 kV PCB and associated equipment	• Tagkawayan Bus-in to Pagbilao–Naga 500 kV Line, ST-DC 4-795 MCM ACSR, 1km •	9,817M	Tagkawayan, Quezon Province	Feb 2033



SUBSTATION

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
Palauig 500 kV Substation	• Generation Entry • Filed to ERC	• Palauig 500 kV SS: 2x1000 MVA Power Transformer, 18-230 kV PCB and associated equipment, 2x90 MVAR, 500 MVAR Shunt Reactor • Palauig 230 kV SS: 13-230 kV PCB and associated equipment, 3x100 MVAR, 230 kV Shunt Capacitor • Botolan 230 kV SS: 2-230 kV PCB and associated equipment	• Palauig 'bus-in' along Castillejos-Bolo 500 kV TL: ST-DC, 4-410 mm^2 TACSR, 2x1.0 km • Botolan-Palauig 230 kV TL: ST-DC, 4-795 MCM ACSR, 18.3 km	10,784M	Zambales	Dec 2033

The project aims to accommodate the connection of various power plants in Western Luzon through the implementation of 2x1,000 MVA 500/230 kV in Palauig, Zambales. It will be connected through "bus-in" along the proposed Castillejos-Bolo 500 kV TL, which is part of the Western Luzon 500 kV Backbone (Stage 2) Project. In addition, a new 230 kV TL will be implemented fron Botolan to Palauig. This will require Botolan SS to be disconnected from the existing Olongapa-Botolan-Labrador 230 kV TL.

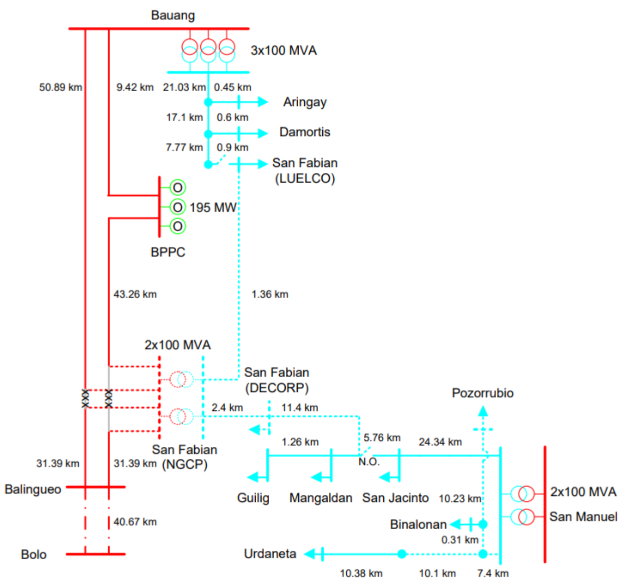


230 kV PROJECTS

Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
San Fabian 230 kV Substation	• Load Growth • Filed to ERC	• San Fabian 230 kV SS: 2x100 MVA, 230/69 kV Power Transformer, 10-230 kV PCB and associated equipment, 4-69 kV PCB and associated equipment	• San Fabian (NGCP) 'Bus-in' to Bauang–BPPC–Balingueo 230 kV TL: ST-DC 1-795 MCM ACSR/AS, 3.76 km • Bolo–Balingueo 230 kV TL (Upgrading): ST-DC, 4-795 MCM, 40.67 km • San Fabian (NGCP)–San Fabian (LUELCO) 69 kV TL: SP-SC, 1-795 MCM, 1.36 km	8,828 M	La Union	Oct 2032

The project aims to cater the load growth of both the Pangasinan and La Union. The project is strategically located in San Fabian, Pangasinan to cater the loads in Pangasinan and La Union. The proposed SS will serve as a new drawdown SS for LUELCO, DECORP and CENPELCO. In addition, the proposed upgrading of the Bolo–Balingueo 230 kV TL will address the N-1 overloading of the line due to the forecasted load growth in Ilocos Region.

The project involves the development of a new 230 kV SS in San Fabian, Pangasinan to address the increasing load growth in Pangasinan and La Union. The new 230 kV drawdown substation will have a 2x100 MVA transformer capacity and will be linked to the Luzon Grid through 'bus-in' connection to the existing Bauang–BPPC–Balingueo 230 kV TL. Furthermore, to accommodate the increasing demand in Ilocos Region, the upgrading of the Bolo–Balingueo 230 kV TL is necessary

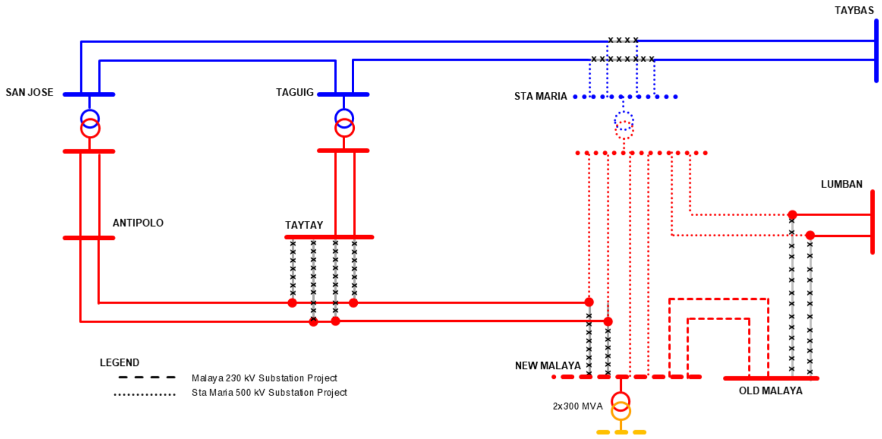


SUBSTATION

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
Malaya 230 kV Collection Station		Malaya Collector Station: 6-230 kV PCB and Associated equipment, 10-115 kV PCB and associated equipment	Malaya 230 kV Line: ST-DC, 4-795 MCM ACSR, 0.5 km	2,673M	Rizal	Dec 2032

The proposed Malaya 230 kV Collector Station accommodates the entry of 300 MW Modular Diesel Plant of AC Energy and the 300 MW PUAC Laguna Bay 2 Solar Power Plant and other power plant proponents.

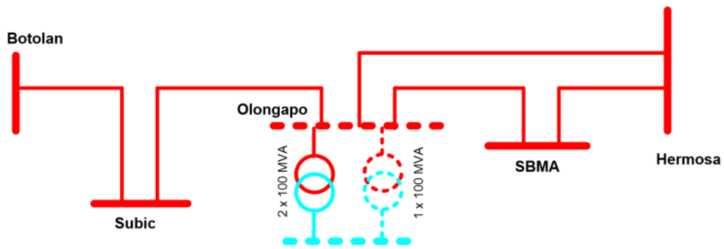
The project involves the development of Malaya 230 kV Collector Station adjacent to the existing Malaya 230/115 kV SS. The Lumban, Taytay 230 kV line and the 2x300 MVA transformer in the existing Malaya SS will be terminated and transferred to the new SS. Overall, the new SS will have a capacity of 2x300 MVA 230/115 kV transformers to accommodate the generation and serve loads of MERALCO.



Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Olongapo 230 kV Subsation Upgrading	• Load Growth • System Reliability • Filed to ERC	• Olongapo 230 kV SS: 1x100 MVA, 230/69 kV Power Transformer, 8-230 kV PCB (GIS) and associated equipment, 9-69 kV PCB and associated equipment		2,638M	Zambales	Oct 2033

The project aims to improve the reliability of the SS. This project will allow the continuous source of power to the load even with the failure of one of its breakers, the project will also address overloading of the transformers during normal and N-1 contingency.

The Olongapo 230 kV SS Upgrading Project involves the upgrading of the existing single-bus configuration of Olongapo 230 kV SS to a double-bus configuration using GIS. The project also includes the upgrading of the existing 50 MVA, 230/69 kV transformer to a 100 MVA, 230/69 kV transformer. In addition, the project also includes the revamping of SS secondary equipment and flood control program to prevent flood from occurring inside the SS.



For additional proposed projects within 2031 to 2040, these will be focusing on the improvement of system reliability. On the 500 kV network, the Bataan–Cavite 500 kV TL will be implemented. In the northern part of Luzon Grid, the transmission backbone for the province of Aurora will be developed through the Baler–Dinadiawan–Santiago TL Project. The Sagada–San Esteban 230 kV TL will provide transmission corridor in Mountain Province by completing the La Trinidad–Sagada-San Esteban 230 kV transmission loop. Another transmission corridor will also be developed through the proposed Capas–Kadampat 230 kV Line.

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

Table 8.3 List of Additional Proposed Projects in Luzon for the period **2031-2040**

Project Name	Description	Location
500 kV PROJECTS		
Luzon–Visayas HVDC Bipolar operation	• To provide an additional 440 MW transfer capacity between Luzon and Visayas.	Camarines Sur and Leyte
Baras–San Antonio 500 kV Transmission Line	• To support the delivery of bulk generation going to the loads in Central Luzon, especially during Maximum South Generation Scenario.	Rizal, Nueva Ecija
Baras–Pinamucan 500 kV Transmission Line	• To support the delivery of bulk generation from Batangas City Area going to Metro Manila.	Rizal, Batangas
Santiago–Kabugao 500 kV Transmission Line	• To accommodate the entry of power plants in Kabugao to ensure that the power supply will meet the demand load of Luzon Grid and will increase the reliability of the 500 kV backbone.	Apayao, Isabela
Bataan–Cavite 500 kV Transmission Line	• To reinforce the TL corridor supplying the loads of Metro Manila.	Bataan, Cavite
Naga–Tublijon 500 kV Transmission Line Project	• To further strengthen the reliability of the transmission network Bicol Region, the existing 230 kV TL from Naga SS to Bacman SS will be upgraded to 500 kV voltage level. This will also accommodate generation capacity addition in the Southernmost part of the Grid.	Camarines Sur, Albay, Sorsogon
230 kV PROJECTS		
San Jose–San Rafael 230 kV Transmission Line Upgrading	• To strengthen the reliability of San Jose—San Rafael 230 kV TL by upgrading the existing SC line to DC lines. And increasing its transmission capacity from 300 MVA to 1,275 MVA.	Bulacan
La Trinidad–Sagada 230 kV Transmission Line	• To accommodate the upcoming HEPP and Wind Farms on Mountain Province	Benguet
Bauang–Balaoan 230 kV TL Upgrading	• To upgrade the single bundle Bauang-Balaoan 230 kV line to 4-795 MCM ACSR to accommodate the generation capacities and increase of demand in La Union.	La Union
Cabanatuan–San Rafael–Mexico 230 kV Transmission Line Upgrading	• To address the low reliability of the existing lines due to the aging of the conductor cable.	Nueva Ecija, Pampanga, Bulacan
Hermosa–Mexico 230 kV Transmission Line Upgrading	• To address the anticipated overloading of the Hermosa–Mexico 230 kV line due to the increase in the demand of Pampanga Province.	Bataan, Pampanga
Calaca–Salong 230 kV Transmission Line 2	• To provide provision for single outage contingency for the existing single circuit Calaca–Salong 230 kV TL.	Batangas
Pasay–Taguig 230 kV Transmission Line	• To increase the reliability of 230 kV TL supplying the loads of Metro Manila.	Metro Manila
Navotas–Pasay 230 kV Transmission Line	• To provide additional reliability of supply in Metro Manila through a new transmission corridor that will connect the northern and southern part of the grid.	Metro Manila
Pasay–Limay 230 kV Transmission Line	• To increase the reliability of 230 kV TL supplying Meralco Sector 1 and secure the supply of power in the area.	Bataan, Metro Manila
Taguig–Muntinlupa 230 kV Transmission Line 2	• To strengthen the corridor of the 230 kV TL in Metro Manila due to the continuous increase of loading in Metro Manila. In addition, the proposed additional 230 kV line will improve the reliability of the system as it will provide N-1 contingency.	Metro Manila
Sagada–San Esteban 230 kV Transmission Line	• To provide a new 230 kV transmission corridor in Mountain Province Area by completing the La Trinidad–Sagada–San Esteban transmission loop.	Mountain Province, Ilocos Sur
Dinadiawan–Santiago 230 kV TL	• To increase the system reliability on the Northeastern side of the Luzon Grid.	Isabela, Aurora
Baler–Dinadiawan 230 kV Transmission Line	• To construct a 52.6 km, ST-DC, 1-795 MCM ACSR/AS 230 kV TL from Baler 230 kV SS to Dinadiawan 230 kV SS to provide additional reliability of power supply in Northeastern side of the Luzon Grid.	Isabela, Aurora
Capas–Bolo 230 kV Transmission Line	• To construct an 80 km, ST-DC, 4-795 MCM ACSR 230 kV TL from Capas 230 kV SS to Bolo 230 kV SS to provide additional reliability of power supply in Central Luzon.	Tarlac, Pangasinan
69 kV PROJECTS		
South Luzon 69 kV Transmission Line Upgrading 1	• To relieve the overloading of various 69 kV TL in NGCP's South Luzon Region, and to prevent load dropping and power interruptions during peak loadings.	Batangas, Camarines Norte, Camarines Sur, Albay
North Luzon 69 kV Transmission Line Upgrading 1	• To mitigate the impending overloading of various 69 kV TL on North Luzon, and to prevent the undervoltage problem on various points along the 69 kV TL.	Ilocos Sur, Benguet, Cagayan, Bataan, Zambales
Mexco–Clark 69 kV Transmission Line Upgrading	• To cater to the growing demands of the loads of PRESCO, AEC, Quanta Paper, Clark Electric, and PELCO I.	Pampanga
500 kV PROJECTS		

Project Name	Description	Location
Marilao 500 kV Substation Expansion	• To cater additional generation capacity in the Northern and Western region, and increase the reliability of the 500 kV system of the Luzon Grid by providing a new 500/230 kV drawdown SS for Metro Manila which will relieve the loading of the critical San Jose 500 kV SS..	Bulacan
Baras 500 kV Substation	• To accommodate the entry of power plants in Rizal to supply the demand load of Metro Manila and swill increase the reliability of the 500 kV backbone of the Luzon Gird.	Rizal
San Antonio 500 kV Substation	• To provide a new 500 kV drawdown SS to Central Luzon.	Nueva Ecija
Alaminos EHV Substation	• To accommodate the entry of power plants in Batangas and Quezon Province and to supply the demand of South Luzon. This will also increase reliability of the 500 kV backbone of the South Luzon Grid	Laguna
Bacolor 500 kV Substation	• To address the load growth in Pampanga area. The 500 kV TL of the proposed Bacolor 500 kV SS will bus-in along Marilao–Hermosa 500 kV TL, on the other hand, the 230 kV will bus-in along Mexico–Guagua 230 kV TL.	Pampanga
Dasmariñas 500 kV Substation Upgrading	• To upgrade the existing capacity of Dasmariñas SS to serve the increasing loads of various Substations in the area.	Cavite
Kalinga 500 kV Substation	• To accommodate the entry of power plants in Kalinga to ensure that the power supply will meet the demand load of Luzon Grid and will increase the reliability of the 500 kV backbone.	Kalinga
Taguig EHV Substation Expansion	• To serve the load growth in Metro Manila through the installation of a 3rd 1000 MVA 500/230 kV Transformer bank at Taguig 500 kV SS	Metro Manila
Castillejos 500 kV Expansion	• To accommodate the entry of power plants through the installation of a 3rd 1000 MVA 500/230 kV Transformer bank at Castillejos 500 kV SS	Zambales
Santiago 500 kV Substation Expansion	• To accommodate the entry of power plants through the installation of a 3rd 1000 MVA 500/230 kV Transformer bank at Santiago 500 kV SS	Isabela
Naga 500 kV Substation Expansion	• To accommodate the entry of power plants through the installation of a 3rd 1000 MVA 500/230 kV Transformer bank at Naga 500 kV SS	Camarines Sur
230 kV PROJECTS		
San Agustin 230 kV Substation	• To provide an additional drawdown SS in the province of Tarlac to address the anticipated overloading of the existing 230/69 kV transformers and associated 69 kV TL both in the province of Tarlac and Pangasinan. The project will also improve the reliability of the supply of loads in Tarlac and Pangasinan acting as another connection point of distribution utilities in the area.	Tarlac
Guagua 230 kV Substation	• To provide an additional drawdown SS in the province of Pampanga. This project will improve the reliability of the supply of loads in Pampanga acting as another connection point of distribution utilities in the area.	Pampanga
Apalit 230 kV Substation	• To provide an additional drawdown SS in the province of Pampanga. This project will improve the reliability of the supply of loads in Pampanga acting as another connection point of distribution utilities in the area.	Pampanga
Iriga 230 kV Substation	• To cater the Load Growth of the Province of Camarines Sur.	Camarines Sur
Malvar 230 kV Substation	• To cater the Load Growth of the Province of Batangas.	Batangas
Balanga 230 kV Substation	• To provide an additional drawdown SS in the province of Bataan. This project will improve the reliability of the supply of loads in Bataan since it will act as another connection point of distribution utilities in the area.	Bataan
San Isidro 230 kV Substation	• To provide an additional drawdown SS in the province of Nueva Ecija. This project will improve the reliability of the supply of loads in Nueva Ecija since it will act as another connection point of distribution utilities in the area.	Nueva Ecija
FBGC 230 kV Substation	• To address the anticipated overloading of the existing 230 kV SS serving Sector 3 of the MERALCO Franchise.	Metro Manila
Valenzuela 230 kV Substation	• To address the anticipated overloading of the existing 230 kV SS serving Sector 1 of the MERALCO Franchise.	Metro Manila
Matnog 230 kV Substation	• To accommodate the entry of power plants in Sorsogon particularly in Matnog to ensure that the power supply will meet the demand load of Luzon Grid.	Sorsogon
Nuvali 230 kV Substation	• To provide additional drawdown SS in Sta. Rosa, Laguna. This project will improve power quality and the reliability of supply MERLACO's Laguna Sector as another connection point in the area.	Laguna
Cabatuan 230 kV Substation	• To provide additional drawdown SS in the province of Isabela. This project will improve the reliability of supply of loads in Isabela as another connection point of distribution utilities in the area.	Isabela
North Luzon Substation Upgrading 3	• To cater the load growth and provide N-1 contingency to various SS in NGCP's North Luzon Region. Without the project, the customers being served by these Substations will experience load dropping and power interruptions during outage and failure of existing transformers and PCB.	Ilocos Norte, Benguet, Pangasinan, Isabela, Cagayan, Bataan, Zambales, Tarlac Pampanga, Nueva Ecija

Project Name	Description	Location
South Luzon Substation Upgrading 3	• To cater the load growth and provide N-1 contingency to various SS in NGCP's South Luzon Region. Without the project, the customers being served by these SS will experience load dropping and power interruptions during outage and failure of existing transformers and PCB.	Batangas, Albay
San Mateo 230 kV Substation	• To provide an additional drawdown SS in San Mateo, Rizal. This project will also improve power quality and the reliability of supply in MERLACO's Sector 2 since it will act as another connection point in the area.	Metro Manila
Bustos 230 kV Substation	• To support the load growth in Bulacan and will help unload the San Rafael 230 kV SS.	Bulacan
Sariaya 230 kV Substation	• To cater the Load Growth of the Province of Quezon and the eastern part of Batangas.	Quezon
Presentacion 230 kV Substation	• To cater the Load Growth in the Eastern part of Camarines Sur. It will utilize the proposed Naga-Presentacion 230 kV TL. The project will also be the connection in the future of the Catanduanes Luzon Island Interconnection.	Camarines Sur
North Luzon Substation Upgrading 4	• To cater the load growth and provide N-1 contingency to various SS in NGCP's North Luzon Region. Without the project, the customers being served by these SS will experience load dropping and power interruptions during outage and failure of existing transformers and PCB.	Pangasinan, Cagayan, Zambales, Pampanga, Nueva Ecija
South Luzon Substation Upgrading 4	• To cater the load growth and provide N-1 contingency to various SS in NGCP's South Luzon Region. Without the project, the customers being served by these SS will experience load dropping and power interruptions during outage and failure of existing transformers and PCB.	Batangas, Camarines Sur, Albay, Sorsogon

Project Name	Description	Location
230 kV PROJECTS		
Luzon Voltage Improvement Project 7	• The project aims to provide additional reactive power support in the network to maintain the system voltage within ±5% of the nominal voltage during normal and single outage contingencies as prescribed under the PGC. LVIP 7 involves the installation of capacitors and STATCOM in various Luzon 230 kV substations	Metro Manila, Bulacan, Laguna, Pampanga, Cavite
Luzon Voltage Improvement Project 8	• To provide additional reactive power support in Pampanga, Laguna, and Batangas in order to maintain the system voltage within ±5% of the nominal value during normal and single outage contingencies as prescribed under the PGC. The proposed project involves the installation of capacitors in various 230 kV substations in Luzon.	Pampanga, Laguna, Batangas

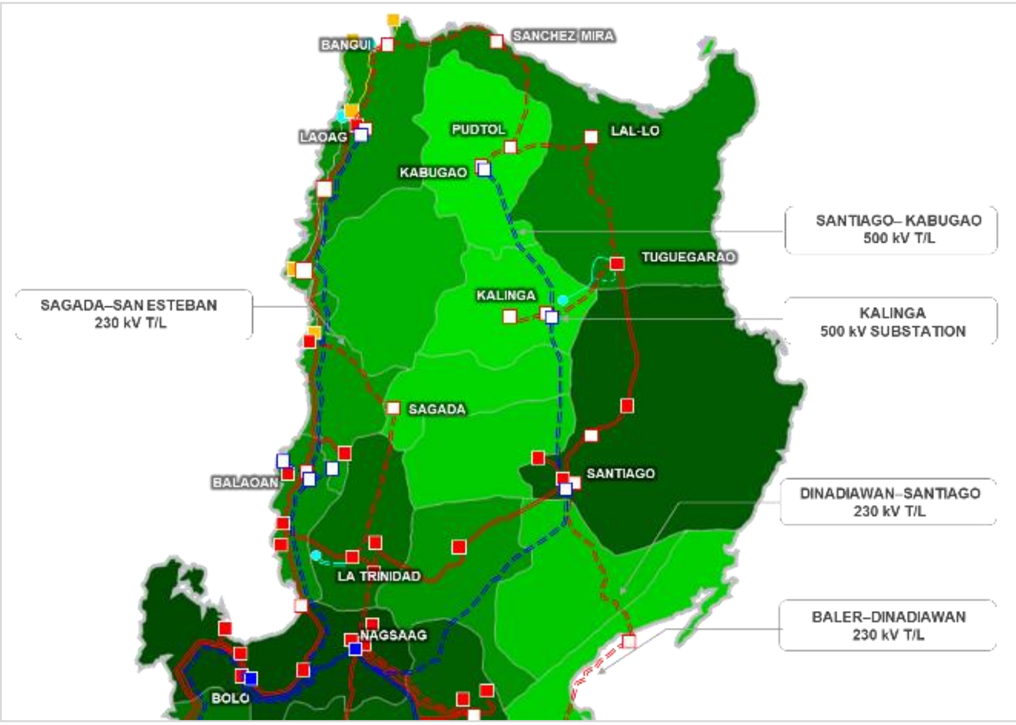


Figure 8.10: North Luzon Transmission Outlook for 2031-2040

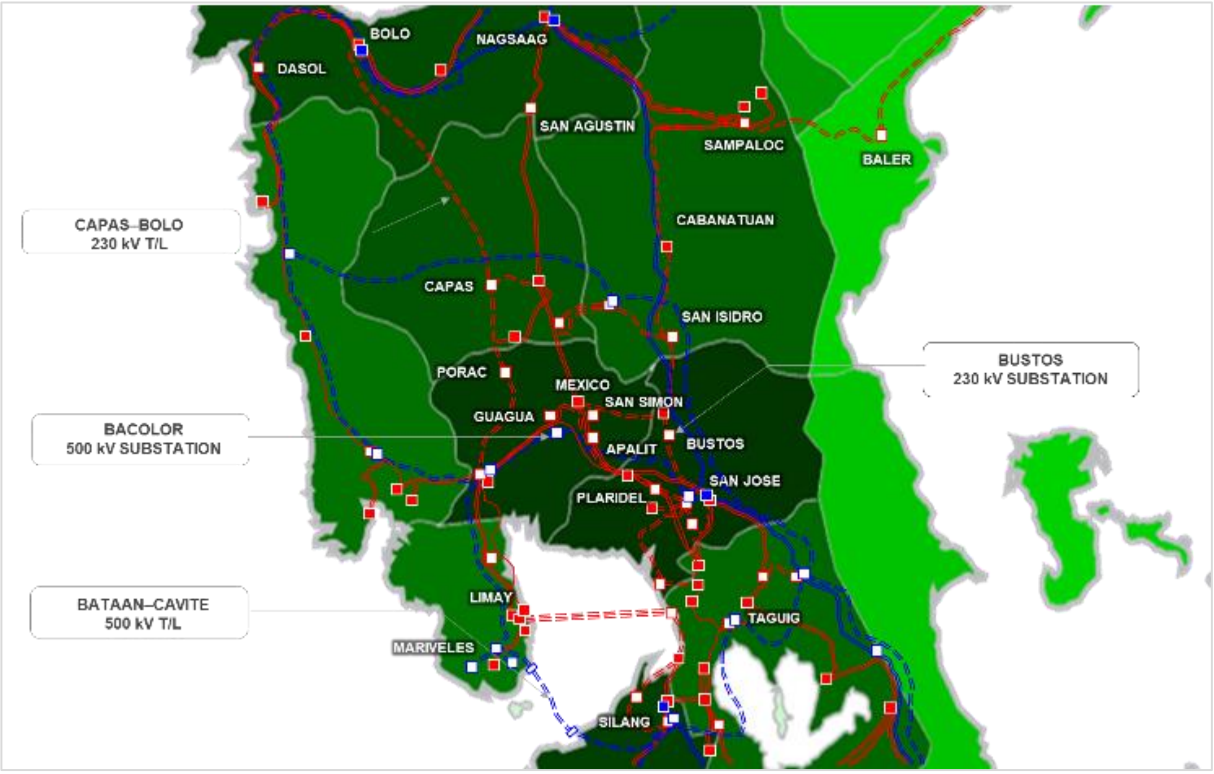


Figure 8.11: Central Luzon Transmission Outlook for 2031-2040

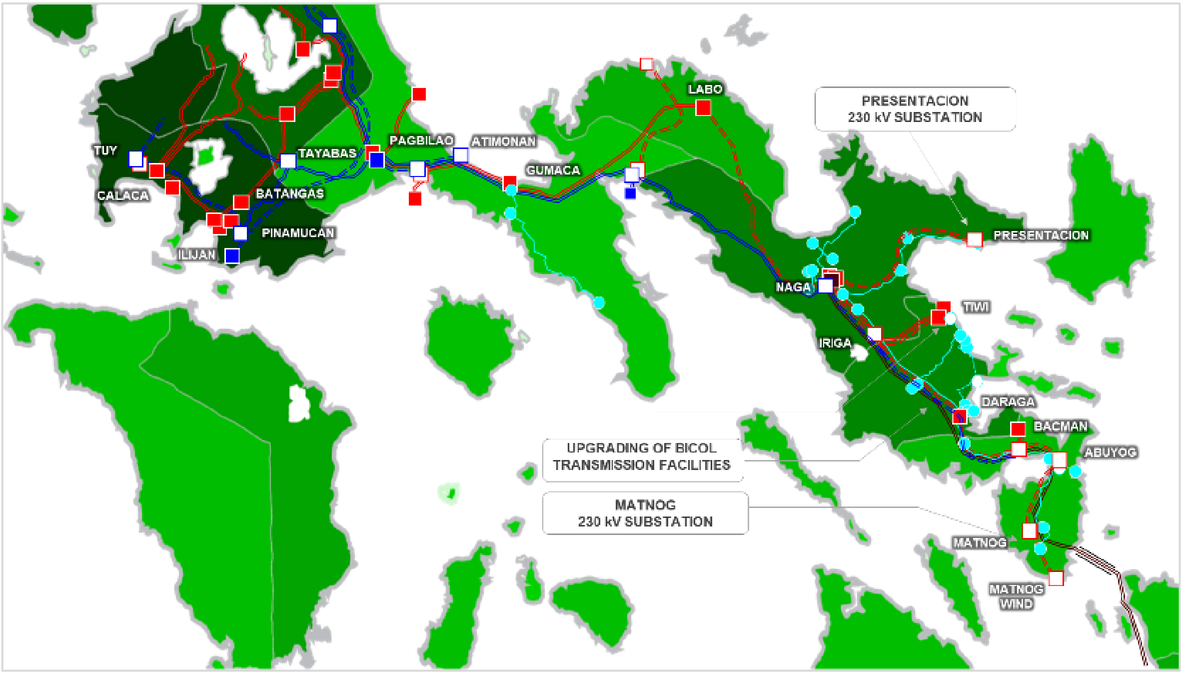


Figure 8.12: Bicol Region Transmission Outlook for 2031-2040

VISAYAS TRANSMISSION OUTLOOK

This section will provide a list of ERC-approved projects on various stages of implementation and 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 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. 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 to other urbanized areas, securing ROW 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 TL 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 a power deficiency issue due to limited power sources on the island. In 2022, the maximum demand in Bohol has already reached 97 MW. The implementation of the 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 Typhoon Yolanda and the 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.

By 2030, future developments in terms of the commercial and industrial sector in the Visayas that would increase the power supply requirements are being expected. To accommodate these developments, new drawdown substations are proposed in Visayas. This will cater for the increase in demand in each area. Furthermore, additional submarine cable will be laid between Panay and Guimaras Island to provide reliability on the powerplants located in Guimaras Island. Proposed powerplants in Northern Samar will be accommodated with the extension of the 138 kV backbone from Calbayog to San Isidro. Moreover, it will provide reliability as the demand in the Northern Samar increases.

9.1 Transmission Outlook for 2023-2030

Transmission projects that are currently being implemented and planned for the Visayas in the period 2023-2030 are listed in Table 9.1 below.

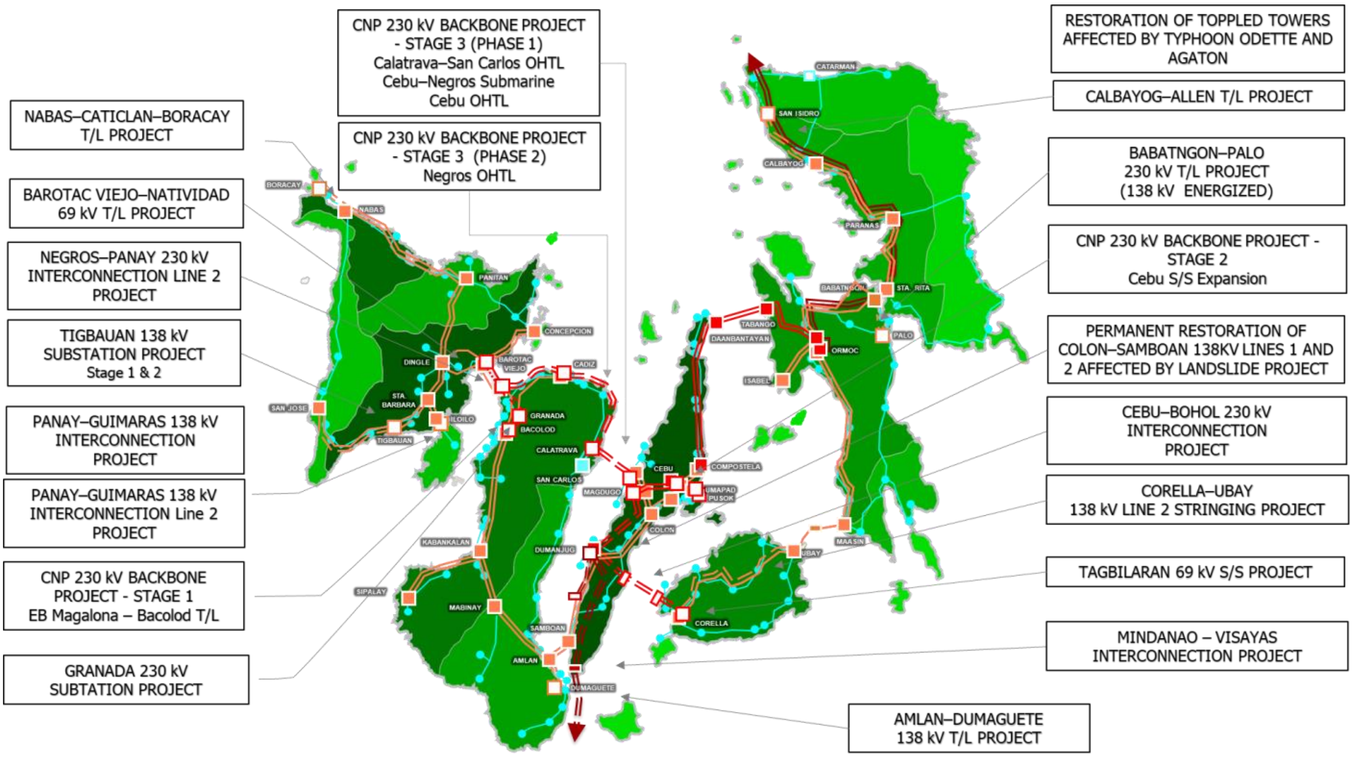


Figure 9.1: Visayas Transmission Outlook for 2023-2030

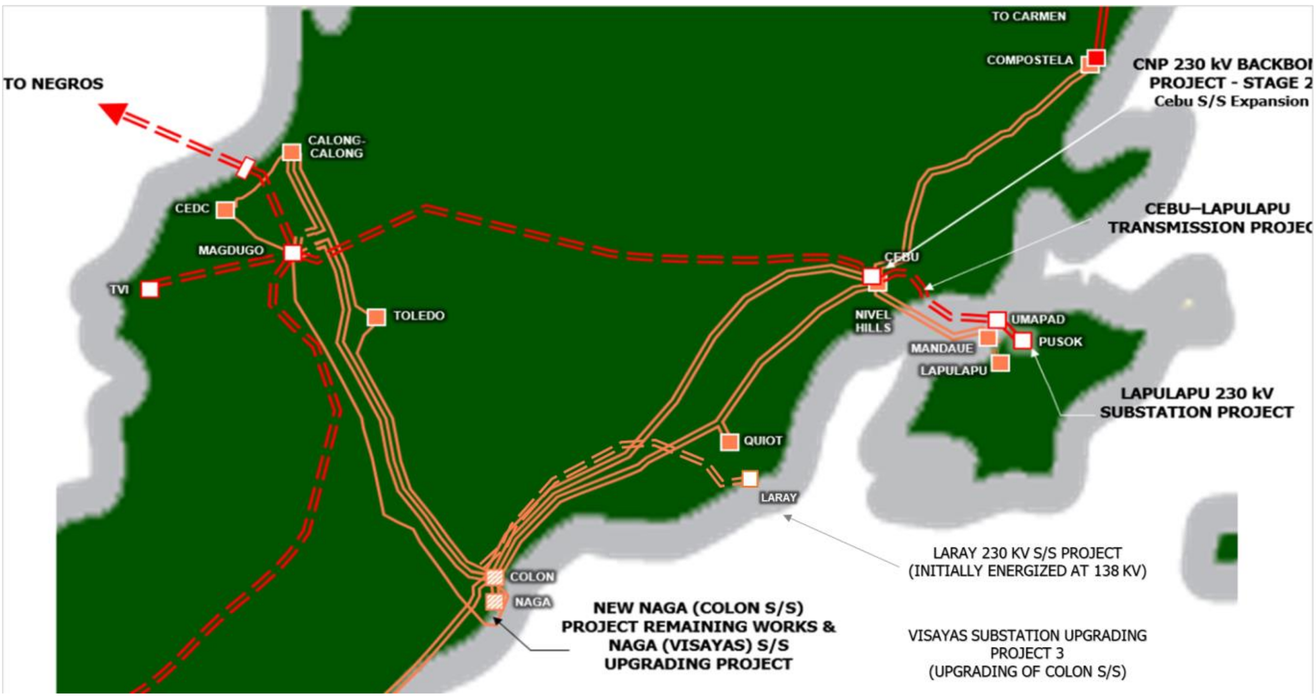
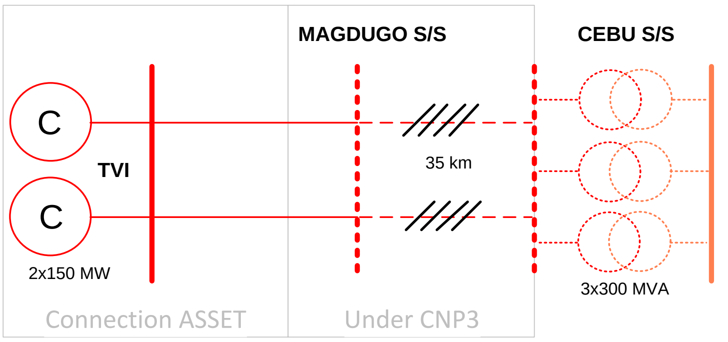


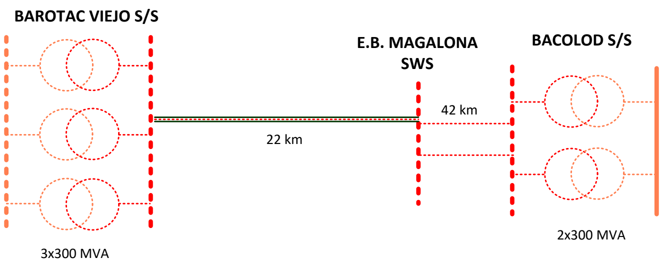
Figure 9.2: Metro Cebu Transmission Outlook for 2023-2030

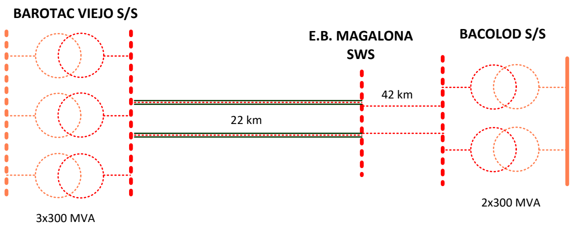
Table 9.1 List of Visayas transmission projects for the period 2023-2030

TRANSMISSION LINE						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
230 kV PROJECTS						
Cebu–Negros–Panay 230 kV Backbone Project – Stage 2 Therma Visayas, Inc. (TVI) is 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. To ensure the effective full generation dispatch of TVI, a new transmission corridor, which includes a high-capacity TL and new SS facilities, is being constructed towards Metro Cebu. The TL portion was previously classified as connection assets and will be implemented by the power plant proponent. On the other hand, the SS portion is classified as a transmission asset, hence, the object of this project. It can be noted also that the TL which will be developed from Magdugo to Cebu will serve as an integral part of the 230 kV backbone in the Visayas. The project involves the construction of 230 kV facilities in the existing Cebu 138 kV SS to facilitate the connection of the proposed TL from Toledo.	• Generation Entry • ERC-approved	• Cebu 230 kV SS: 3x300 MVA 230/138 kV Power Transformer, 10- 230 kV PCB (GIS) and 3-138 kV PCB. • Construction of Warehouse	• Extension of Magdugo-Cebu 230 kV TL, ST/SP-DC, 2-610 mm^2 TACSR OHTL, 0.91 km • Extension of Cebu-Lapulapu 230 kV TL, Underground Cable System, SC of 1200 MW Capacity 0.415 km 1st stringing and 2-795 MCM ACSR ST/SP-DC, 0.240km • Extension of Cebu-Lapulapu 230 kV Lines, Underground Cable System, Single Circuit of 1200 MW Capacity, 0.540 km, 2nd Stringing • Extension of Colon-Quiot-Cebu 138 kV TL, 138 kV Underground Cables, DC of 180 MW capacity, 0.232 km.	1,933M	Cebu, Negros, and Panay	Aug 2023



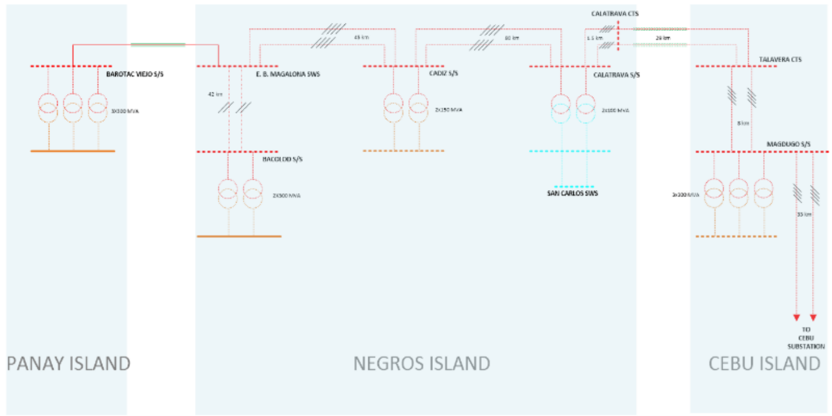
Cebu–Negros–Panay 230 kV Backbone Project - Stage 1 To ensure the effective transmission of excess power generation from Panay towards Negros, a high-capacity transmission corridor is being proposed. Strategically, the project will be designed consistent with the long-term transmission master plan of 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 a transmission corridor from Barotac Viejo SS to Bacolod SS and will be composed of the submarine cable system and overhead TL. It is designed at 230 kV voltage level but is currently energized and operated at	• Generation Entry • ERC-approved	• Bacolod SS Expansion: 2-138 kV PCB. • Barotac Viejo SS (Expansion): 5-138 kV PCB and associated equipment 1x40 MVAR, 138 kV Shunt Reactor	• Bacolod–E. B. Magalona, 230 kV TL, ST-DC, 2-795 MCM ACSR, 42 km. • Barotac Viejo–E.B. Magalona 230 kV S/C (initially energized at 138 kV), Single Circuit, 1-1600 mm2 XLPE, 18.15 km • Barotac Viejo–E.B. Magalona 230 kV U/G (initially energized at 138 kV), Single Circuit, 3-1600 mm2 XLPE, 0.75 km	6,723M	Cebu, Negros, and Panay	Sep 2023



TRANSMISSION LINE						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
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.						
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. This entails an 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.	• Generation Entry • Filed to ERC	• Barotac Viejo SS (Expansion): 1x70 MVAR, 230 kV Line reactor, 2-230 kV PCB • E.B. Magalona SS (Expansion): 1x70 MVAR, 230 kV Line reactor, 3-230 kV PCB	• Barotac Viejo–E. B. Magalona, 230 kV, SC, 3-1,600 mm2 XLPE Submarine Cable, 22 km.  	4,079M	Negros and Panay	Aug 2023
Cebu–Negros–Panay 230kV Backbone Project - Stage 3 Phase 1 – submarine cable energization Phase 2 – remaining OHTL The development of new power plants, including baseload and renewable, in Panay and Negros Islands will result in an 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 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 SS in Panay to a new Magdugo SS in Cebu. It will be primarily composed of overhead TL,	• Generation Entry • ERC-approved	• Magdugo 230 kV SS: 3x300 MVA 230/138-13.8 kV Power Transformer, 2x70 MVAR 230 kV Shunt Reactors, 15-230 kV PCB, 15-138 kV PCB • Calatrava 230 kV SS: 2x100 MVA 230/69-13.8 kV Power Transformer, 2x70 MVAR 230kV Shunt Reactor, 12-230 kV PCB, 14-69 kV PCB • Cadiz 230 kV SS: 2x150 MVA 230/138-13.8 kV Power Transformer, 10-230 kV PCB, 6-138 kV PCB • E. B. Magalona SWS: 1x70 MVAR 230 kV Line Reactor 9-230 kV PCB • Barotac Viejo 230 kV SS: 3x300 MVA 230/138-13.8 kV Power Transformer 1x70 MVAR 230 kV Line Reactor, 8-230 kV PCB, 6-138 kV PCB • Bacolod 230 kV SS: 2x300 MVA 230/138-13.8 kV Power Transformer, 6-230 kV PCB, 1-138 kV PCB • Colon 138 kV SS: 2-138 kV PCB • San Carlos 69 kV SWS: 11-69 kV PCB • Quiot 138 kV SS: Uprating of 4-138 kV PCB • Cebu 138 kV SS: Uprating of 6-138 kV PCB **Submarine Cable** • Calatrava–Talavera 230 kV Submarine Cable, DC, 6-1,600 mm^2 XLPE, 29 km • Talavera CTS, Cable Sealing End • Calatrava CTS, Cable Sealing End	• Magdugo–Cebu 230 kV TL: ST-DC, 4-795 MCM ACSR, 33 km. • Talavera–Magdugo 230 kV TL: ST-DC, 4-795 MCM ACSR, 8 km. • Magdugo-Calong-Calong-Colon Bus-in Lines 1 and 2, 138 kV TL, ST-DC, 4-795 MCM ACSR, 3.7 km; • Cadiz–Calatrava 230 kV TL: ST-DC, 4-795 MCM ACSR, 80 km. • E. B. Magalona–Cadiz 230 kV TL, ST-DC, 4-795 MCM ACSR, 45 km. • Transfer of the CEDC 138 kV Line from AYA SS to Colon SS • Calatrava CTS–Calatrava SS: ST-DC, 4-795 MCM ACSR, 1.5 km. • Reconductoring/Bundling of Termination at Cebu, Quiot and Colon SS: STACIR Conductor and Line Hardware for 138 kV Steel Tower; • 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 TL, ST-DC, 1-795 MCM ACSR, 5.6 km.	31,597M	Cebu, Negros, and Panay	Aug 2023

TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
submarine cable interconnections, and corresponding new SS facilities.						



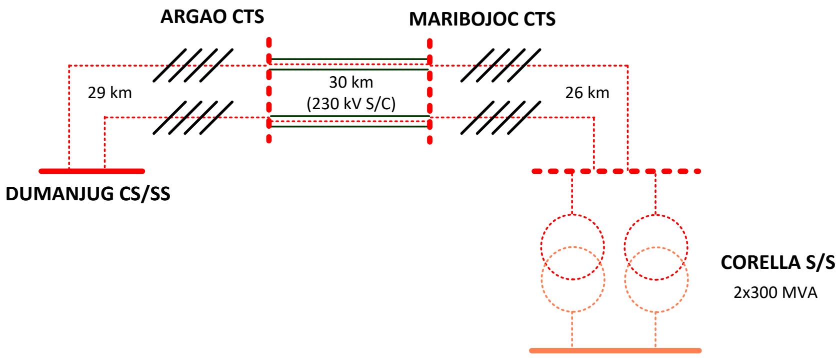
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Cebu–Bohol 230 kV Interconnection Project	• Load Growth • ERC-approved	• Dumanjug 230 kV SS: 2x70 MVAR 230 kV line reactors, 2-230 kV PCB • Corella 230 kV SS: 2x300 MVA, 230/138-13.8 kV Power Transformers, 2x70 MVAR 230 kV line reactors, 8-230 kV PCB, 5-138 kV PCB • Argao CTS (with provision to be SWS) • Maribojoc CTS (with provision to be SWS)	• Dumanjug–Argao TL: 230 kV, ST-DC, 4-795 MCM ACSR, 29 km. • Maribojoc–Corella TL: 230 kV, ST-DC, 4-795 MCM ACSR, 26 km.	16,972M	Cebu Bohol	Jun 2024

Currently, Cebu, Leyte, and Bohol are connected radially which are prone to isolation. 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 conditions, there is a need to provide additional transmission backbone towards Bohol.

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

Submarine Cable

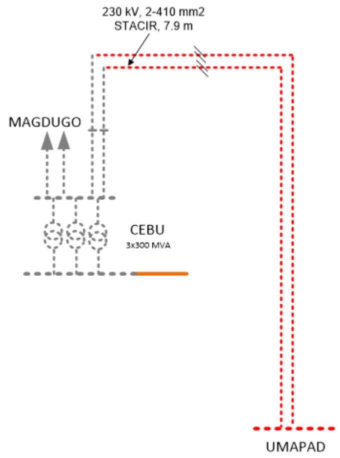
• Argao–Maribojoc 230 kV S/C, DC submarine cable system with a transfer capacity of 600 MW at 230 kV, 30 km. (with provision for 3rd circuit)



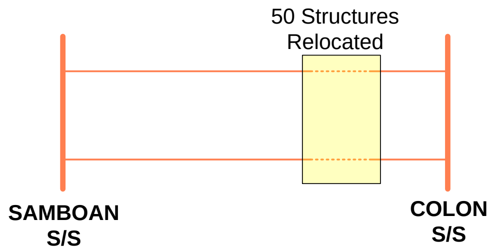
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Cebu–Lapu-Lapu Transmission Project	• System Reliability • ERC-approved	• Lapu-lapu 138 kV S/S, 1-138 kV GIS Switchbay.	• Cebu–Umapad 230 kV TL: ST/SP-DC, 2-410 mm2 STACIR, 7.9 km.	2,845M	Cebu	Apr 2024

TRANSMISSION LINE

<table>
<tr><th rowspan="2">Project Name and Description</th><th rowspan="2">Project Driver and Status</th><th colspan="2">Project Components</th><th rowspan="2">Project Cost (Million Pesos)</th><th rowspan="2">Location</th><th rowspan="2">ETC</th></tr>
<tr><th>Substation</th><th>Transmission Line</th></tr>
<tr><td>The existing transmission corridors serving the major load centers in Mandaue and Mactan in Cebu do not have N-1 contingency provisions. During the outage of one of the two 138 kV circuits of the Cebu–Mandaue–Lapu-Lapu 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 load centers in Mandaue and Mactan even during N-1 condition, a new transmission corridor, composed of overhead TL and submarine/underground cable system, is proposed between Cebu SS and Lapu-Lapu SS.</td><td></td><td colspan="2">
</td><td></td><td></td><td></td></tr>
<tr><td colspan="7">138 kV PROJECTS</td></tr>
<tr><td>Permanent Restoration of Colon–Samboan 138kV 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 Mines and Geosciences Bureau (MGB) of the Department of Environmental and Natural Resources (DENR) hindering maintenance and construction activities in the affected TL. Moreover, in the event of the recurrence of landslide and ground movements, the toppling of the structures will affect the stability of the grid.

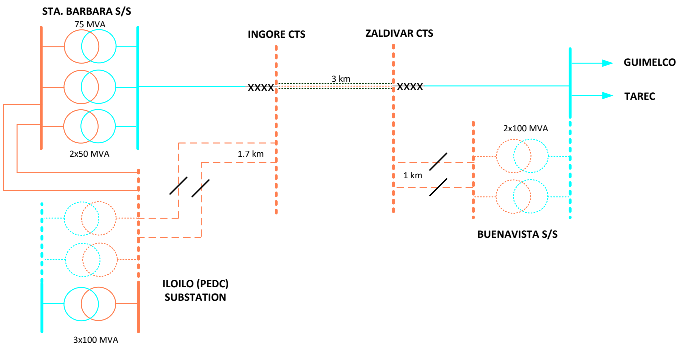
The project includes the rerouting of the portion of Colon-Samboan 138 kV Line 1 and 2 affected by the landslide. This will avoid the 1 km danger zone declared by MGB.</td><td>• System Reliability
• Filed to ERC</td><td></td><td>• Colon-Samboan Line 1, 1-795 MCM ACSR, 138 kV, ST-DC1, 8km, 26 rerouted 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.

</td><td>328M</td><td>Colon, Cebu</td><td>Sep 2023</td></tr>
<tr><td>Restoration of Toppled Towers Affected by Typhoon Odette and Agaton

A system reliability project that aims to permanently restore the portion of the 138 kV transmission lines that was damaged during the devastation of Typhoon Odette on December 2021 and Typhoon Agaton last April 2022.</td><td>• System Reliability
• Filed to ERC</td><td></td><td>• Four (4) towers for Cebu–Colon 138 kV TL
• Four (4) towers for Calong-Calong–Colon 138 kV TL
• Two (2) towers for Ubay–Corella 138 kV TL
• Two (2) special towers and one (1) tower for C.P. Garcia–Ubay 138 kV TL
• Three (3) towers for Ormoc–Maasin 138 kV TL.</td><td>1,047M</td><td>Cebu, Bohol and Leyte</td><td>May 2023</td></tr>
</table>

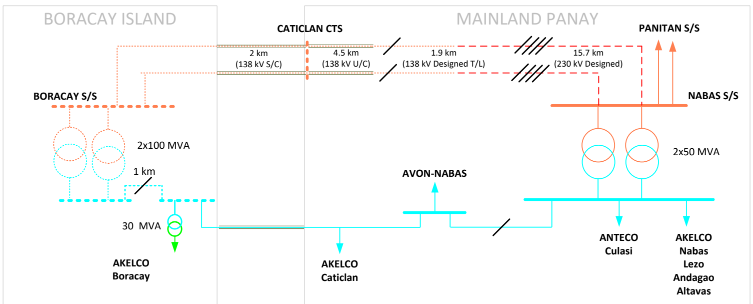
TRANSMISSION LINE						
Project Name and Description	Project Driver and Status	Project Components – Substation	Project Components – Transmission Line	Project Cost (Million Pesos)	Location	ETC
The affected transmission lines are the Cebu–Colon 138 kV T/L, Calong-Calong–Colon 138 kV TL, C.P. Garcia–Ubay 138 kV TL and Ubay–Corella 138 kV TL. Tower structures were toppled during the occurrence of Typhoon Odette last December 2021. The said transmission lines served the customers in Cebu and Bohol Provinces. The damage parts of C.P. Garcia-Ubay 138 kV TL are special towers and serves as connection of Bohol Island to the Visayas grid through Leyte. The Typhoon Agaton damages the Ormoc–Maasin 138 kV TL when it landed on Leyte Island last April 2022						
Visayas 69 kV Transmission Line Upgrading Project This aims to avoid overloading of the 69 kV lines in Visayas while awaiting the completion of the needed transmission projects. These foreseen overloading of 69 kV lines are primarily due to the load growth within the specified areas. As the demand grows, overloading in the 69 kV lines will worsen which may lead to load curtailment.	• System Reliability • Filed to ERC		• Reconductoring of Ormoc–Lemon 69 kV Line portion, 1-795 MCM ACSR, 20 km • Reconductoring of Ormoc–Simangan 69 kV Line portion, 1-795 MCM ACSR, 6 km • Reconductoring of Babatngon–Abucay 69 kV Line portion, 1-795 MCM ACSR, 16 • Reconductoring of Corella–Tagbilaran 69 kV Line portion, 1-795 MCM ACSR, 6 km • Reconductoring of Sta. Barbara–Bolong portion 69 kV Line, 1-795 MCM ACSR, 6 km	2,820 M	Leyte, Bohol and Panay	Dec 2025
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 1.7 km overhead TL from the cable terminal station in Ingore towards Iloilo SS, as well as the expansion and upgrading works at Zaldivar SS and Iloilo SS.	• Filed to ERC • Generation Entry	• Iloilo SS: 3x100 MVA,138/69-13.8 kV Power Transformers, 2-138 kV PCB, 10-69 kV PCB (GIS) • Buenavista 138 kV SS: 1x100 MVA 138/69-13.8 kV Power Transformer, 6-138 kV PCB (GIS), 4-69 kV PCB • Transfer of existing 1x100 MVA 138/69-13.8 kV Power Transformer from Iloilo SS to Buenavista SS	• Iloilo SS–Ingore CTS 138 kV TL Portion: ST-DC, 1-795 MCM ACSR, 1.7 km • Iloilo SS–Ingore CTS 138 kV U/G Portion: SC, XLPE cables of 200 MW capacity per circuit, 0.15 km. • Iloilo 69 kV U/C: Four circuits, XLPE cables of 100 MW capacity per circuit, 0.25 km • Extension of Sta. Barbara–Iloilo 138 kV Line: DC, XLPE cables of 400 MW capacity per circuit, 0.15 km • Baldoza 69 kV Line Transfer TL Portion: SP-SC, 1-795 MCM ACSR, 0.07 km • Baldoza 69 kV Line Transfer U/G portion: SC, XLPE cable of 100 MW capacity per circuit, 0.38 km • PPC & MORE 69 kV Line Transfer TL Portion: SP-SC, 1-795 MCM ACSR, 0.09 km • PPC & MORE 69 kV Line Transfer U/G portion: SC, XLPE cable of 100 MW capacity per circuit, 0.37 km • Banuyao 69 kV Line Transfer TL Portion: SP-SC, 1-795 MCM ACSR, 0.8 km	3,011M	Panay and Guimaras	Dec 2024

TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
			• Banuyao 69 kV Line Transfer U/G portion: SC, XLPE cable of 100 MW capacity per circuit, 0.36 km • Buenavista 138 kV U/C two circuits of 200 MW-capacity, 0.15 km • Zaldivar CTS-Buenavista SS 138 kV TL: ST-DC, 1-795 MCM ACSR, 1 km • Zaldivar Bypass Line: 69 kV TL, ST-SC, 1-336.4 MCM ACSR, 0.7 km.			



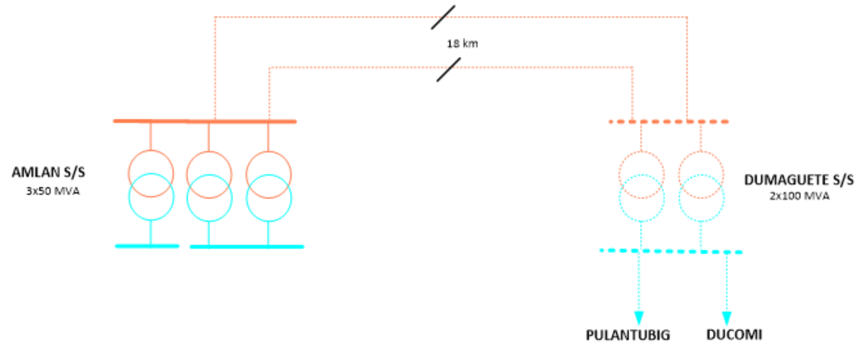
Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Nabas–Caticlan–Boracay Transmission Line Project In line with the developments in the tourism industry in Boracay Island, the power requirement is expected to increase. The power requirement of Caticlan and Boracay Island is currently supplied by Nabas SS via a single circuit 69 kV overhead TL and submarine cable. These 69 kV transmission facilities are not enough to cater the forecasted demand of the island. The project involves the construction of a new submarine cable, underground cable and overhead transmission line from Nabas to Boracay and the construction of a new drawdown substation in Boracay Island.	• Load Growth • Filed to ERC	• Boracay 138 kV GIS SS (New), 2x100 MVA 138/69-13.2 kV Power Transformers, 5-138 kV PCB (GIS), 6-69 kV PCB (GIS). • Nabas 138 kV SS (Expansion), 4-138 kV PCB • Nabas Transition Station. **Submarine Cable** • Caticlan–Boracay S/C, Submarine Cable System, DC of 100 MW capacity at 138 kV, 2 km • Caticlan CTS (New), Cable Sealing End.	• Nabas–Unidos 230 kV TL (Initially energized at 138 kV), 230 kV, ST/SP-DC, 4-795 MCM ACSR, 15.7 km. • Unidos-Caticlan 138 kV TL, ST/SP-DC, 138 kV, 1-795 MCM ACSR, 1.9 km • Unidos–Caticlan 138 kV U/G, DC, 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	5,274M	Aklan	Jun 2024



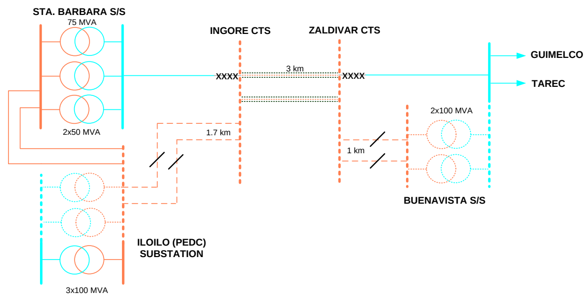
Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Amlan–Dumaguete 138 kV Transmission Line Project The power requirement in the southern part of Negros Oriental is being served by a 69 kV line which draws power from Amlan SS. However, the 69 kV line will not be sufficient to cater the projected increase in the power demand in the area.	• Load Growth • Filed to ERC	• Amlan 138 kV SS: 3-138 kV PCB. • Dumaguete 138 kV SS (New): 2x100 MVA, 138/69-13.8 kV Power Transformer 6-138 kV PCB, 6-69 kV PCB.	• Amlan–Dumaguete 138 kV TL: ST-DC, 1-795 MCM ACSR, 18 km.	2,366M	Negros Occidental	Mar 2025

TRANSMISSION LINE

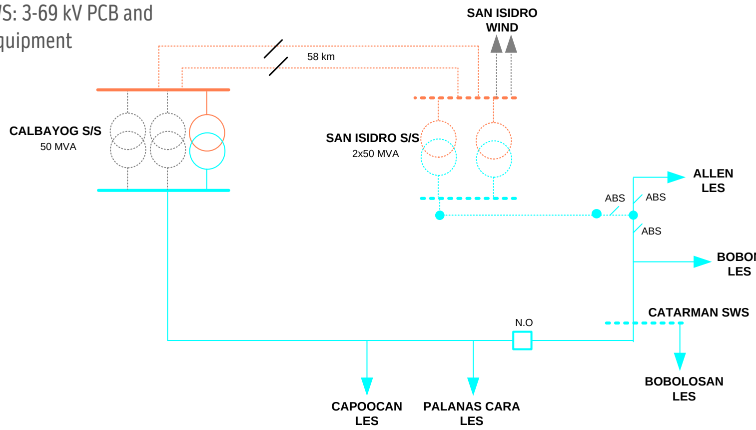
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
To accommodate the future power requirement in the southern part of Negros Oriental, a new drawdown SS is proposed near Dumaguete City. The project will provide an alternative source of power to Negros Oriental Electric Cooperative II (NORECO II), thereby, unloading Amlan SS 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 SS via a 138 kV TL.						



Panay–Guimaras 138 kV Interconnection Line 2 Project The proposed project involves the laying of the second submarine cable from Panay to Guimaras Island. This will provide reliability to the existing and future power plants in Guimaras Island.	• System Reliability • Filed to ERC	• Iloilo SS: 1-138 kV PCB and associated equipment	• Ingore–Sawang 138 kV S/C: 3-400 mm2 XLPE, Submarine Cable, Single Circuit, 3 km • Sawang CTS–Zaldivar 138 kV U/C: XLPE U/C, 0.8 km	3,828.32M	Panay and Guimaras	Jul 2028



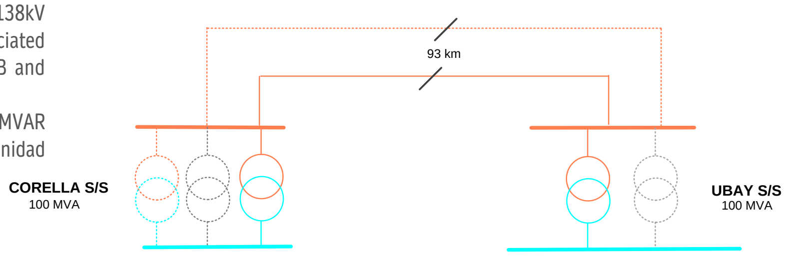
Calbayog–Allen Transmission Line Project The power consumers in the northern part of Samar draws power from Calbayog SS via the existing Calbayog-Palanas Cara and Palanas Cara-Catarman-Allen-Bobolosan 69 kV TL, which traverse the mountainous area of Calbayog and Catarman. Such terrain poses frequent and extended outage of the 69 kV lines in Northern Samar which result in power curtailment. To improve the reliability of power delivery and accommodate the load growth and power plant in the northern part of Samar, a 138 kV TL traversing northern Samar up to the new SS 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 TL serving Northern Samar.	• Generation Entry and System Reliability • Filed to ERC	• Calbayog SS: 4-138 kV PCB and associated equipment • San Isidro SS: 2x50 MVA Power Transformers and accessories (Redeployment of Power Transformers from Paranas SS and Calong-calong SS) 10-138 kV PCB and associated equipment; 3-69 kV PCB and associated equipment. • Catarman SWS: 3-69 kV PCB and associated equipment	• Calbayog–San Isidro 138 kV TL, ST-DC, 1-795 MCM ACSR, 60 km • San Isidro–Allen 69 kV TL, SP-SC, 1-795 MCM ACSR, 22 km	8,896.95M	Northern Samar	Jun 2026



Corella–Ubay 138 kV Line 2 Stringing Project	• Generation Entry and	• Corella SS (Expansion): 1-138kV PCB and associated equipment	• Corella–Ubay 138 kV TL 2 138 kV TL, ST-DC2, 1-795 MCM ACSR, 93 km	2,121M	Bohol	Sep 2030

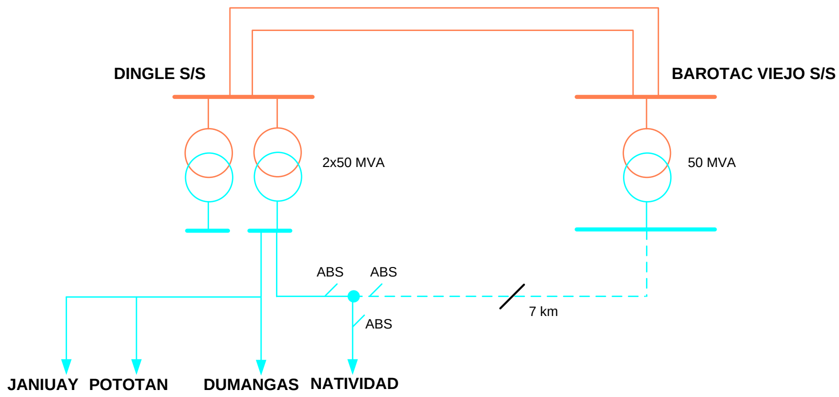
TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
The proposed project involves the installation of the second circuit from Corella to Ubay SS. This will provide reliability to the existing and future power plants connected in Ubay SS.	System Reliability • Filed to ERC	• Ubay SS (Expansion): 3-138kV PCB and associated equipment, 2-138kV PCB and associated equipment, transfer of 2x5 MVAR Capacitor Bank from Trinidad LES to Ubay				



69 kV PROJECTS

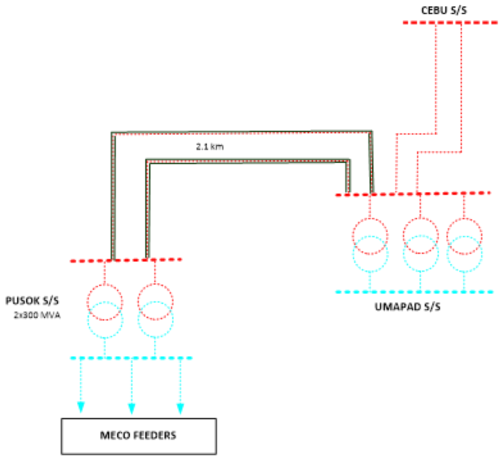
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Barotac Viejo–Natividad 69 kV Transmission Line Project This project extends the 69 kV line serving Natividad to Barotac Viejo and forms a 69 kV loop between Dingle and Barotac Viejo substations. This provides N-1 to the 69 kV feeder serving Iloilo II Electric Cooperative (ILECO II) and Iloilo III Electric Cooperative (ILECO III) and allows for the operational flexibility and reliability for both cooperatives.	• System Reliability • Filed to ERC		• Barotac Viejo–Natividad 69 kV TL, SP-SC, 1x795 MCM ACSR, 7 km	405.59M	Iloilo	Feb 2028



SUBSTATION

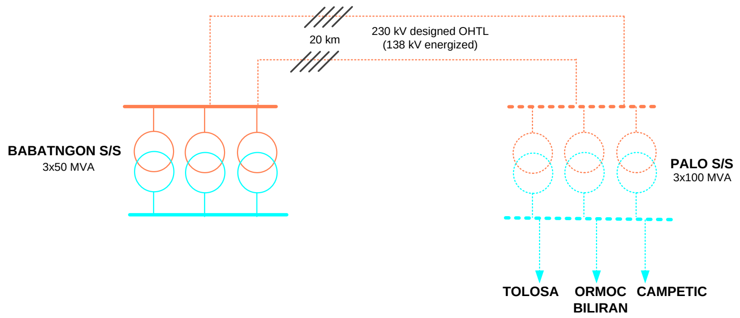
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
230 kV PROJECTS						
Visayas Substation Upgrading Project 1 To accommodate the projected demand and avoid overloading of the transformer, there is a need to upgrade the SS capacity of Tabango SS to 1x50 MVA. This will provide an N-1 provision on the said SS. To accommodate the increase in demand in the area, there is a need to upgrade the SS capacity in Daanbantayan SS 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 SS.	• System Reliability • Filed to ERC	Cebu: • Daanbantayan SS: 150 MVA 230/69-13.8 kV Power Transformer, 1-230 kV PCB, 4-69 kV PCB. Leyte: • Tabango SS: 1x50 MVA 230/69-13.8 kV Power Transformer, 1-230 kV PCB, 3-69 kV PCB • Maasin SS: 1x50 MVA 138/69-13.8 kV Power Transformer, 4-138 kV PCB, 8-69 kV PCB. Samar: Calbayog SS: 50 MVA 138/69-13.8 kV Power Transformer, 1-138 kV PCB, 2-69 kV PCB.		1,317M	Cebu, Leyte, Samar	Dec 2023
Lapu-Lapu 230 kV Substation Project Power consumers in Mactan Island currently draw power from Lapu-Lapu 138 kV SS. With the continuing economic and infrastructure developments within the area, the projected	• Load Growth • Filed to ERC	• Pusok 230 kV GIS SS (New), 2x300 MVA 230/69-13.8 kV Power Transformers, 8-230 kV PCB (GIS), 10-69 kV PCB (GIS). Submarine Cable • Umapad–Pusok 230 kV S/C, 600 MW per circuit, DC, 2.1 km.		3,935M	Lapu-Lapu, Cebu	Dec 2024

SUBSTATION

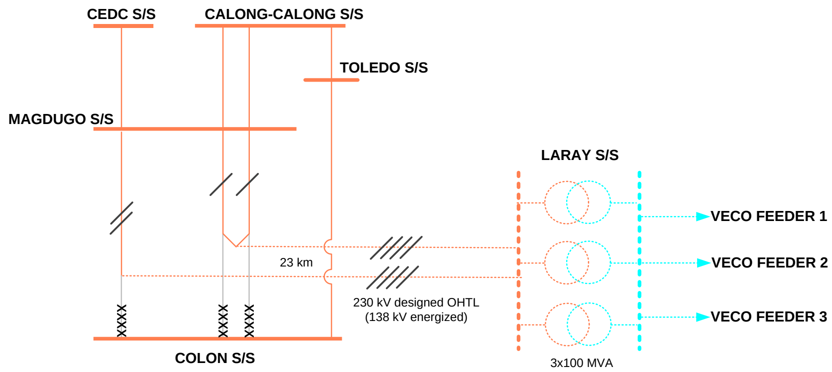
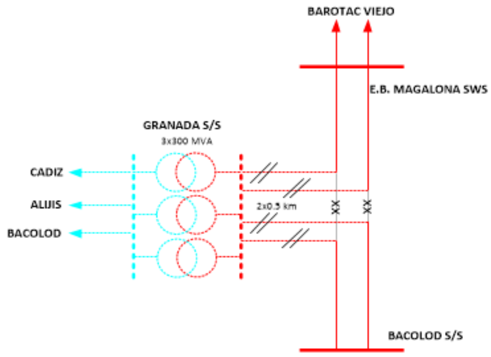
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
power requirement will not be adequately served by the existing SS capacity. The project provides an alternative connection point to power consumers particularly for Mactan Island, thus, will accommodate the projected increase in the power demand. The new SS will be connected to Umapad 230 kV SS and will be located in Lapu-Lapu, Cebu.						
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.	• System Reliability • Filed to ERC	Leyte: • Isabel SS: 1x50 MVA 138/69-13.8 kV Power Transformer (1x50 MVA transformer transferred from Calong-calong SS), 3-138 kV PCB, 2-69 kV PCB. (Additional), 9-138 kV PCB, 2-69 kV PCB. (Replacement), Centralized Control Building (CCB), Full upgrading of secondary devices. • Tabango SS: 1x50 MVA 230/69-13.8 kV Power Transformer, 2-230 kV PCB, 2-69 kV PCB, CCB, Full upgrading of secondary devices. • Maasin SS: 1x50 MVA 138/69-13.8 kV Power Transformer, 3-138 kV PCB, 9-69 kV PCB, Expansion of Control Room. Samar: • Paranas SS: 2x100 MVA 138/69-13.8 kV Power Transformer (Replacement of 30 MVA and 50 MVA transformers), 9-69 kV PCB, CCB, Full upgrading of secondary devices • Calbayog SS, 1x50 MVA 138/69-13.8 kV Power Transformer, 5-138 kV PCB, 7-69 kV PCB, Full upgrading of secondary devices, CCB. Cebu: • Calong-calong SS, 3x100 MVA 138/69-13.8 kV Power Transformer (Replacement of 2x50 MVA transformers), 2-138 kV PCB, 13-69 kV PCB, Full upgrading of secondary devices, CCB, Dismantling of existing 69 kV Switchyard, and Calong-calong 69 kV feeder line extensions • Compostela SS: 2x100 MVA 138/69-13.8 kV Power Transformer (Replacement of 2x50 MVA transformers), 2-230		14,421M	Cebu, Negros, Panay, Leyte	Dec 2025

SUBSTATION						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
		kV PCB, 3-69 kV PCB, and Relocation of Warehouse • Samboan SS: 4-138 kV PCB, 2-69 kV PCB, CCB and Full upgrading of secondary devices • Toledo SS: 3x100 MVA 138/34.5-13.8 kV Power Transformer (Replacement of 3x40 MVA transformers), Transfer of termination of various TL, and CCB • Daanbantayan SS: 1x150 MVA 230/69-13.8 kV Power Transformer, 2-69 kV PCB, CCB. Bohol: • Ubay SS: 1x100 MVA 138/69-13.8 kV Power Transformer, 10-138 kV PCB, 11-69 kV PCB, CCB, and 69 kV line extensions • Corella SS: 1x100 MVA 138/69-13.8 kV Power Transformer, 2-138 kV PCB, 8-69 kV PCB and 69 kV line extensions. Negros: • Kabankalan SS: 2x100 MVA 138/69-13.8 kV Power Transformer (Replacement of 30 and 50 MVA Transformers), 3-138 kV PCB, 4-69 kV PCB, CCB and Telecom Shelter, Kabankalan–Overflow 69 kV Line Extension, and Full upgrading of secondary devices • Mabinay SS: 1x50 MVA 138/69-13.8 kV Power Transformer, 4-138 kV PCB, 5-69 kV PCB, CCB and Telecom Shelter, and Full upgrading of secondary devices. Panay: • San Jose SS: 2x50 MVA 138/69-13.8 kV Power Transformer, 6-138 kV PCB, 5-69 kV PCB, Expansion of Control Building • Panitan SS: 3x100 MVA 138/69-13.8 kV Power Transformer (Replacement of 2x30 and 50 MVA transformers), 8-138 kV PCB (GIS), 10-69 kV PCB (GIS), CCB and Container Van and Dismantling of existing 69 kV Switchyard • Dingle SS: 2x100 MVA 138/69-13.8 kV Power Transformer (Replacement of 2x50 MVA Transformers), 3-138 kV PCB, 9-69 kV PCB, CCB and Telecom Shelter, and Full upgrading of secondary devices • Concepcion SS: 1x100 MVA 138/69-13.8 kV Power Transformer, 1-138 kV PCB • Barotac Viejo SS: 50 MVA 138/69-13.8 kV Power Transformer (50 MVA Transformer transferred				

SUBSTATION

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
		from Iloilo SS), 2-138 kV PCB, 2-69 kV PCB, • Sta. Barbara SS: 1x75 MVA 138/69-13.8 kV Power Transformer (Spare), Upgrading of Secondary Equipment. Cable				
Visayas Substation Upgrading Project 3 The proposed project involves the upgrading of the Colon and Cadiz SS to increase the SS capacity due to the forecasted load growth and to sustain the N-1 contingency provision prescribed by the PGC. This project also involves the expansion of various substations in Visayas to accommodate the entry of powerplants.	• Load Growth, Generation Entry, System Reliability • Filed to ERC	• Cadiz SS (expansion) 2x100 MVA 138/69-13.8 kV Power Transformers and accessories 10-69 kV PCB and associated equipment. • E.B. Magalona 230 kV SS (expansion) 2-230 kV PCB and associated equipment • Sta. Barbara 138 kV SS (expansion) 2-138 kV PCB and associated equipment • Naga 138 kV SS (expansion) 2-138 kV PCB and associated equipment Colon 138 kV SS (expansion): 2x100 MVA 138/69-13.8 kV Power Transformers and accessories 1-138 kV PCB and associated equipment 2-69 kV PCB and associated equipment. • Calbayog 69 kV SS (expansion): 1-69 kV PCB and associated equipment		4,516.55M	Samar, Cebu, Negros, Panay	Oct 2027
Babatngon-Palo 230 kV Tranmission Line Project (Initially energized at 138 kV) The project is proposed 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 involves the construction of a new drawdown SS in Palo which will be linked to Babatngon SS via 230 kV designed TL energized at 138 kV. The proposed SS will serve Don Orestes Romualdez Electric Cooperative, Inc. (DORELCO) and Leyte Electric Cooperative II (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 Ormoc–Babatngon and Palo–Javier 230 kV TL.	• Load Growth, System Reliability • Filed to ERC	• Palo SS: 3x100 MVA Power Transformers and accessories; 8-230 kV PCB and associated equipment; 9-69 kV PCB and associated equipment. • Babatngon SS: 3-138 kV PCB and associated equipment  	• Babatngon–Palo 230 kV TL, ST-DC, 4x795 MCM ACSR, 20 km • Palo–Alang-Alang 69 kV TL, SP-DC, 1-795 MCM ACSR, 0.5 km • Palo–Tolosa & Palo–Campetik 69 kV TL, SP-DC, 1-795 MCM ACSR, 2x0.75 km	6,002.30M	Leyte	Dec 2030
Laray 230 kV Substation Project (Initially energized at 138 kV)	• Load Growth, System Reliability • Filed to ERC	• Laray GIS SS (New) 3x100 MVA 138/69-13.8 kV Power Transformers and accessories, 10-230 kV PCB (GIS) and associated equipment, 7-69 kV PCB GIS and associated equipment	• OHTL from Laray to Tapping Point along Magdugo-Colon 138 kV Lines (in the area of Naga), ST/SP-DC, 2-610 mm2 TACSR, 4-795 MCM ACSR, 23 km	6,410.18M	Cebu	Nov 2028

SUBSTATION

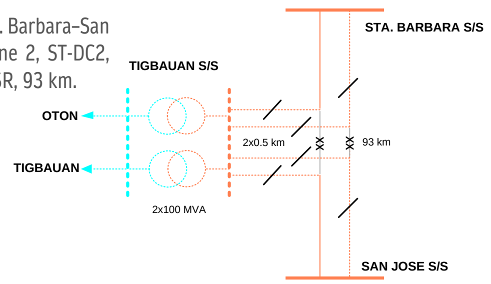
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
The project involves the construction of a new drawdown GIS SS within the area of Metro Cebu, which is a major load center in the Visayas. It will be tapped to the Magdugo–Colon 138 kV Line via 230 kV TL that will be initially energized at 138 kV. The Magdugo–Colon 138 kV TL shall be disconnected from Colon SS, hence, Laray SS will be directly linked to Magdugo SS, bypassing Colon SS.						
Granada 230 kV Substation Project The project aims to provide alternative connection point to power consumers in Northern Negros, thus, will accommodate the projected increase in the power demand. The new SS will bus-in to the existing 230 kV TL from E.B Magalona to Bacolod and will be located in the area of Granada.	• Load Growth • Filed to ERC	• Granada SS: 3x300 MVA, 230/69-13.8 kV Power Transformers, 12-230 kV PCB and associated equipment, 10-69 kV PCB and associated equipment	• Granada 230 kV Bus-in Lines, ST-DC, 2-795 MCM ACSR, 2x0.50 km 	4,032.39M	Negros Occidental	Jun 2030

138 kV PROJECTS

Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Visayas Substation Reliability Project II	• System Reliability • ERC-approved	• Mandaue 138 kV SS Expansion: 1x100 MVA 138/69-13.8 kV Power Transformer, 1-138 kV GIS Switch Bay, 1-69 kV GIS Switch Bay • Lapu-Lapu 138 kV SS Expansion: 1x100 MVA 138/69-13.8 kV Power Transformer, 1-138 kV GIS Switch Bay, 1-69 kV GIS Switch Bay • Ormoc SS: 1-100 MVA 138/69-13.8 kV Power Transformer, 3-69 kV PCB and associated equipment • Sta. Barbara SS: 2-50 MVA 138/69-13.8 kV Power Transformer, 2-138 kV and 5-69 kV PCB and associated equipment • Sta. Rita SS: 1-50 MVA 138/69 kV-13.8 Power Transformer (transferred from Ormoc S/S), 2-69 kV PCB (transferred from Babatngon and Ormoc SS) and 1-69 kV Air Break Switch (transferred from Bagolibas SS) • Babatngon SS: 1-50 MVA 138/69-13.8 kV Power Transformer, 1-138 kV and 1-69 kV PCB and associated equipment		1,038M	Cebu and Negros	Dec 2023

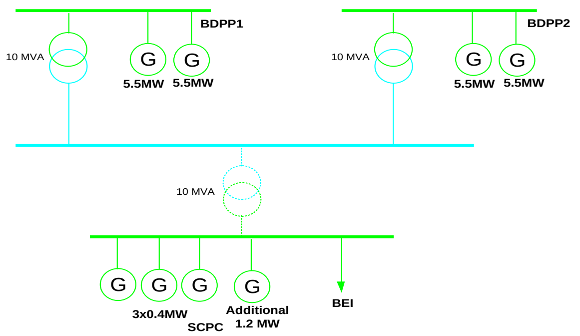
SUBSTATION

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
Tigbauan 138 kV Substation Project Power consumers in Southern Panay draws power from Sta. Barbara and San Jose SS. With the continuing economic and infrastructure developments within the area, the projected power requirement will not be adequately served by the existing SS capacity. The project aims to provide alternative connection point to power consumers particularly for Southern Panay, thus, will accommodate the projected increase in the power demand. The new SS will bus-in to the Sta. Barbara–San Jose 138 kV TL and will be located in Tigbauan, Panay.	• Load Growth • Filed to ERC	Stage 2 • Tigbauan 138 kV SS: 2x100 MVA 138/69-13.8 kV Power Transformer, 10-138 kV PCB, and 4-69 kV PCB • Sta. Barbara SS: 1-138 kV PCB, and 2-69 kV PCB • San Jose SS: 2-138 kV PCB.	Stage 1 • Portion of the Stringing of Sta. Barbara–San Jose 138 kV Line 2, ST-DC2, 1-795 MCM ACSR, 93 km. (energized at 69 kV) Stage 2 • Tigbauan 138 kV Bus-in Line, ST-DC, 1-795 MCM ACSR, 2x0.50 km. • Tigbauan 69 kV Cut-in Line, SP-DC, 1-795MCM ACSR, 0.5 km. • Sta. Barbara 69 kV Tie Line, SP-SC, 1-795 MCM ACSR, 0.4km. • Stringing of Sta. Barbara–San Jose 138 kV Line 2, ST-DC2, 1-795 MCM ACSR, 93 km.	4,198M	iloilo	Stage 1 – Dec 2023 Stage 2- Sep 2030
Naga (Visayas) Substation Upgrading Project The equipment at Naga SS, 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 a longer duration. Accordingly, these outages may result in power curtailment. To improve the reliability of the SS, equipment shall be replaced. The project involves the construction of new steel tower structures and the installation of associated overhead line components. It also involves the use of steel tower structures with higher wind design capability. This project was formerly named as Naga SS Rehabilitation Project.	• System Reliability • ERC-approved	• Naga 138 kV SS, 6-138 kV PCB, • Construction of New Control Room • Dismantling of Primary and Secondary Equipment at Naga SS		477M	Naga	Jun 2023
Visayas Regional PCB Replacement Project The projects involve the replacement of the existing PCB in various NGCP SS in the Visayas due to the following: Underrated capacity – short circuit current and/or continuous current capacity is less than the actual current that will flow into the circuit breaker.	• System Reliability • Filed to ERC	• Cebu SS: 1-69kV, PCB, 8-138 kV PCB and associated equipment. • Pajo LES, 1-69 kV PCB and associated equipment • Garcia Hernandez LES, 1-69 kV PCB and associated equipment • Bacolod SS: 6-69 kV PCB, 1-138 kV PCB and associated equipment • Amlan SS: 3-69 kV PCB and associated equipment • Sta. Barbara SS: 1-69 kV PCB and associated equipment		2,645.13M	Cebu, Bohol, Negros, Panay	Dec 2026



SUBSTATION

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
Old age - These PCB are more or less 40 years old in the service, hence they are becoming less and less reliable every passing year. Although these PCB can still operate, the reliability of the system is endangered due to their unpredictable operation. These PCB are bound to fail to operate that will result in widespread system disturbance which should be avoided.						
69 kV PROJECTS						
Tagbilaran 69 kV Substation Project This project involves the installation of a 10 MVA transformer for Tagbilaran SS that will allow a 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 DPP 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 a dedicated connection to Tagbilaran SS, and the expansion of SCPC's Hydro Electric Power Plant will be catered.	• System Reliability • ERC-approved	• Tagbilaran 69 kV SS (New), 1x10 MVA 69/13.8 kV power transformer and 3-69 kV PCB. • Construction of New Control Room.		410M	Bohol	Sept 2023



VOLTAGE IMPROVEMENT

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
138 kV PROJECTS						
Visayas Voltage Improvement Project Various areas in Samar and Leyte are experiencing low voltage occurrences due to long 69 kV TL. Likewise, areas in Cebu and Bohol are also experiencing low voltage occurrences due to high concentrations of load. These low voltages may result in power curtailment. To address the low voltage problems in these areas, Capacitor are proposed to be strategically installed at identified substations and load-ends.	• Power Quality • ERC-approved	Stage 1 • Compostela 138 kV SS, 2x20 MVAR, 138 kV Capacitor, 2-138 kV PCB, • Cebu 138 kV SS, 2x20 MVAR, 138 kV Capacitor, 2-138 kV PCB, • Corella 69 kV SS, 3x5 MVAR, 69 kV Capacitor, 3-69 kV PCB. Stage 2 • Himayangan LES, 1x5 MVAR, 69 kV Capacitor, 1-69 kV PCB, • Bobolosan LES, 1x5 MVAR, 69 kV Capacitor, 1-69 kV PCB, • Tolosa LES, 1-5 MVAR, 69 kV Capacitor, 1-69 kV PCB.		711M	Cebu, Bohol, Leyte, and Samar	Dec 2023
Visayas Voltage Improvement Project 2 Various areas in Visayas are experiencing low voltage occurrences due to long 69 kV transmission lines and high concentration of	• Power Quality • Filed to ERC	Stage 1: • Calbayog 138 kV SS: ±20 MVAR 138 kV STATCOM, 2-138 kV PCB • Naga 138 kV SS: ±40 MVAR 138 kV STATCOM, 2x20 MVAR Capacitor, 4-138 kV PCB • Panitan 138 kV SS: ±20 MVAR 138 kV STATCOM, 1-138 kV PCB • Baybay 69 kV LES: 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCB		8,713M	Samar, Leyte, Cebu, Negros, Panay	Stage 1-Dec 2025 Stage 2-Dec 2033

load. These low voltages, if not addressed, will result in load curtailment. Currently, there are no power plants in Samar Island to provide the needed voltage regulation in the area. Overvoltage is experienced during off-peak demand while undervoltage during peak demand. With the increase in demand in the area of Naga and Panitan SS, undervoltage is experienced in the area. Additionally, stability issues are experienced in the area. There is no more headroom for the reactive power support during heavy fault, thus, may cause multiple tripping of power plants and may lead to instability of the system.		Sipalay 69 kV LES: 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCB • San Jose 69 kV LES: 3x5 MVAR 69 kV Capacitor Bank, 3-69 kV PCB • Roxas 69 kV LES: 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCB Stage 2: • Quinapondan 69 kV LES: 5 MVAR 69 kV Capacitor Bank, 1-69 kV PCB • Balamban 69 kV LES: 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCB • Carmen 69 kV LES: 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCB • Valladolid 69 kV LES: 5x5 MVAR 69 kV Capacitor Bank, 5-69 kV PCB • Bayawan 69 kV LES: 1x5 MVAR 69 kV Capacitor Bank, 1-69 kV PCB • Estancia 69 kV LES: 2x5 MVAR 69 kV Capacitor Bank, 2-69 kV PCB			
Visayas Mobile Capacitor Project	• Power Quality • Filed to ERC	• Dauin 69 kV LES: 3x5 MVAR 69 kV Mobile Capacitor, 3-69 kV PCB. Tigbauan 69 kV LES: 1x5 MVAR 69 kV Mobile Capacitor, 1-69 kV PCB. • Biliran 69 kV LES: 2x5 MVAR Mobile Capacitor, 2-69 kV PCB.	1,165M	Panay, Negros and Leyte	Jun 2024

9.2 Transmission Outlook for 2031-2040

By 2035, with the implementation of projects that will strengthen the Visayas Backbone, future developments in terms of the commercial and industrial sector in the Visayas that would increase the power supply requirements are being expected. To accommodate these developments, new drawdown substations are proposed in the key cities across the Visayas grid.

Furthermore, with the projected entry of large power plants in Panay, Samar, and Leyte Island, the main backbone will be extended towards Northern Panay and Leyte Island. 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 Talisay–Bonbon 230 kV TL under Cebu–Leyte 230 kV Interconnection Line 3 and 4 Project. As more powerplants are expected to come to Panay, major reinforcements of the 230 kV lines also need to be constructed. The HVDC system between Luzon and Visayas will be upgraded to double its transfer capacity in sharing excess generation among Luzon, Visayas and Mindanao grids.

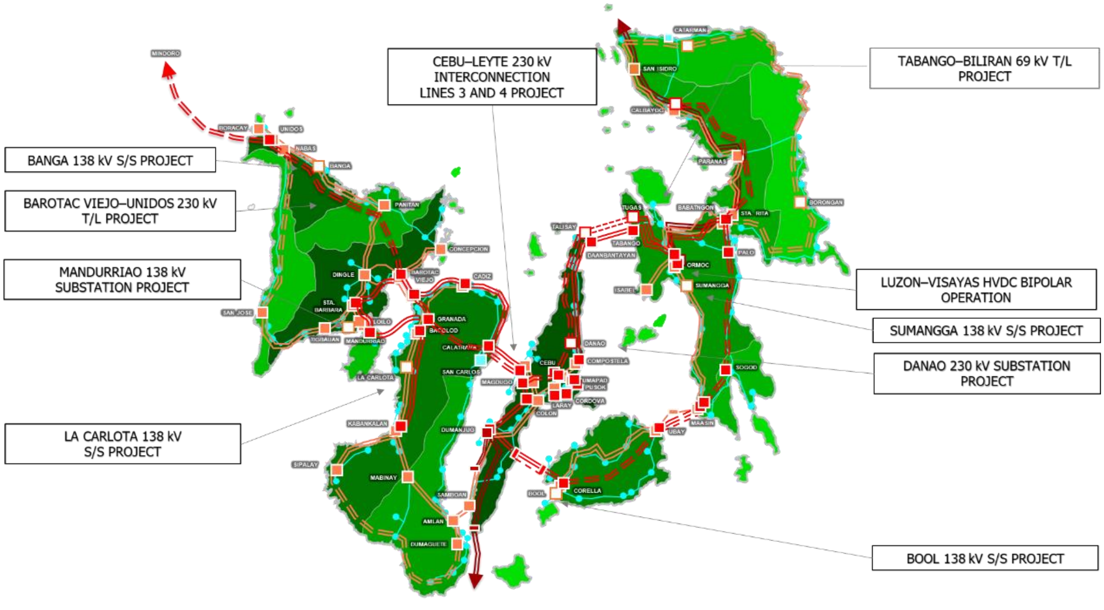


Figure 9.3: Visayas Transmission Outlook for 2031-2040

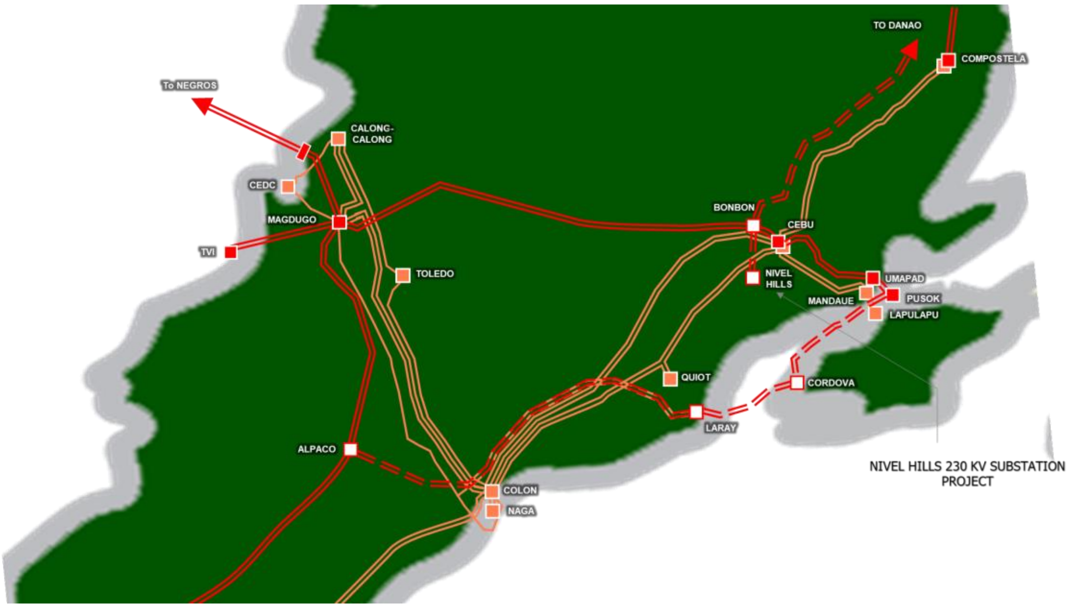
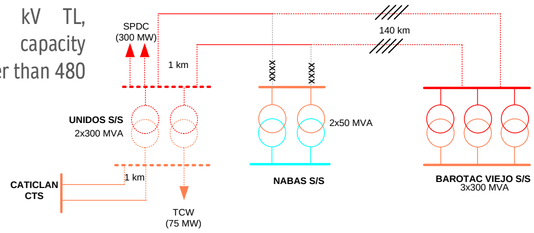
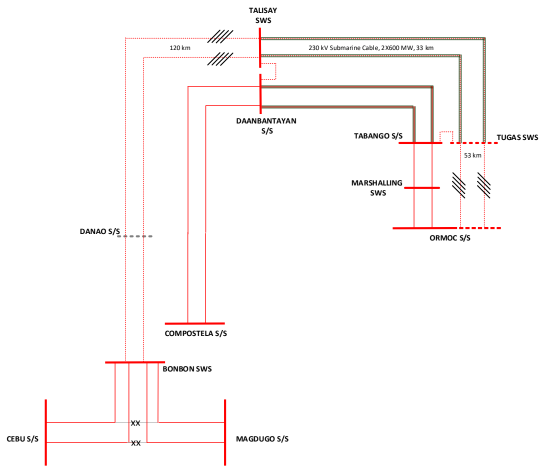


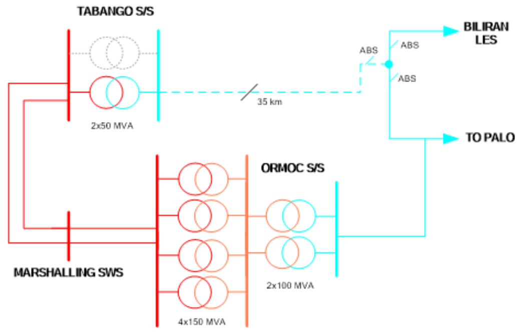
Figure 9.4: Metro Cebu Transmission Outlook 2031-2040

Table: 9.2 List of Committed Visayas transmission projects for the period 2031-2040.

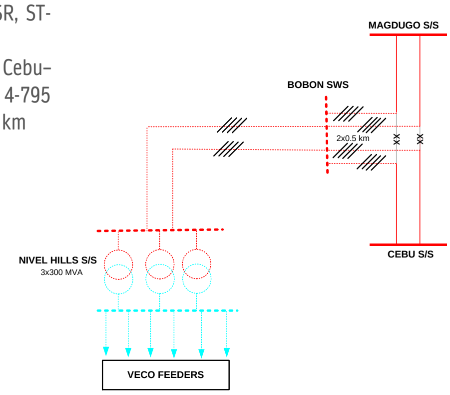
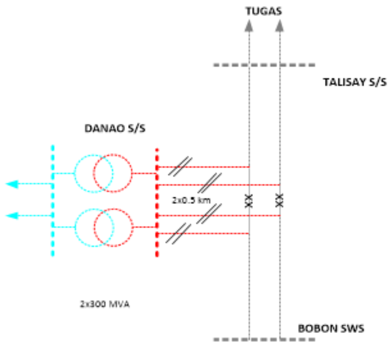
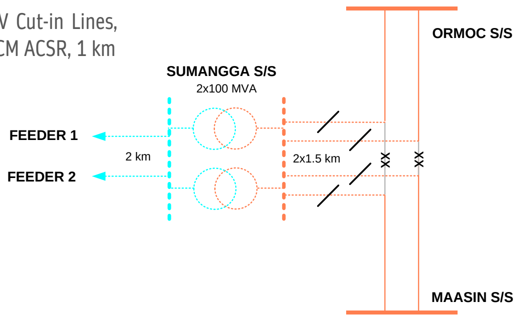
TRANSMISSION LINE						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
500 kV						
Luzon–Visayas HVDC Bipolar Operation Project The development of new power plants in Luzon will result in increased excess generation in the island. Currently, the transfer capacity of the HVDC from Luzon to Visayas is only 440 MW. In order to utilize the excess generation from each island, there is a need to upgrade the existing HVDC system between Luzon and Visayas. The project aims to accommodate additional generation, import and export to the Visayas Grid. The upgrade of Luzon-Visayas HVDC will also help in the maximum utilization of the Mindanao-Visayas Interconnection enabling more efficient sharing of reserves among Luzon, Visayas and Mindanao. The Project involves the development of the Naga 500/230 kV SS, as well as upgrading of the Naga and Ormoc Converter/Inverter Stations in order to provide an additional transfer capacity between Luzon and Visayas. There will be an additional 450 MW transfer capacity between Luzon and Visayas upon completion of the project. It aims to accommodate additional excess generation, import and export to the Visayas Grid and vice versa.	• Generation Entry • Filed to ERC	• Naga Converter Station (Expansion) 3x172 MVA single phase converter transformers; 1300A – 576 Thyristor, 96 Modules, 3 Quadruples rated at 172.1kV thyristor valves; AC filters 1x78MVAR AC high pass filter; 240mH smoothing reactor; • Ormoc Converter Station (Expansion) 3x172 MVA single phase converter transformers; 1300A – 576 Thyristor, 96 Modules, 3 Quadruples rated at 172.1kV thyristor valves; AC filters 3x35MVAR filter banks; 240mH smoothing reactor; • Naga SS (Expansion) 2x1000 MVA Power transformers and accessories, 2x90 MVAR 500 kV Line Reactor, 2x100 MVAR 230 kV Shunt Capacitor, 8-500 kV PCB, 2-230 kV PCB and associated equipment; • Pagbilao SS 2-500 kV PCB and associated equipment		22,462.63M	Naga and Leyte	Dec 2032

TRANSMISSION LINE						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
230 kV PROJECTS						
Barotac Viejo–Unidos 230 kV Transmission Line Project The project involves the construction of a new drawdown SS in Unidos, Aklan with a 2x300 MVA 230/138-13.8kV transformer capacity. It will bus-in along the proposed Nabas–Caticlan TL which is under the Nabas–Caticlan–Boracay Transmission Project. Termination of the 230 kV designed transmission line from Nabas SS will be disconnected and will be extended going to Barotac Viejo SS thus, connecting Unidos SS to Barotac Viejo SS. The project will accommodate the incoming power plants in Northern Panay.	• Generation Entry • Filed to ERC	• Unidos GIS SS (New): 2x300 MVA 230/138-13.8 kV Power Transformers and accessories; 7-230 kV PCB (GIS) and associated equipment; 6-138 kV PCB (GIS) and associated equipment • Barotac Viejo SS (Expansion): 4-230 kV PCB and associated equipment	• Bus-in of Unidos SS to Nabas–Caticlan TL (Going to Caticlan): 138 kV TL, ST-DC, 1-795 MCM ACSR, 1 km • Bus-in of Unidos SS to Nabas–Caticlan TL (Going to Nabas): 230 kV TL, ST-DC, 4-795 MCM ACSR, 1 km. • Barotac Viejo–Unidos 230 kV TL (Extension up to Barotac Viejo), ST-DC, 4-795 MCM ACSR, 140 km. • Reconductoring of Barotac Viejo–Dingle 138 kV TL, Conductor with capacity equivalent or higher than 480 MVA, DC, 53 km. 	16,259.97M	Panay	May 2033
Cebu–Leyte 230 kV Interconnection Lines 3 and 4 Project The project involves the construction of a new transmission backbone from the main load center in Cebu towards the bulk generation hub in Leyte. The project includes laying of double-circuit submarine cables between Cebu and Leyte Islands. The project also involves construction of 230 kV overhead TL and switching stations to complete the new 230 kV transmission backbone. It will accommodate the entry of powerplants in Leyte, Samar, and Cebu and will maximize the power interchange between Luzon, Visayas, and Mindanao.	• Generation Entry and System Reliability • Filed to ERC	• Talisay SWS (New): 14-230 kV PCB and associated equipment; 4x70 MVAR Line Reactors • Tugas SWS (New): 14-230 kV PCB and Associated equipment; 4x70 MVAR Line Reactors • Bonbon 230 kV SS (Expansion): 2-230 kV PCB and associated equipment • Ormoc 230 kV SS (Expansion): 4-230 kV PCB and associated equipment; Series Reactor along the existing Ormoc–Tabango 230 kV TL (per ckt) • Tabango 230 kV SS (Expansion): 1-230 kV PCB and associated equipment • Daanbantayan 230 kV SS (Expansion): 1-230 kV PCB and associated equipment	• Talisay–Tugas S/C: 230 kV Submarine Cable, 600-MW per circuit submarine cables, DC 33 km • Bonbon–Talisay TL: 230 kV T/L, ST-DC, 4-795 MCM ACSR, 120 km • Tugas–Ormoc TL: 230 kV T/L, ST-DC, 4-795 MCM ACSR, 53 km • Daanbantayan–Talisay TL: 230 kV TL, ST-DC, 4-795 MCM ACSR, 1 km • Tabango–Tugas TL: 230 kV T/L, ST-DC, 4-795 MCM ACSR, 1 km 	44,405.71M	Leyte, Cebu	Dec 2031
69 kV PROJECTS						
Tabango–Biliran 69 kV Transmission Line Project	• Load Growth and System Reliability • Filed to ERC	• Tabango SS: 1-69 kV PCB and associated equipment • Biliran LES: 3-69 kV Air-Break Switch	• Tabango–Biliran 69 kV TL SP-SC, 1-795 MCM ACSR, 35 km	1,723.55M	Northern Leyte	Sep 2034

TRANSMISSION LINE

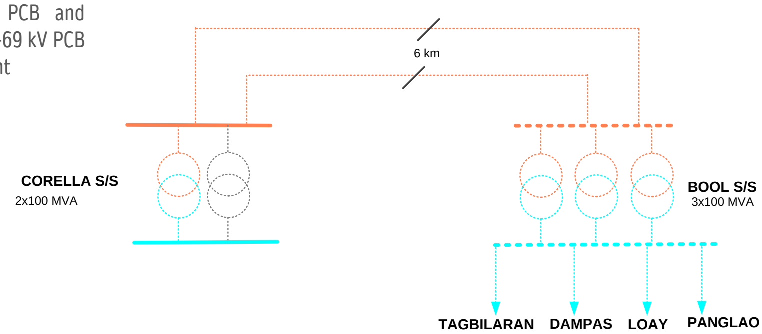
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
The project involves the extension of 69 kV line from Tabango SS to the Biliran (LES) to form a loop and provide single outage contingency (N-1) capability to the TL serving northern Leyte and Biliran Island.						

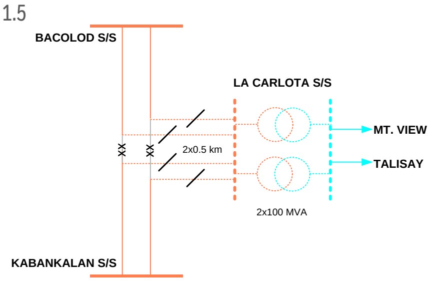
SUBSTATION

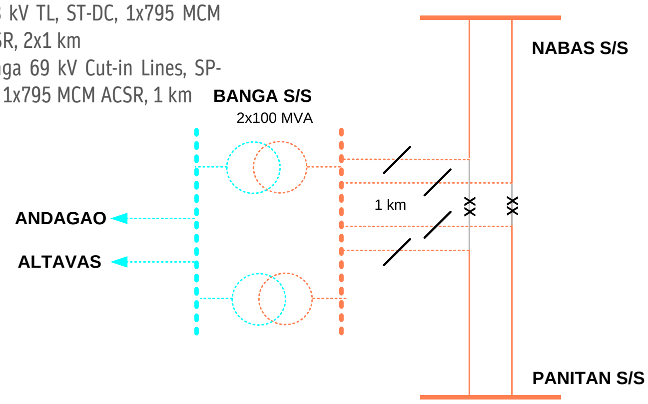
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
230 kV PROJECTS						
Nivel Hills 230 kV Substation Project The project involves the construction of a new drawdown GIS SS with 3x300 MVA 230/69 kV transformers within the area of Metro Cebu, which is a major load center in the Visayas. It will bus-in to Cebu–Magdugo 230 kV TL via 230 kV TL which is approximately 5 km in length and will be connected through the 230 kV SWS that will be located in the area of Bonbon, Cebu.	• Load Growth and System Reliability • Filed to ERC	• Nivel Hills GIS SS (New): 3x300 MVA 230/69-13.8 kV Power Transformers and accessories; 6-230 kV PCB (GIS) and associated equipment; 10-69 kV PCB (GIS) and associated equipment • Bonbon SWS (New): 10-230 kV PCB (GIS) and associated equipment	• Nivel Hills SS–Bonbon SWS: 230 kV, 4-795 MCM ACSR, ST-DC, 5 km • Bus-in of Bonbon SWS to Cebu–Magdugo OHTL 230 kV, 4-795 MCM ACSR, ST-DC, 2x0.5 km	6,867.38M	Cebu	Dec 2033 
Danao 230 kV Substation Project The project involves putting up a new 230 kV drawdown SS in Danao, Cebu with 2x300 MVA 230/69 kV Power Transformers. The new Danao 230 kV SS will bus-in along Bonbon SWS–Talisay SWS 230 kV TL proposed under Cebu–Leyte 230 kV Interconnection Lines 3&4 Project.	• Load Growth and System Reliability • Filed to ERC	• Danao 230 kV SS: 2x300 MVA, 230/69 kV Power Transformers and accessories; 10-230 kV PCB and associated equipment; 8-69 kV PCB and associated equipment	• Bus-in lines to the Compostela-Daanbantayan 230 kV TL, ST-DC, 4x795 MCM ACSR, 2x1 km	3,763.87M	Cebu	Aug 2032 
138 kV PROJECTS						
Sumangga 138 kV Substation Project The project involves putting up a new 138 kV SS in Sumangga, Ormoc City, Leyte with 2x100 MVA 138/69 kV Power Transformers. The new Sumangga 138 kV SS will bus-in along Ormoc-Maasin 138 kV TL.	• Load Growth and System Reliability • Filed to ERC	• Sumangga 138 kV SS: 2x100 MVA Power Transformers and accessories; 10-138 kV PCB and associated equipment; 5-69 kV PCB and associated equipment • Ormoc 138 kV SS: 6-69 kV PCB and associated equipment	• Bus-in to the Ormoc–Maasin 138 kV TL, ST-DC, 1x795 MCM ACSR, 2x1.5 km • Sumangga 69 kV Cut-in Lines, SP-DC, 1x795 MCM ACSR, 1 km	3,977.94M	Leyte	Dec 2033 

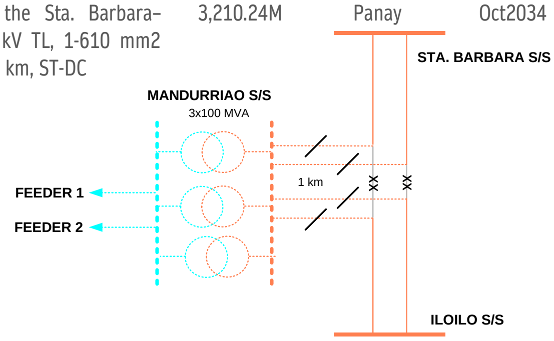
TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Bool 138 kV Substation Project The project aims to provide alternative connection points to power consumers particularly for Southern Bohol, thus, will accommodate the projected increase in the power demand. The project involves the construction of the 138 kV overhead transmission line from Corella to Bool and the construction of the SS in Bool with 3x100 MVA capacity. Loads served by BOHECO I and BLCI are the primary beneficiaries of the project.	• Load Growth and System Reliability • Filed to ERC	• Bool 138 kV SS: 3x100 MVA Power Transformers and accessories; 8-138 kV PCB and associated equipment; 9-69 kV PCB and associated equipment • Corella SS: 2-138 kV PCB and associated equipment; 1-69 kV PCB and associated equipment	• Corella–Bool138 kV TL, ST-DC, 1x795 MCM ACSR, 6 km • Bool 69 kV Cut-in Lines, SP-DC, 1x795 MCM ACSR, 1 km	4,046.69M	Bohol	Dec 2032
La Carlota 138 kV Substation Project The project involves the construction of a new 138 kV SS in La Carlota, Negros Occidental with 2x100 MVA 138/69 kV power transformers to accommodate the load growth in Negros Occidental.	• Load Growth • Filed to ERC	• La Carlota SS: 2x100 MVA, 138/69-13.8 kV Power Transformers; 10-138 kV PCB and associated eqpt; 4-69 kV PCB and associated eqpt.	• La Carlota 138 kV Bus-in Lines, ST-DC, 1-795 MCM ACSR, 2x0.50 km • La Carlota 69 kV Cut-in Lines, SP-DC, 1-795 MCM ACSR, 1.5 km	4,022.05M	Negros	Dec 2032
Banga 138 kV Substation Project Power consumers in Northern Panay draw power from Nabas and some from Panitan SS. With the continuing economic and infrastructure developments within the area, the projected power requirement will not be adequately served by the existing SS capacity. The project provides an alternative connection point to power consumers particularly for Northern Panay, thus, will accommodate the projected increase in the power demand. The new SS will bus-in to the Panitan–Nabas 138 kV TL and will be located in Banga, Aklan.	• Load Growth and System Reliability • Filed to ERC	• Banga 138 kV SS: 2x100 MVA Power Transformers and accessories; 10-138 kV PCB and associated equipment; 5-69 kV PCB and associated equipment	• Bus-in to the Panitan–Nabas 138 kV TL, ST-DC, 1x795 MCM ACSR, 2x1 km • Banga 69 kV Cut-in Lines, SP-DC, 1x795 MCM ACSR, 1 km	2,621.10M	Panay	Sep 2032
Mandurriao 138 kV Substation Project The project involves the extension of the 138 kV transmission backbone towards southern part of Panay. This includes the construction a new SS in Mandurriao, Iloilo City that will bus-in between Sta. Barbara-Iloilo 138 kV T/L.	• Load Growth and System Reliability • Filed to ERC	• Mandurriao 138kV SS: 3x100 MVA, 138/69-13.8 kV Power Transformer and accessories; 8-69 kV PCB and associated equipment; 11-138 kV PCB and associated equipment	• Bus-in to the Sta. Barbara–Iloilo 138 kV TL, 1-610 mm2 TACSR, 2x1 km, ST-DC	3,210.24M	Panay	Oct2034









The entry of indicative power plants in the identified CREZ areas in Panay, Negros, Samar, and Bohol Island will require extending the main backbone towards Southern Panay, Negros Occidental, Bohol, and Samar Island. Reinforcements of the 230 kV backbone lines are also proposed to accommodate the entry of these indicative power plants. Upgrading of the existing substations and construction of 138 kV transmission lines are also needed to provide power quality, reliability and resiliency.

By 2040, a more secure, more robust, and stronger transmission system is expected. 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 the 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, Panay, Negros and Samar's 138 kV system will also be further extended and looped to improve supply, power quality, security, and reliability.

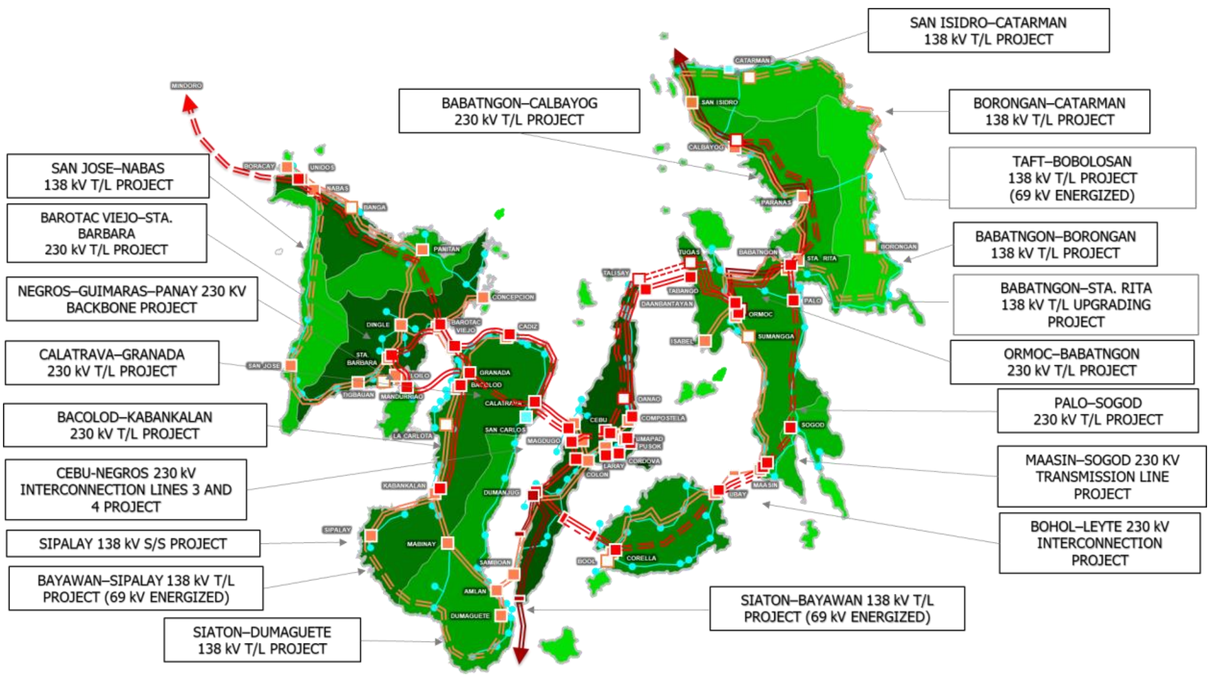


Figure 9.5: Visayas Transmission Outlook for 2031-2040

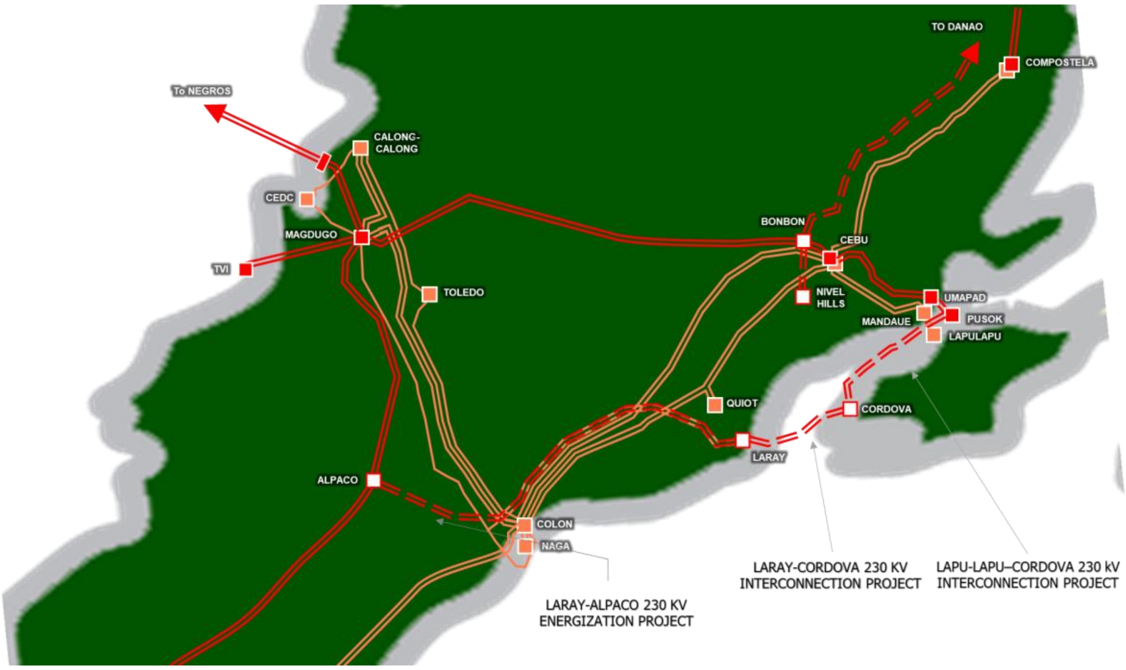


Figure 9.6 Metro Cebu Transmission Outlook 2031-2040

Table: 9.3 List of Additional Proposed Projects in the Visayas for the period 2031-2040

TRANSMISSION LINE		
Project Name	Project Description	Location
230 kV PROJECTS		
Ormoc–Babatngon 230 kV Transmission Line Project	• There is a need to provide reliable power transmission to Leyte and Samar customers. In 2017, a magnitude-6.5 earthquake shook Ormoc, Leyte which left the region without electricity. The Leyte-Samar grid is primarily dependent in Ormoc SS as it houses the HVDC connection to the Luzon Grid and it is where the 230 kV transmission system from Cebu ends. Ormoc SS also serves as the major drawdown SS in Leyte and Samar, large generators injecting power in the Ormoc–Tabango 230 kV Transmission Corridor are absorbed through the 138 kV transmission system that connects Ormoc SS and other 138 kV Substations in Leyte and Samar. The excess power is either transmitted to Cebu via 230 kV transmission backbone or to Luzon Grid via 350 kV HVDC transmission corridor.	Leyte
Laray–Cordova 230 kV Interconnection Project	• The project involves the construction of a new drawdown Substations within the area of Cordova in Visayas. It will be connected to Laray 230 kV SS in Mainland Cebu crossing to Cordova Island via DC 230 kV S/C with a transfer capacity of 600 MW per circuit.	Cebu
Laray–Alpaco 230 kV Energization Project	• The project involves the construction of a new SWS within the area of Alpaco in Metro Cebu. It will bus-in to the proposed Magdugo–Dumanjug 230 kV TL which is part of the Mindanao–Visayas Interconnection Project. The proposed overhead TL coming from Laray GIS SS, which is connected to Magdugo–Colon 138 kV TL will be extended and will be connected to the new Alpaco SWS. Additionally, with this energization of Laray 230 kV SS will be done.	Cebu
Bacolod–Kabankalan 230 kV Transmission Line Project	• The project connects the northern and southern part of Negros Island. It enables the exchange of power between the two areas. It is part of the long-term plan of putting up a 230 kV backbone loop in the southern portion of Negros. The project aims to provide additional termination points for future powerplants in the area.	Negros Occidental
Bohol–Leyte 230 kV Interconnection Project	• The Bohol–Leyte 230 kV Interconnection Project involves the development of a 230 kV Backbone from Bohol to Leyte. The completion of the project will complete the 230 kV transmission loop between Cebu, Bohol, and Leyte Island. It involves the construction of 230 kV TL that will traverse from Corella–Ubay–Tugas and from Guadalupe–Maasin. Moreover, a DC 230 kV S/C will be laid from Tugas to Guadalupe SWS with a transfer capacity of 600 MW per circuit.	Bohol and Leyte
Maasin–Sogod 230 kV Transmission Line Project	• The projects involve the construction of a new drawdown SS in the area of Sogod. This will accommodate the customers in Southern Leyte thus giving reliability and addressing the undervoltage issues in the area. A 230 kV designed TL that will be energized at 138 kV will be constructed from Maasin going to the new Sogod SS.	Leyte

TRANSMISSION LINE		
Cebu–Negros 230 kV Interconnection Line 3 and 4 Project	• The Interconnection project involves the construction of a Cebu–Negros 230 kV S/C Line 3 and 4. The proposed facility will accommodate the excess generation from Panay and Negros going to Cebu. This project will also pave way for the construction of the new Calatrava SWS in Negros and Talavera SWS in Cebu.	Cebu and Negros
Babatngon–Calbayog 230 kV Transmission Line Project	• The project involves extending the 230 kV backbone in Samar Island. A 230 kV TL will be constructed from Babatngon going to Calbayog SS. It aims to accommodate the entry of power plants under CREZ in the area and will provide system reliability and resiliency in between Leyte and Samar	Leyte and Samar
Barotac Viejo–Sta. Barbara 230 kV Transmission Line Project	• The project involves extending the 230 kV backbone in Southern Panay. A 230 kV TL will be constructed from Barotac Viejo going to Sta. Barbara SS. It aims to accommodate the entry of powerplants under CREZ in the area and will provide system reliability and resiliency in Southern Panay.	Panay
Negros-Guimaras-Panay 230 kV Backbone Project	• This project involves developing a 230 kV Transmission Loop between Negros, Guimaras, and Panay Island. It involves laying of DC submarine cables from Negros to Guimaras and to Panay Island. This is to ensure to accommodate the upcoming powerplant entry under CREZ in the area of Negros, Panay and Guimaras. This will also provide reliability to the Negros–Panay interconnection.	Negros and Panay
Calatrava-Granada 230 kV Transmission Line Project	• With the entry of generation through CREZ in Negros, Panay and Guimaras power will flow going to Cebu and the E.B Magalona–Cadiz–Calatrava 230 kV Backbone Line will overload. The project involves developing a 230 kV Transmission loop in Negros. It involves the construction of a 230 kV TL that will traverse from Granada to Calatrava SS.	Negros
Lapu-Lapu-Cordova 230 kV Interconnection Project	• The 230 kV transmission corridor in Cebu and Mactan Island is a DC 230 kV TL and submarine cable that traverses from Lapu-Lapu–Umapad–Cebu–Magdugo–Alpaco–Laray–Cordova. Double Outage of the TL from Umapad to Lapu-Lapu will result to the isolation of Lapu-Lapu SS from the grid. The Lapu-Lapu–Cordova 230 kV Interconnection Project will complete the 230 kV transmission loop in Metro Cebu. This will provide a reliable and resilient power grid in Cebu and Mactan Island.	Cebu
Palo–Sogod 230 kV Transmission Line Project	• The project aims to complete the ultimate plan of creating a 230 kV loop between Cebu, Bohol, and Leyte Islands by the construction of 90-km Palo–Sogod 230 kV TL thereby ensuring the reliable and resilient transmission of power between Cebu, Bohol, and Leyte Island.	Leyte
138 kV PROJECTS		
Babatngon–Sta. Rita 138 kV Transmission Line Upgrading	• The project involves the upgrading of a portion of the existing Babatngon–Paranas 138 kV line along San Juanico Strait and the construction of Sta. Rita SS, which will bus-in to the said transmission corridor.	Leyte and Samar
Siaton–Bayawan 138 kV Transmission Line Project (Initially energized at 69 kV)	• The project involves the construction of 138 kV-designed TL, energized at 69 kV, that will connect Siaton and Bayawan LES. The project is part of the ultimate plan of establishing 138 kV loop in southern Negros.	Negros Occidental and Negros Oriental
Taft–Bobolosan 138 kV Transmission Line Project (Initially energized at 69 kV)	• The project involves the construction of 138 kV-designed TL, energized at 69 kV, that will connect Taft and Bobolosan load End SS. These structures, to be found in northeastern Samar, will be part of the ultimate plan of establishing a 138 kV loop around Samar Island	Northern and Eastern Samar
San Isidro–Catarman 138 kV Transmission Line Project	• The proposed project involves the development of a new DC 138 kV TL from Calbayog SS going to San Isidro and Catarman in Northern Samar. This transmission facility will improve the reliability in the area.	Samar
Bayawan–Sipalay 138 kV Transmission Line Project (Initially energized at 69 kV)	• The project involves the construction of 138 kV-designed TL, energized at 69 kV, that will connect Bayawan and Sipalay LES. The project is part of the ultimate plan of establishing 138 kV loop in southern Negros.	Negros Occidental and Negros Oriental
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 the 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.	Cebu
Babatngon–Borongan 138 kV Transmission Line Project	• The Paranas-Borongan-Quinapondan 69 kV Line serves loads of the Eastern Samar through ESAMELCO's LES. The existing 69 kV line serving the said area is having a length of more than 190 km which is prone to long outages and tedious to maintain. The proposed Babatngon-Borongan 138 kV TL Project aims to provide a transmission backbone corridor along the eastern part of Samar Island. The project will also drastically improve the reliability of the power supply in the area. This project will also construct a new drawdown 138 kV SS in Borongan.	Samar and Leyte
Borongan–Catarman 138 kV Transmission Line Project	• Samar Island is located in eastern part of Visayas. Samar is frequently impacted by typhoons from Pacific Ocean which makes its transmission system very susceptible to interruption. There is a need to strengthen the reliability of transmission backbone in Samar Island by creating 138 kV transmission loop system within the Island. The Borongan–Catarman 138 kV TL Project will address the generation and load curtailment in the event of outage of the entire Babatngon–Sta Rita 138 kV TL. Sta. Rita, Paranas,	Samar

TRANSMISSION LINE		
	Calbayog, San Isidro and Catarman SS are no longer solely dependent on Babatngon–Sta Rita 138 kV TL. Moreover, the proposed project completes the 138 kV backbone loop and thereby ensures reliable transmission of power within Samar Island.	
Siaton-Dumaguete 138 kV Transmission Line Project	• The project aims to complete the 138 kV Backbone loop in the Southern Negros area. It involves the extension of the 138 kV line from Siaton going to Dumanjug substation. This will strengthen the transmission reliability and will provide resiliency in the Negros Island.	Negros
San Jose–Nabas 138 kV Transmission Line Project	• The project aims to complete the ultimate plan of creating a 138 kV loop in Panay Island by the construction of 125-km San Jose–Nabas 138 kV TL thereby ensuring the reliable and resilient transmission of power in Panay Island.	Panay

SUBSTATION		
Project Name	Project Description	Location
138 kV PROJECTS		
Sipalay 138 kV Substation Project	• The proposed project involves the upgrading of the existing Sipalay 69 kV SWS to a 138 kV SS. This SS facility will serve as a new drawdown SS in preparation for the looping configuration in the southern part of Negros Island.	Negros
Visayas Substation Upgrading Project 4	• The proposed project involves the expansion of the various Visayas SS to increase the SS capacity due to the forecasted load growth and to sustain the N-1 contingency provision prescribed by the PGC.	Cebu, Panay, Leyte, Negros and Bohol
Visayas Regional PCB Replacement Project 2	• The projects involve the replacement of the existing PCB in various NGCP SS in the Visayas due to the following: ▪ Underrated capacity – short circuit current and/or continuous current capacity is less than the actual current that will flow into the circuit breaker. ▪ Old age - These PCB are more or less 40 years old in the service, hence they are becoming less and less reliable every passing year. Although these PCB can still operate, the reliability of the system is endangered due to their unpredictable operation. These PCB are bound to fail to operate that will result in widespread system disturbance which should be avoided.	Cebu, Negros, Panay, Bohol, Leyte, Samar
Visayas PCB Replacement Project 3	• The projects involve the replacement of the existing PCB in various NGCP SS in the Visayas due to the following: ▪ Underrated capacity – short circuit current and/or continuous current capacity is less than the actual current that will flow into the circuit breaker. ▪ Old age - These PCB are more or less 40 years old in the service, hence they are becoming less and less reliable every passing year. Although these PCB can still operate, the reliability of the system is endangered due to their unpredictable operation. These PCB are bound to fail to operate that will result in widespread system disturbance which should be avoided	
Visayas Substation Upgrading Project 5	• The proposed project involves the expansion of the various Visayas SS to increase the SS capacity due to the forecasted load growth and to sustain the N-1 contingency provision prescribed by the PGC.	Cebu, Panay, Leyte, Negros and Bohol

VOLTAGE IMPROVEMENT		
Project Name	Project Description	Location
230 kV PROJECTS		
Visayas Voltage Improvement Project 3	• The Visayas Voltage Improvement Project 3 aims to provide reactive power support to address undervoltage problems in Visayas.	Cebu
Visayas Voltage Improvement Project 4	• The Visayas Voltage Improvement Project 4 will address the undervoltage problems in Cebu and Negros Islands. The installation of Capacitor in Granada, La Carlota, and Cordova SS will address the projected undervoltage in each area.	Cebu and Negros

MINDANAO TRANSMISSION OUTLOOK

The power supply deficiency experienced in Mindanao for the past years especially during the dry season has 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 as well as the energization of the Balo-i-Villanueva-Maramag-Bunawan transmission line to 230 kV was implemented. With the completion of the interconnection between Mindanao and the Visayas, there would be more opportunities for power exchange. In this chapter, several projects were proposed that will make the Mindanao grid more reliable and robust to ensure the continuity of power delivery.

In terms of transmission system configuration, Mindanao is relatively a robust grid. However, security issues on the island remain a serious concern, thus NGCP is still facing major challenges in implementing its operations and construction of key transmission projects. Notably, another vital issue in the Mindanao grid is the looming low voltage issue in Zamboanga City. Due to the long distance and radial configuration of the transmission line delivering power to the area relative to the continuous increase in demand, there will be an impending low voltage in the area which can be resolved by power mitigating transmission facility in the short term. In this case, a local power plant should be constructed in the area to balance the essential reactive requirement of the system.

Meanwhile, to support the other requirements for load growth and system reliability of the Mindanao Grid, the reinforcement of the existing 138 kV substations, the extension of some of the existing 230 kV and 138 kV transmission lines, looping of some 69 kV transmission systems, as well as the implementation of power quality projects are necessary.

10.1 Transmission Outlook for 2023-2030

From the year 2023 to 2030, the development plan will be focusing on the extension of 138 kV corridors namely the Maco-Mati 138 kV TL, San Francisco-Tago 138 kV TL, and Tacurong-Kalamansig 69 kV TL. In this horizon, the upgrading and expansion of several substations projects will also be implemented.

To accommodate huge spot loads, the Koronadal 138 kV SS will be developed to cater to the entry of the planned mining operation in the municipality of Tampakan. In northern Mindanao, the Laguindingan 230 kV SS is being constructed to serve the power requirement of the Laguindingan Economic Zone. In North Cotabato, the completion of the Kabacan SS is on the way to address the power demand requirement of the customers in the province.

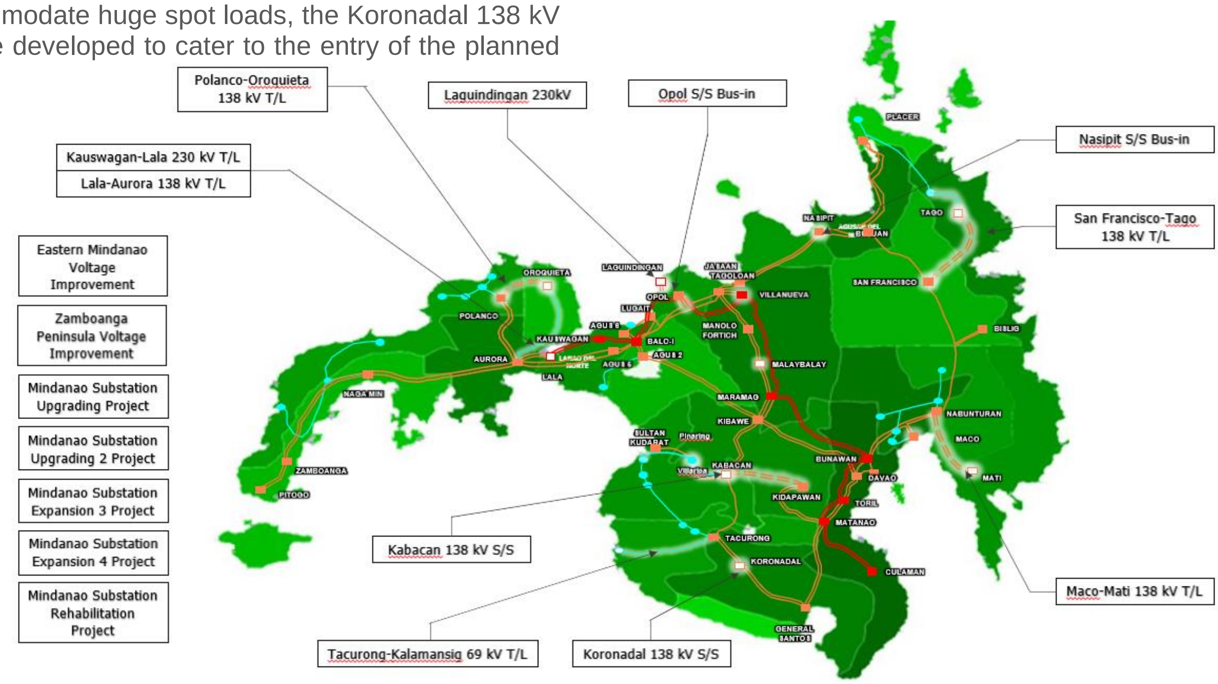


Figure 10.1: Proposed Mindanao Transmission Outlook for 2023-2030

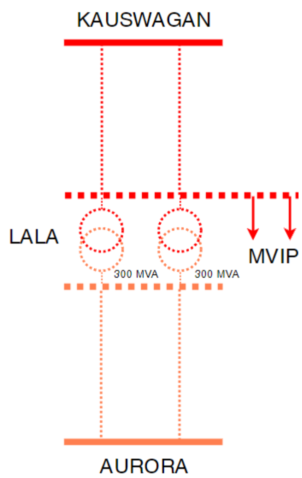
Table 10.1 List of Proposed Mindanao Transmission Projects for the period 2023-2030

TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
230 kV PROJECTS						
Kauswagan–Lala 230 kV Transmission Line	• Generation Entry, System Reliability • ERC-approved	• Lala 230 kV SS: 2x300 MVA 230/138 kV Power Transformers, 8-230 kV PCB, 6-138 kV PCB • Aurora 138 kV SS: 3-138 kV PCB	• Kauswagan-Lala 230 kV TL, ST-DC, 4-795 MCM ACSR, 56 km. • Lala-Aurora 138 kV TL, ST-DC, 2-795 MCM ACSR, 27.17 km.	2,836M	Lanao del Norte, Zamboanga del Sur	Jun 2023

Formerly Balo-i – Kauswagan –Aurora 230 kV TL Phase 2, the project connects the Kauswagan SS to Lala SS utilizing a DC TL in a bundle-of-two power conductor configuration at 230 kV voltage level. The project includes the installation of two power transformers in the Lala SS to be linked to the existing Aurora SS through a 138 kV TL.

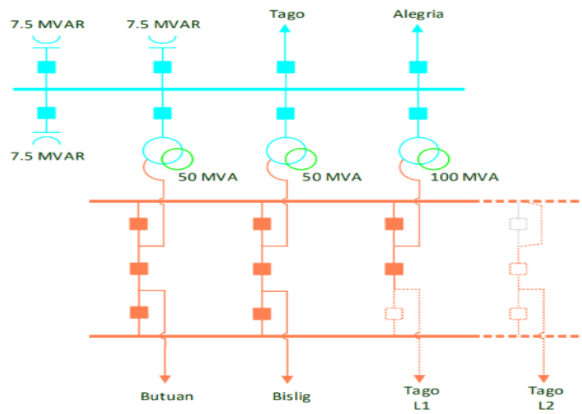
The majority of power consumption in the Zamboanga Peninsula is supplied through Balo-i – Agus 5 – Aurora 138 kV lines. These TL are critically loaded during the N-1 condition. The project provides a reliable transmission network for the Zamboanga Peninsula to achieve continuous normal grid operation. It is the extension of the planned Mindanao 230 kV transmission backbone facility which complements the MVIP.



Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
138 kV PROJECTS						
San Francisco– Tago 138 kV Transmission Line	• Load Growth, System Reliability • Filed to ERC	• San Francisco 138 kV SS: 2-138 kV PCB • Tago 138 kV SS: 1x50 MVA 138/69 kV Power Transformer, 6-138 kV PCB, 8-69 kV PCB	• San Francisco–Tago 138 kV TL, ST-DC, 1-795 MCM ACSR/AS, 91 km. • Madrid–Tago 69 kV TL, SP-SC, 1-795 MCM ACSR/AS, 59.4 km. • Tago SS Cut-in to Cagwait–Tandag 69 kV TL, SP-SC, 1-795 MCM ACSR/AS, 2x1 km	5,596M	Agusan del Sur, Surigao del Sur	May 2025

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 the absence of an alternative transmission facility.

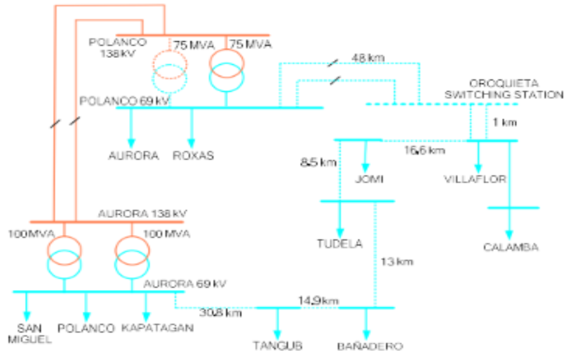
The project is comprised of the 138 kV line extension from San Francisco SS to the new Tago SS and the looping of the 69 kV lines in Surigao del Sur. This project allows the switching of loads during line outages and solves the power quality and reliability problems being experienced in the area.



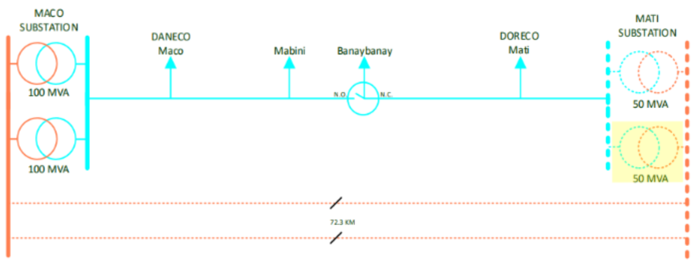
Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Polanco–Oroquieta 138 kV Transmission Line	• Load Growth	• Polanco 138 kV SS: 4-10 MVAR Shunt Capacitors 4-138 kV PCB • Oroquieta 69 kV SWS (New) 2-7.5 MVAR Shunt Capacitors 8 -69 kV PCB	• Polanco–Oroquieta 138 kV Line (New), ST-DC, 1-795 MCM ACSR, 48 km • Oroquieta–Villaflor 69 kV Line (New), ST-DC, 1-795 MCM ACSR, 1 km	8,742M	Misamis Occidental	Feb 2028

TRANSMISSION LINE

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
The project covers the construction of 48 km 138 kV TL (initially energized at 69 kV) from Polanco 138 kV SS to Oroquieta SWS and upgrading of the existing 84 km 69 kV TL from Aurora SS to MOELCI I's Villaflor SS. Also included in the project are the 2-7.5 MVAR Shunt Capacitors at Banadero and Villaflor LES and a 69 kV PCB for the entry of BESS Project in Aurora.		• Aurora 69 kV SS: 2-69 kV PCB • Bañadero 69 kV SS: 2-7.5 MVAR Shunt Capacitor 2-69 kV PCB • Villaflor 69 kV SS: 2-7.5 MVAR Shunt Capacitor 2-69 kV PCB	• Aurora–Villaflor 69 kV Line (Upgrading), SP-SC, 1-795 MCM ACSR, 84 km			

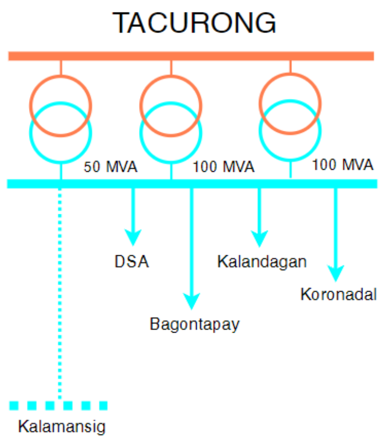


Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Maco–Mati 138 kV Transmission Line The project involves the construction of a 72.3 km, 138 kV, 1-795 MCM ACSR, ST-DC TL from Maco 138 kV SS to new Mati 138 kV SS. A 50 MVA 138/69 kV power transformer will be installed at the Mati SS. Another 50 MVA 138/69 kV power transformer from Nasipit SS will be transferred to the said SS.	• Load Growth	• Maco 138 kV SS: 4-138 kV PCB and associated equipment • Mati 138 kV SS: 1x50 MVA 138/69 kV Power Transformer 6-138 kV PCB and associated equipment 5-69 kV PCB and associated equipment	• Maco–Mati 138 kV Line, ST-DC, 1-795 MCM ACSR, 72.3 km	7,684M	Davao Del Norte	Dec 2028



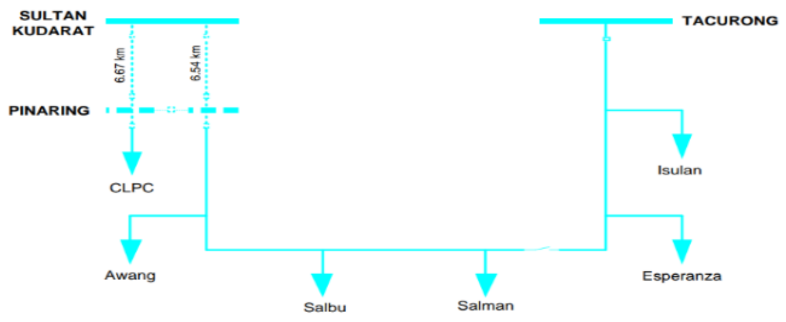
69 kV PROJECTS

Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Tacurong–Kalamansig 69 kV Transmission Line 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 the SOCCSKSARGEN Region are considered off-grid loads and are currently being served by a limited and costly power. The project involves the implementation of a new 69 kV SC line, expansion of Tacurong SS, and construction of a switching station in Kalamansig. The completion of the project ends the dependency of power consumers from SPUG as they start enjoying the reliable and cheaper power supply from the grid.	• System Reliability • Filed to ERC	• Tacurong 138 kV SS: 1-69 kV PCB • Kalamansig 69 kV SwS: 1x7.5 MVAR 69 kV Capacitor, 3-69 kV PCB	• Tacurong-Kalamansig 69 kV TL, ST/SP-SC, 1-336.4 MCM ACSR, 85 km.	2,349 M	Sultan Kudarat	Dec 2024



Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Sultan Kudarat–Pinaring 69 kV Transmission Line Upgrading The project involves the following: construction of a new 69 kV SWS in Pinaring,	• Load Growth System Reliability and Security	• Sultan Kudarat 69 kV SS: 2-69 kV PCB and associated equipment • Pinaring 69 kV SWS: 6-69 kV PCB and associated equipment	• Sultan Kudarat–Pinaring 69 kV TL, SP-SC (Upgrading), 1-795 MCM ACSR, 6.67 km • Sultan Kudarat–Pinaring 69 kV TL, SP-SC (New), 1-795 MCM ACSR, 6.67 km	2,249M	Sultan Kudarat	Jun 2028

TRANSMISSION LINE						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
construction of 6.67 km, 69 kV, 1-795 MCM ACSR, SP-SC TL from Sultan Kudarat to Pinaring 69 kV SWS , and upgrading of the existing 6.67 km Sultan Kudarat–Pinaring 69 kV segment of Sultan Kudarat-DSA-Tacurong 69 kV Line to 1-795 MCM ACSR.						

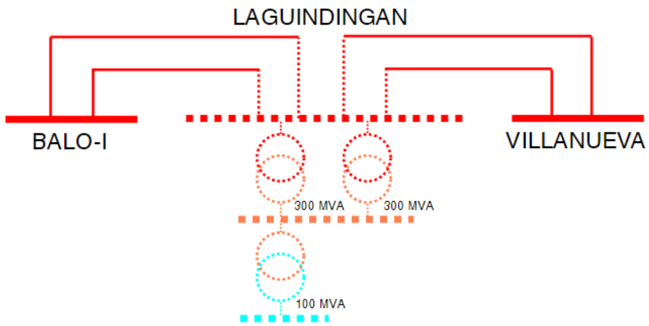


SUBSTATION						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
230 kV PROJECTS						
Mindanao Substation Upgrading Project (MSUP) The existing transformer capacities in various substations in Mindanao are not sufficient to further accommodate the projected demand load while some substations are yet to comply with the single-outage (N-1) contingency requirement of the PGC. Additionally, voltage violation and breaker failures frequently occur in some areas in the Mindanao Grid. MSUP involves the installation of additional power transformers and Capacitor, and the replacement of old, defective, obsolete, and underrated PCB to ensure adequate and reliable transmission system in Mindanao.	• Load Growth • ERC-approved	• Bislig 138 SS:1x50 MVA, 138/69 kV Power Transformer 3-138 kV PCB, 6-69 kV PCB • Butuan 138 kV SS, 3x7.5 MVAR 69 kV Capacitors, 5-138 kV PCB, 3-69 kV PCB • Kidapawan 138 kV SS: 1x50 MVA 138/69 kV Power Transformer (from Culaman SS), 1-69 kV PCB • Pitogo 138 kV SS: 1x100 MVA 138/69 kV Power Transformer, 2x7.5 MVAR 69 kV Capacitors, 1-138 kV CAIS, 1-69 kV CAIS, 2-69 kV PCB • Placer 138 kV SS: 1x100 MVA 138/69 kV Power Transformer, 2x7.5 MVAR 69 kV Capacitors, 2-138 kV PCB, 7-69 kV PCB • San Francisco 138 kV SS: 1x50 MVA 138/69 kV Power Transformer, 3x7.5 MVAR 69 kV Capacitors, 4-138 kV PCB, 4-69 kV PCB • Gen. Santos 138 kV SS: 1x100 MVA 138/69 kV Power Transformer, 1x7.5 MVAR 69 Capacitor, 1-138 kV PCB, 8-69 kV PCB • Tacurong 138 kV SS: 1x7.5 MVAR 69 kV Capacitor, 10-69 kV PCB • Agus 6 138 kV SS: 1x100 MVA 138/69 kV Power Transformer, 2-138 kV PCB, 3-69 kV PCB • Maramag 138 kV SS: 1x75 MVA 138/69 kV Power Transformer, 1-138 kV PCB, 1-69 kV PCB • Naga Min 138 kV SS: 1x100 MVA 138/69 kV Power Transformer, 2-69 kV PCB • Opol 138 kV SS: 1x75 MVA 138/69 kV Power Transformer, 2-69 kV PCB • Polanco 138 kV SS: 1x75 MVA 138/69 kV Power Transformer, 3-138 kV PCB, 1-69 kV PCB.		5,016M	Surigao del Sur, Agusan del Norte North Cotabato, Zamboanga del Sur, Surigao del Norte, Agusan del Sur, South Cotabato, Sultan Kudarat, Lanao del Norte, Bukidnon, Zamboanga Sibugay, Misamis Oriental and Zamboanga del Norte	May 2026

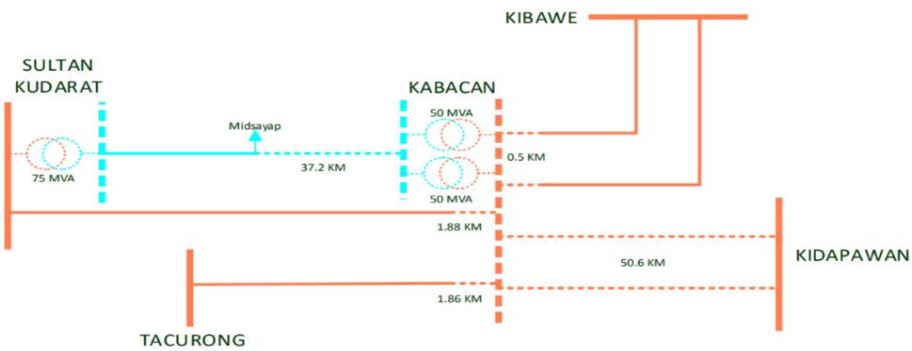
SUBSTATION

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
Mindanao Substation Upgrading Project 2 (MSUP 2) The project involves the installation of additional 300 MVA, 230/138 kV Power Transformer at Bunawan SS, 2-150 MVA 138/69 kV Power Transformers at Davao SS, 2-100, 138/69 kV MVA Power Transformers at General Santos, Toril and Bunawan Substations, 100 MVA 138/69 kV Power Transformers at Balo-I, Tagoloan, Jasaan, Butuan, Kidapawan, and Aurora substations, and 50 MVA 138/69 Power Transformer at Kibawe SS. Also, the project includes the installation of PCB for the connection of BESS projects in Jasaan, Maramag and Toril Substations and for the entry of Power Plant projects such as South Pulangi 255 MW HEPP at Kibawe SS, 3.6 MW Mt. Apo Geothermal Power Plant at Kidapawan SS and 28 MW Sangali Diesel Power Plant at Zamboanga SS.	• System Reliability and Security	• Balo-i SS: 1x100 MVA, 138/69 kV Power Transformer, 3-138 kV PCB, 6-69 kV PCB • Tagoloan SS: 1x100 MVA, 138/69 kV Power Transformer, 4-138 kV PCB, 4-69 kV PCB • Jasaan SS: 1-100 MVA, 138/69 kV Power Transformer, 2-138 kV PCB, 3-69 kV PCB • Kibawe SS: 1-50 MVA, 138/69 kV Power Transformer, 5-138 kV PCB, 2-69 kV PCB • Butuan SS: 1-100 MVA, 138/69 kV Power Transformer, 1-138 kV PCB, 1-69 kV PCB • Davao SS: 2-150 MVA, 138/69 kV Power Transformer, 3-138 kV PCB, 7-69 kV PCB • Toril SS: 2-100 MVA, 138/69 kV Power Transformer, 2-138 kV PCB, 7-69 kV PCB • Bunawan SS: 1-300 MVA 230/138 kV Power Transformer, 2-100 MVA, 138/69 kV Power Transformer, 3-230 kV PCB, 10-138 kV PCB, 5-69 kV PCB • Kidapawan SS: 1-100 MVA, 138/69 kV Power Transformer, 1-69 kV PCB • General Santos SS: 2-100 MVA, 138/69 kV Power Transformer		7,264.54M	Lanao Del Norte, Bukidnon, Agusan Del Norte, Misamis Oriental Davao, Sultan Kudarat, Zamboanga, Surigao Del Sur	May 2026
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 conditions. The installation of an additional transformer in each of these substations maintains the continuous operation even during the outage of one of the transformers. This development also complies with the N-1 contingency criterion of the PGC.	• Load Growth • Filed to ERC	• Pitogo 138 kV SS: 1x100 MVA 138/69 kV Power Transformer, 2-138 kV PCB, 1-69 kV PCB • Placer 138 kV SS: 1x100 MVA 138/69 kV Power Transformer • San Francisco 138 kV SS: 1x100 MVA 138/69 kV Power Transformer, 2-138 kV PCB, 1-69 kV PCB • Matanao 138 kV SS: 1x100 MVA 138/69 kV Power Transformer, 2-138 kV PCB, 1-69 kV PCB		1,465M	Zamboanga del Sur, Surigao del Norte, Agusan del Sur, Davao del Sur	Mar 2024
Mindanao Substation Rehabilitation Project (MSRP) Mindanao Substation Rehabilitation Project (MSRP) consists of the replacement of seventy-five (75) defective, deteriorated, obsolete, and low fault level capacity PCB with new ones which provide system reliability and power quality to the grid. An additional six circuit breakers are for Bunawan SS which connect the feeder of Davao	• Ongoing	• Aurora SS: 1-138 kV PCB 3-69 kV PCB • Zamboanga SS: 3-138 kV PCB 3-69 kV PCB • Agus 5 Switchyard: 6-138 kV PCB • Balo-I SS: 13-138 kV PCB • Lugait SS: 5-138 kV PCB, 1-69 kV PCB • Tagoloan SS: 4-138 kV PCB 1-69 kV PCB • Maramag (Pulangi 4) SS: 10-138 kV PCB, 3-69 kV PCB • Nasipit SS: 2-138 kV PCB • Davao SS: 4-138 kV PCB, 2-69 kV PCB		3,047,13M	Zamboanga del Sur, Surigao del Norte, Agusan del Sur, South Cotabato, Sultan Kudarat, Lanao del Norte, Bukidnon, Zamboanga Sibugay, Misamis	Dec 2026

SUBSTATION							
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
Light and Power Corporation (DLPC) while two definite-purpose circuit breakers are for the connection of capacitor bank in Sultan Kudarat SS.		• Bunawan SS: 5-138 kV PCB • Sultan Kudarat SS: 6-69 kV PCB • Maco SS: 1-7.5 MVAR, 69 kV 2-69 kV PCB • Nabunturan SS: 1x7.5 MVAR, 69 kV 3-138 kV PCB 4-69 kV PCB			Oriental and Zamboanga del Norte	
Laguindingan 230 kV Substation The abrupt industrial and commercial developments in the area of Laguindingan requires substantial power supply requirement, which exceeds the existing capacity of nearby transmission facilities. The project involves the implementation of a new 230 kV SS within Laguindingan that will bus-in to the existing Balo-i – Villanueva 230 kV line. This provides a 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.	• Load Growth • Filed to ERC	• Laguindingan 230 kV SS: 2x300 MVA 230/138 kV and 1x100 MVA 138/69 kV Power Transformers, 10-230 kV PCB, 7-138 kV PCB, 3-69 kV PCB equipment • Tagoloan 138 kV SS: 5-138 kV PCB	• Laguindingan SS: Bus-in to Balo-i–Laguindingan 230 kV TL, ST-DC, 2-795 MCM ACSR/AS, 2 x 5.75 km	2,606M	Misamis Oriental	Dec 2024

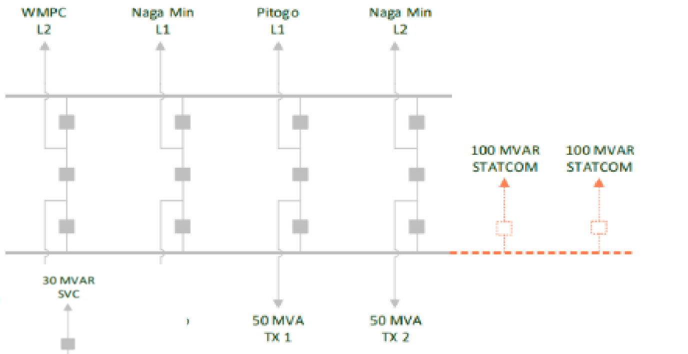


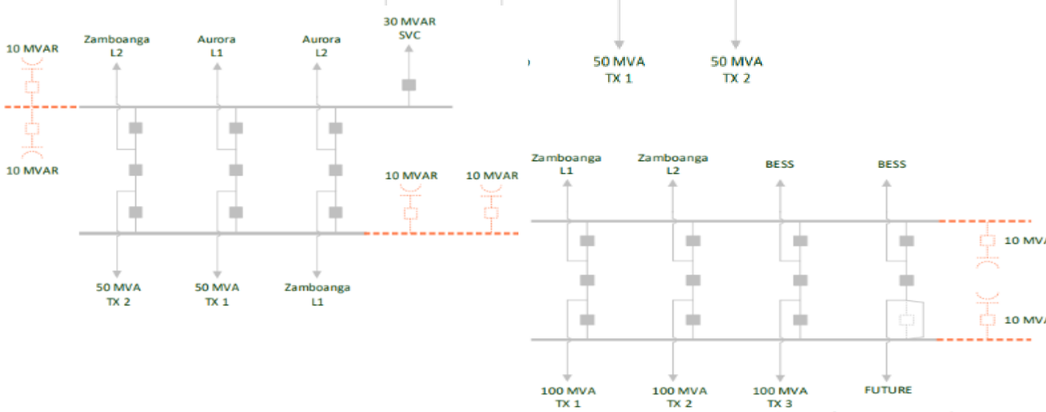
138 kV PROJECTS						
Kabacan 138 kV Substation Phase 1 – Substation Phase 2 - Remaining TL The Kibawe – Sultan Kudarat and Kabacan – Tacurong 138 kV lines traverse areas with the prevalent presence of militant groups and lawless elements. Thus, transmission facilities are exposed to a high risk of sabotage. An outage of any of these lines 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 new Kabacan SS, 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 new PCB in General Santos SS,	• System Reliability • Filed to ERC	• Kabacan 138 kV SS: 1x50 MVA 138/69 kV Power Transformer, 11-138 kV PCB, 1-69 kV PCB • Kidapawan 138 kV SS: 2-138 kV PCB • Gen. Santos 138 kV SS: 4-138 kV PCB	• Kabacan-Kidapawan 138 kV TL, ST-DC, 1-795 MCM ACSR/AS, 50.6 km • Kabacan-Villarica 69 kV TL, SP-SC, 1-336.4 MCM ACSR/AS, 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	4,978M	Cotabato	Dec 2024 (SS portion) Dec 2025 (TL portion)



SUBSTATION						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
allowing the entry of the 105 MW Coal-Fired Power Plant Phase 2 of Sarangani Energy Corporation (SEC).						
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	• Load Growth Filed to ERC	• Pitogo SS: 1x100 MVA 138/69 kV Power Transformer, 1-138 kV PCB ,1-69 kV PCB • Naga Min SS: 1x100 MVA 138/69 kV Power Transformer, 2-138 kV PCB, 2-69 kV PCB • Polanco SS: 1x100 MVA 138/69 kV Power Transformer, 2-138 kV PCB, 2-69 kV PCB • Agus 6 SS: 1x100 MVA 138/69 kV Power Transformer, 2-138 kV PCB, 2-69 kV PCB • Maramag SS: 1x100 MVA, 138/69 kV Power Transformer, 2-138 kV PCB, 2-69 kV PCB • Maco SS: 1x100 MVA 138/69 kV Power Transformer,2-138 kV PCB, 2-69 kV PCB • Culaman SS: 1x50 MVA, 230/69 kV Power Transformer, 2-230 kV PCB, 2-69 kV PCB • Sultan Kudarat SS: 2-100 MVA, 138/69 kV Power Transformer, 4-138 kV PCB, 4-69 kV PCB • Nasipit SS: 1-100 MVA 138/69 kV Power Transformer, 2-138 kV PCB, 2-69 kV PCB		2,968M	Surigao del Sur, Agusan del Norte North Cotabato,	Dec 2025

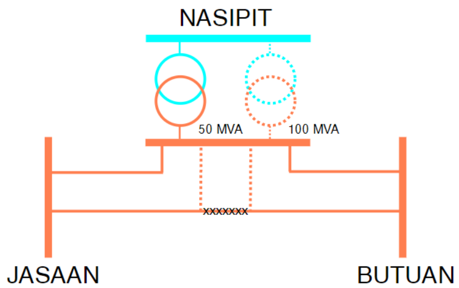
VOLTAGE IMPROVEMENTS						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
138 kV PROJECTS						
Zamboanga Peninsula Voltage Improvement Project (ZPVIP) The main problem in the Zamboanga Peninsula is the absence of a local baseload 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 SS, 4x10 MVAR 138 kV Capacitor in Naga Min SS, and 2x10 MVAR Capacitor in Pitogo SS. STATCOM offers a fast response in the control of reactive power flow, thereby increasing the stability of the network.	• Power Quality • Filed to ERC	• Zamboanga SS: 1x200 MVAR Static Synchronous Compensator, 3-138 kV PCB, 1-69 kV PCB • Naga Min SS: 4x10 MVAR Capacitors, 4-138 kV PCB • Pitogo SS: 2x10 MVAR Capacitors, 6-138 kV PCB • General Santos SS: 3x30 MVAR Capacitors, 3-138 kV PCB • Tacurong SS: 2x30 MVAR Capacitors, 2-138 kV PCB		1,925M	Sultan Kudarat, South Cotabato	Jun 2024

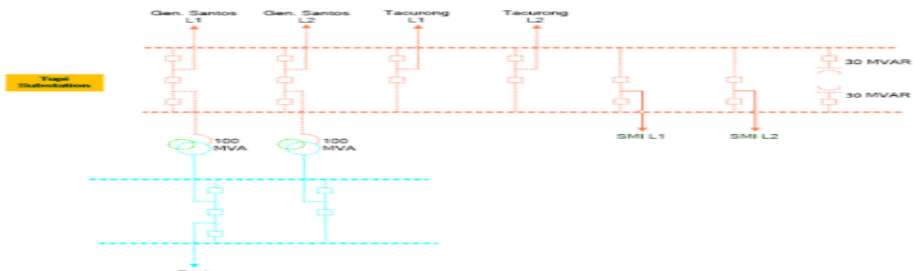




VOLTAGE IMPROVEMENTS

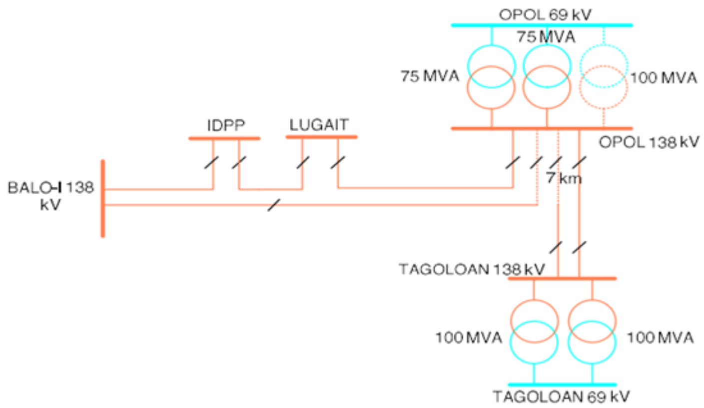
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
Nasipit Substation Bus-in The project is proposed to avoid the foreseen low voltage on the substations in the Northeastern Mindanao following an outage of the Nasipit-Butuan 138 kV Single Circuit line. The bus-in line ensures the continuous supply of electricity to Agusan and Surigao provinces even during N-1. Also, the additional transformer in Nasipit SS complies with the PGC requirement on N-1 contingency and solves possible load curtailment if the only existing transformer becomes unavailable due to outage or preventive maintenance. Lastly, the replacement of PCB in the substation is important to precisely protect equipment from fault.	• Power Quality, System Reliability • Filed to ERC	• Nasipit SS: 1-100 MVA Power Transformer 2-138 kV PCB, 3-69 kV PCB	• Jasaan–Butuan Bus-in Line, ST-DC, 1-795 MCM ACSR, 4 km Swinging of TM2 Lines, ST-DC, 2-795 MCM ACSR, 0.5 km	816M	Agusan del Norte	Jun 2024
Eastern Mindanao Voltage Improvement Project (EMVIP) The substations in eastern Mindanao experience undervoltage due to increasing demand. The installation of Capacitor in the substations ensures the voltage level within the prescribed limits of PGC even during contingency scenarios. It also maintains the nominal voltage level in the area until the completion of the Eastern Mindanao 230 kV TL Project	• Power Quality, • Filed to ERC	• Butuan SS: 3x10 MVAR Shunt Capacitor, 3-138 kV PCB • San Francisco SS: 3x10 MVAR Shunt Capacitor, 3-138 kV PCB • Nabunturan SS: 3x10 MVAR Shunt Capacitor, 3-138 kV PCB • Maco SS: 3x10 MVAR Shunt Capacitor, 3-138 kV PCB • Tandag SS: 1x7.5 MVAR Shunt Capacitors, 1-69 kV PCB • Claver SS: 1x7.5 MVAR Shunt Capacitor, 1-69 kV PCB		868M	Agusan del Norte, Agusan del Sur, Davao de Oro	Jun 2024
Koronadal 138 kV Substation Power is being supplied to Koronadal City from a substation in its neighboring city, Tacurong. The demand for South Cotabato's capital and the nearby municipalities is rapidly increasing, whose amount is already equivalent to a loading of an existing substation in Mindanao. Also, there is a planned operation of mining in the municipality of Tampakan that will require a 138 kV direct connection to the grid.	• Load Growth • Filed to ERC	• Koronadal 138 kV SS, 2x150 MVA 138/69 Power Transformers, 14-138 kV PCB, 6-69 kV PCB	• Koronadal SS Bus-in to Tacurong–General Santos 138 kV TL, ST-DC, 1-795 MCM ACSR, 0.5 km.	2,539M	South Cotabato	Jun 2026
Opol Substation Bus-in The project is a grid expansion and reliability project which also improves the system voltage within the franchise area of Misamis Oriental I Electric Cooperative (MORESCO I) and other	• System Reliability • Filed to ERC	• Opol 138 kV SS: 1x100 MVA Power Transformer, 5-138 kV PCB, 1-69 kV PCB	• Opol SS Bus-in to Balo-i-Tagoloan 138 kV Line, ST-DC, 1-795 MCM ACSR/AS, 4 km • Opol-Carmen 69 kV Line Re-routing, SP-SC, 1-336.4 MCM ACSR/AS, 0.5 km	1,274M	Misamis Oriental	Sept 2027





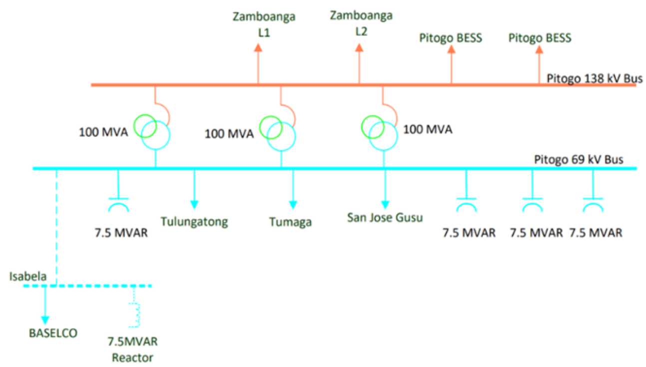
VOLTAGE IMPROVEMENTS

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
nearby facilities of CEPALCO. The project involves the bus-in of Opol SS to the existing Balo-i-Tagoloan 138 kV SC TL, and installation of a new 100 MVA power transformer and associated PCB.						



ISLAND INTERCONNECTION

Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
Mindanao-Visayas Interconnection Project Mindanao Interconnection Project-Phase 1 (2011-037RC) - this phase involved the preparation of the updated project feasibility study, the conduct of the transmission route survey and the hiring of consultancy services. The Conduct of Desktop Study and Hydrographic Survey for the Western Route of the Visayas -Mindanao Interconnection Project (2015-201RC). This project involved the conduct of Desktop Study and Hydrographic Survey for the interconnection of the Visayas and Mindanao Grids considering the western route option. Mindanao-Visayas Interconnection Project (Visayas–Mindanao Interconnection Project (2017-034RC) - considering the western route for the MVIP, the proposed interconnection involves the installation of a 92 km HVDC submarine cable, a total of 211 km of HVDC overhead TL and 93 km of conventional alternating current (AC) TL. It will also involve the construction of inverter/converter stations at both ends of the HVDC system as well as various SS expansions.	• Island Interconnection • ERC -Approved	• Dumanjug Converter Station 2-225 MW Thyristor Valve 2-225 MW 230 kV AC/±350 kV DC Converter Transformer 2-150 MVA 230/138 kV Power Transformer 2-100 MVA 138/69 kV Power Transformer 14-230 kV PCB and associated equipment 10-138 kV PCB and associated equipment 5-69 kV PCB and associated equipment • Lala Converter Station 2-225 MW Thyristor Valve 2-225 MW 230 kV AC/±350 kV DC Converter Transformer 8-230 kV PCB and associated equipment • Umapad GIS SS (New) 2-300 MVA 230/69 kV Transformer 9-230 kV PCB and Associated equipment 9-69 kV PCB and associated equipment • Magdugo SS (Expansion) 2-230 kV PCB and associated equipment	• Dumanjug CS/SS–Magdugo SS 230 kV Line, ST-DC, 4-795 MCM ACSR/AS, 52 km Bus-in of Dumanjug SS to Colon–Samboan 138 kV Line, ST-DC, 1-795 MCM ACSR/AS, 8 km • Lapulapu SS–Umapad SS Extension 138 kV Line, ST-DC, 4x795 MCM ACSR, 3 km • Dumanjug CS–Santander CTS ±350 kV Line, Bi-Pole, 3-795 MCM ACSR/AS, 73 km • Dapitan CTS–Lala CS ±350 kV Line, Bi-Pole, 3-795 MCM ACSR/AS, 138 km • Dumanjug CS–Alegria ES 20 kV Line, ST-DC, 2-795 MCM ACSR/AS, 20 km • Lala CS–Kolambugan ES 20 kV Line, ST-DC, 2-795 MCM ACSR/AS, 20 km • Santander CTS–Dapitan CTS ±350 kV Line, Bi-Pole, 1,500 mm2 HVDC Mass Impregnated (MI), 92 km	31,615.751 M	Surigao Del Norte, Misamis Occidental	Aug 2023



10.2 Transmission Outlook for 2031-2040

From the year 2031 to 2040, most of the projects will be concentrating on the improvement of system reliability. In this period, the following 230 kV line segments of the grid will be implemented: The Villanueva–Kinamlutan 230 kV TL, Bunawan–Tagum 230 kV TL, and the Eastern Mindanao 230 kV TL. These projects will complete the 230 kV loop in the eastern part of the Mindanao grid. Additionally, the Lala–Sta. Clara–Zamboanga 230 kV TL will be constructed to provide a high voltage power line emanating from Lanao del Norte, which further improves the reliability of power transmission towards the Zamboanga Peninsula.

Several substation projects such as the Tigbao SS, Tumaga SS, and Malaybalay SS were also proposed during the horizon which will accommodate load demand requirements in these areas.

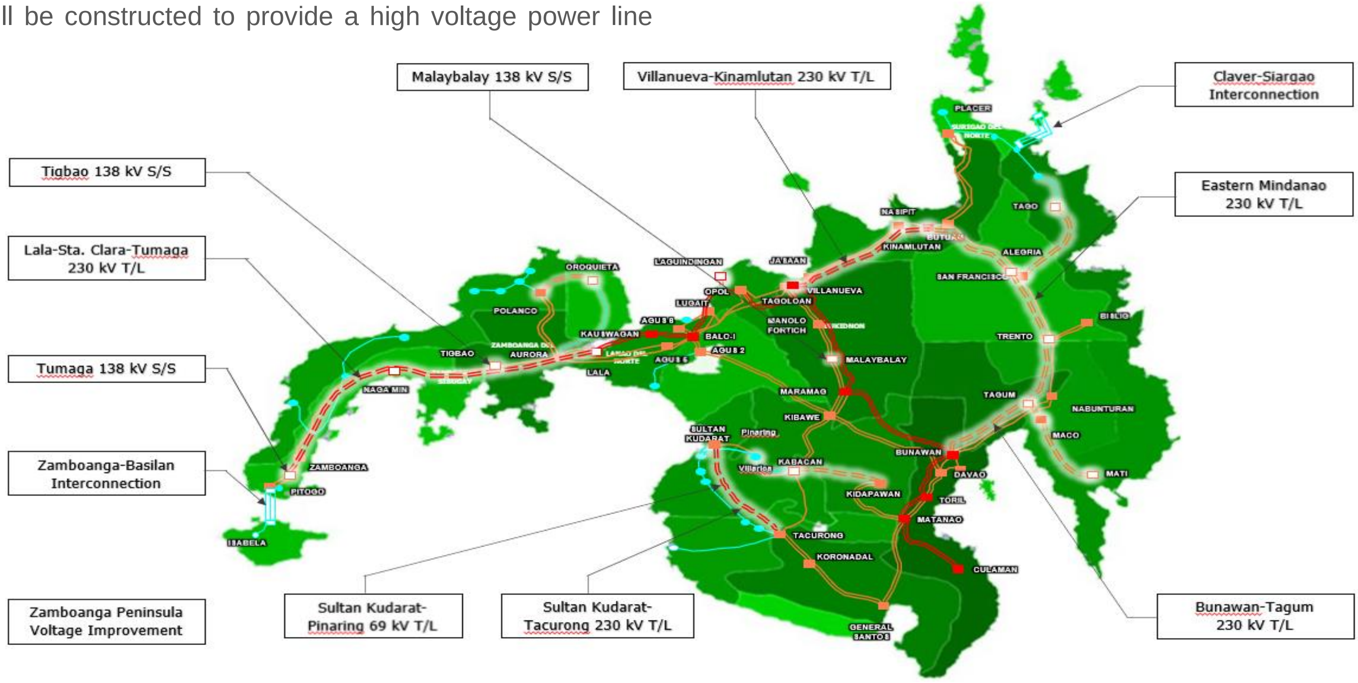
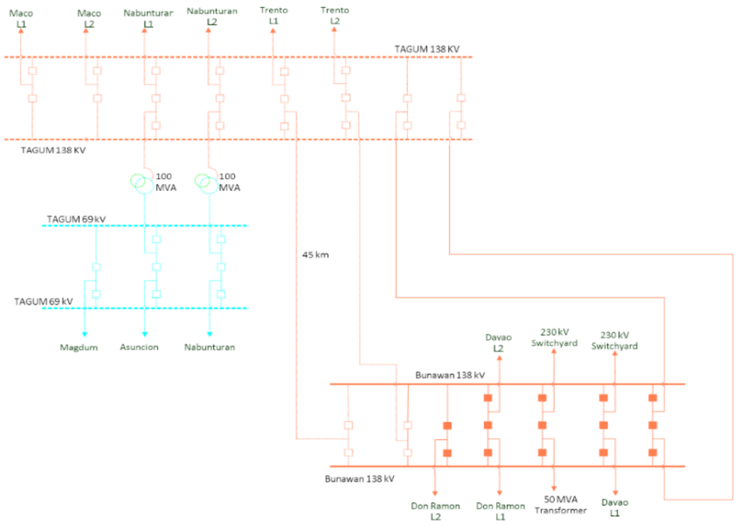


Figure 10.2: Proposed Mindanao Transmission Outlook for 2031-2040

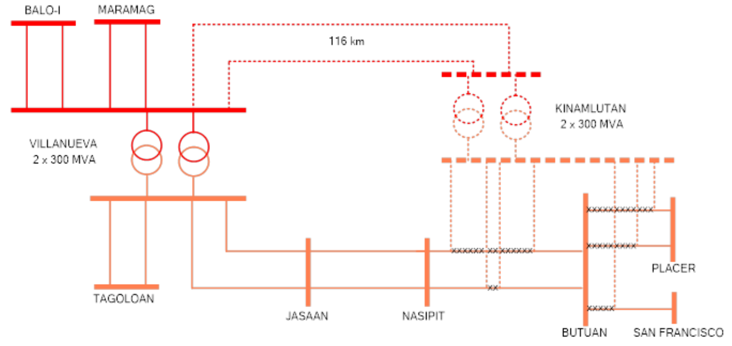
Table 10.2 List of Proposed Mindanao Transmission Projects for the period 2031-2040

TRANSMISSION LINE						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
230 kV PROJECTS						
Bunawan–Tagum 230 kV Transmission Line The project aims to provide a new transmission corridor that mitigates the anticipated thermal overloading of the Bunawan–Nabunturan and Bunawan–Maco–Nabunturan 138 kV TL during an outage of one of the circuits. The new 230 kV transmission corridor accommodates generation entry in the area. In addition, the 2x100 MVA transformer on Tagum 230 kV Substation accommodates the Asuncion LES of Northern Davao Electric Cooperative (NORDECO) which is currently connected to Nabunturan 138 kV Substation and reinforces the Maco–Tagum 69 kV Line during N-1 condition.	• Generation Entry • Load Growth • Filed to ERC	• Tagum 230 kV SS: 2 x 100 MVA Power Transformer, 20-138 kV PCB, 8-69 kV PCB • Bunawan 138 kV SS: 4-138 kV PCB	• Bunawan–Tagum 230 kV TL, ST-DC, 2-795 MCM ACSR, 45 km • Tagum–Bunawan 138 kV Line Extension, ST-DC, 1-795 MCM ACSR, 1.5 km • Tagum–Nabunturan 138 kV Line Extension, ST-DC, 1-795 MCM ACSR, 1.5 km • Tagum–Magdum 69 kV TL, SP-DC, 1-795 MCM ACSR, 3 km • Tagum–Maco 138 kV Line Extension, ST-DC, 1-795 MCM ACSR, 0.5 km • Magdum–Asuncion 69 kV TL, SP-SC, 1-795 MCM ACSR, 17 km Tagum Cut-in Line to Nabunturan–Asuncion 69 kV TL, SP-SC, 1-795 MCM ACSR, 0.5 km	10,624.87M	Agusan del Sur, Davao del Norte, Davao de Oro	Mar 2031

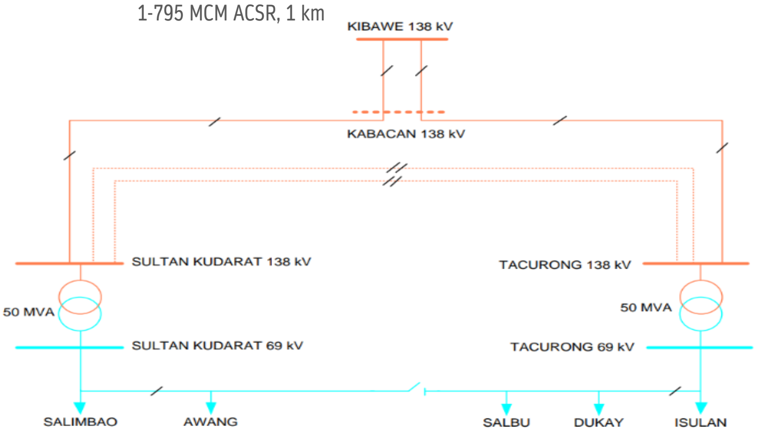
TRANSMISSION LINE

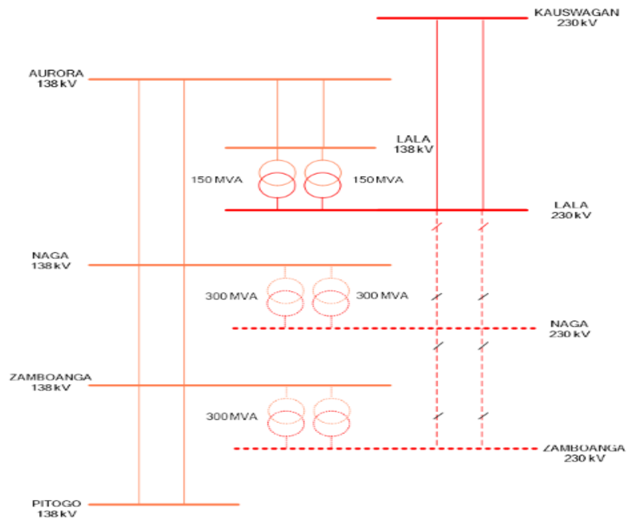
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
						
Eastern Mindanao 230 kV Transmission Line The project extends the 230 kV backbone from Agusan del Norte to Agusan del Sur and from Davao del Sur to Davao de Oro to strengthen the transmission corridor in Eastern Mindanao that is currently in single-circuit 138 kV configuration. Also, this project anticipates the Competitive RE Zone in Agusan del Sur.	• Generation Entry • System Reliability and Security	• Alegria 230 kV SS: 12-138 kV PCB • Trento 230 kV SS: 12-138 kV PCB	• Kinamlutan–Alegria–Trento–Tagum 230 kV TL, ST-DC, 2-795 MCM ACSR, 209 km • Bislig–Trento 138 kV Line Extension, ST-DC, 1-795 MCM ACSR, 6 km. • Alegria–San Francisco 138 kV Line Extension, SP-SC, 1-795 MCM ACSR, 0.8 km • Tago–Alegria 138 kV Line Extension, SP-SC, 1-795 MCM ACSR, 0.8 km • San Fancisco–Bislig 138 kV Line Bus-in to Trento SS, ST-SC, 1-795 MCM ACSR, 2 km • Bislig–Nabunturan 138 kV Line Bus-in to Trento Substation, ST-SC, 1-795 MCM ASR, 2.2 km	41,839M	Agusan del Sur, Agusan del Norte, Davao del Sur, Davao de Oro	Oct 2032
Villanueva–Kinamlutan 230 kV Transmission Line The project increases the power transfer capacity and provides a reliable transmission corridor serving Northeastern Mindanao. The new 230 kV line accommodates the anticipated load demand due to the progressive development triggered by the mining industries in Caraga Region. This project is complementary to the Eastern Mindanao 230 kV TL Project.	• System Reliability and Security • load Growth	• Kinamlutan 230 Kv SS: 3x300 MVA Power Transformers, 10-230 kV PCB, 19-138 kV PCB • Villanueva 230 kV SS: 4-230 kV PCB, 5-138 kV PCB, 2-100 ohms Series Reactor	• Villanueva–Kinamlutan 230 kV TL: ST-DC, 2-795 MCM ACSR, 157.5 km • Kinamlutan SS Bus-in to Nasipit-Butuan 138 kV Line 1: ST-DC, 1-795 MCM ACSR, 0.85 km • Kinamlutan SS Bus-in to Nasipit-Butuan 138 kV Line 2: ST-DC, 1-795 MCM ACSR, 0.85 km Placer SS 138 kV Line Extension to Kinamlutan SS: ST-DC, 1-795 MCM ACSR, 0.7 km • San Francisco SS 138 kV Line Extension to Kinamlutan SS: ST-DC, 1-795 MCM ACSR, 0.7 km	23,512M	Misamis Oriental, Agusan del Norte	Jan 2033

TRANSMISSION LINE



Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Sultan Kudarat–Tacurong 230 kV Transmission Line The project provides the immediate need for a reliable power delivery service for southwestern Mindanao area through a looped transmission network. The project reinforces the single-circuit Kabacan–Sultan Kudarat 230 kV line by creating a network that can accommodate the anticipated load demand in the Maguindanao Province.	• System Reliability and Security	• Sultan Kudarat SS: 5-230 kV PCB, 3-138 kV PCB • Tacurong SS: 5-230 kV PCBt ,3-138 kV PCB	• Sultan Kudarat–Tacurong 230 kV TL, ST-DC, 2-795 MCM ACSR, 101 km. • Sultan Kudarat 230 kV–Sultan Kudarat 138 kV Tie Line, SP-SC, 1-795 MCM ACSR, 1 km	11,587M	Maguindanao, Sultan Kudarat	Oct 2033
Lala–Sta. Clara–Tumaga (formerly Lala–Naga Min–Zamboanga) 230 kV Transmission Line The extension of the Mindanao 230 kV transmission backbone towards the Zamboanga peninsula offers operation stability by having another transmission corridor with a higher power transfer capacity. The development of the 230 kV TL in combination with the Zamboanga Peninsula Voltage Improvement Project (ZPVIP) will improve the overall power quality in NWMA.	• System Reliability and Security	• Lala 230 kV SS: 4-230 kV PCB • Sta Clara (Naga) 230 kV SS: 2x300 MVA Power Transformer, 6-230 kV PCB, 6-138 kV PCB • Tumaga 230 kV SS: 2x300 MVA Power Transformer, 6-230 kV PCB, 6-138 kV PCB	• Lala-Sta Clara-Tumaga 230 kV TL: 2-795 MCM ACSR, STDC, 260 km	18,011M	Lanao del Norte, Zamboanga Sibugay, Zamboanga del Sur	Jul 2034

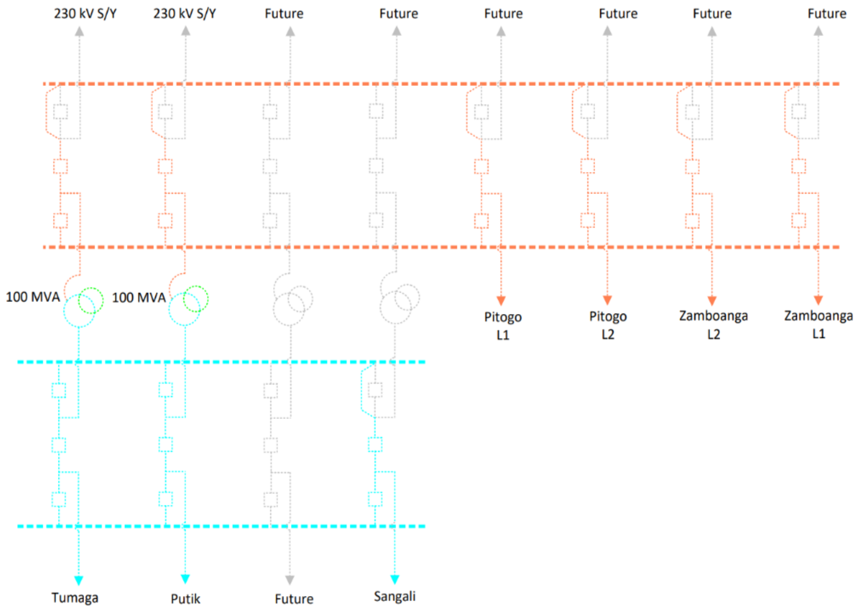




SUBSTATION

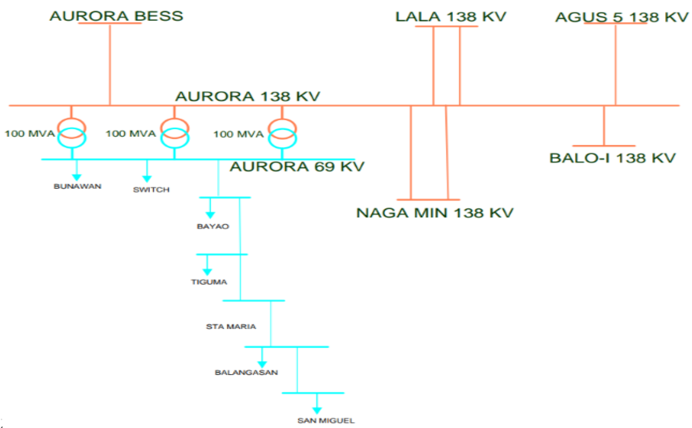
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
230/ 138 kV PROJECTS						
Tumaga 230 kV Substation	• System Reliability and Security	• Tumaga 230 kV SS: 2x150 MVA Power Transformer, 12-138 kV PCB, 8-69 kV PCB	• Tumaga Bus-in Line to Zamboanga 138 kV, ST-DC, 1-795 MCM ACSR, 0.5 km • Tumaga Bus-in Line to Pitogo 138 kV, ST-DC, 1-795 MCM ACSR, 0.5 km • Tumaga-Putik/ Tumaga LES 69	3,665M	Zamboanga del Sur	Jan 2032

The project involves the construction of a ‘bus-in’ SS along the Zamboanga–Pitogo 138 kV TL and the upgrading of 69 kV TL from the Tumaga 138 kV SS to Zamboanga City Electric Cooperative, Inc. (ZAMCELCO’s) Tumaga and Putik LES. The project will accommodate the growing demand of Zamboanga City attributed to the industrial facilities such as canning factories, shipyards, ports, warehouses, manufacturing plants, and airports. The project will also address the imminent thermal overloading of the Zamboanga–Tumaga–Pitogo 69 kV network in Zamboanga City by upgrading the Tumaga–Pitogo 69 kV TL. Furthermore, the project will complement the implementation of the Lala–Sta Clara–Tumaga 230 kV TL that offers operation stability by having another transmission corridor with a higher power transfer capacity.



Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
138/ 69 kV PROJECTS						
Tigbao 138 kV Substation	• Load Growth	• Tigbao 138 kV SS: 2 x 100 MVA Power Transformer, 10-138 kV PCB, 6-69 kV PCB	• Aurora-Naga Min 138 kV Line Bus-in to Tigbao SS, ST-DC, 1-795 MCM ACSR, 2-1.7 km.	2,164M	Zamboanga del Sur	Sep 2032

The project aims to address the thermal overloading of the Aurora 138 kV SS by providing Zamboanga del Sur Electric Cooperative (ZAMSURECO I) another connection facility from the grid. The project accommodates the increasing demand in the area due to inherent overloading of the existing Aurora 138 kV SS during N-1 condition. Further, development inside the said SS is infeasible due to space restrictions.

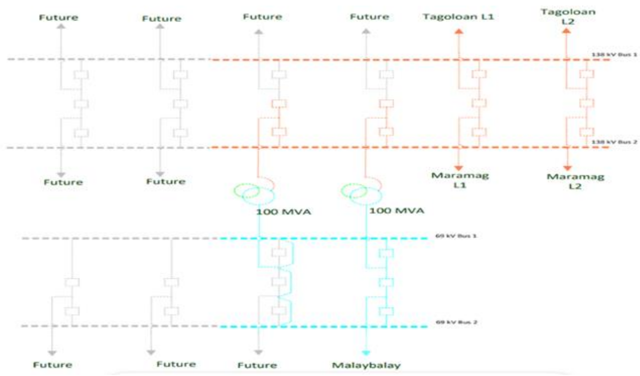


Project Name and Description	Project Driver and Status	Substation	Transmission Line	Project Cost (Million Pesos)	Location	ETC
Malaybalay 138 kV Substation	• Load Growth	• Malaybalay 138 kV SS: 2x100 MVA Power Transformer, 10-138 kV PCB, 5-69 kV PCB	• Malaybalay Bus-in Line to Manolo Fortich, 138 kV TL, ST-DC, 1-795 MCM ACSR, 0.5 km • Malaybalay Bus-in Line to Maramag, 138 kV TL, ST-DC, 1-795 MCM ACSR, 0.5 km	2,473M	Bukidnon	Dec 2032

The project involves the construction of 138 kV SS between Malaybalay City and Valencia City that will bus-in to the existing Manolo Fortich

SUBSTATION

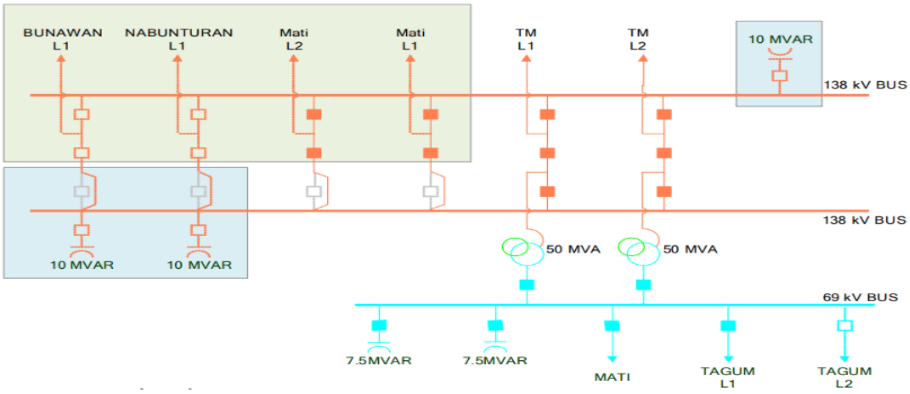
Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
and Maramag 138 kV TL. Also involved is the installation of 2x100 MVA 138/69 kV Power Transformers, and PCB and its associated equipment.						



69 kV PROJECTS

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
Maco-Tagum 69 kV Substation	• System Reliability and Security	• Maco 138 kV SS: 2-69 kV PCB	• Maco–Tagum 69 kV TL (New), SP-SC, 1-795 MCM ACSR/AS, 7.7 km • Maco–Tagum 69 kV TL (Upgrading), SP-SC, 1-795 MCM ACSR/AS, 31.3 km	2,088M	Davao Del Norte	Dec 2032

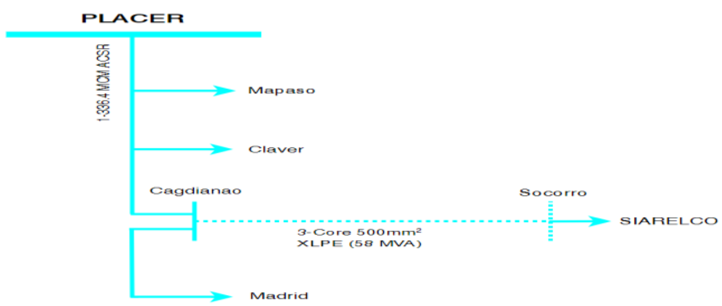
The project involves the construction of 12 km, 69 kV , 1-795 MCM ACSR, SP-SC TL from Maco 138 kV SS to NORDECO Tagum (Mirafuentes) 69 kV LES and upgrading of the existing 31 km Maco-Tgaum 69 kV Line (up to the Magdum 2-Way ABS).



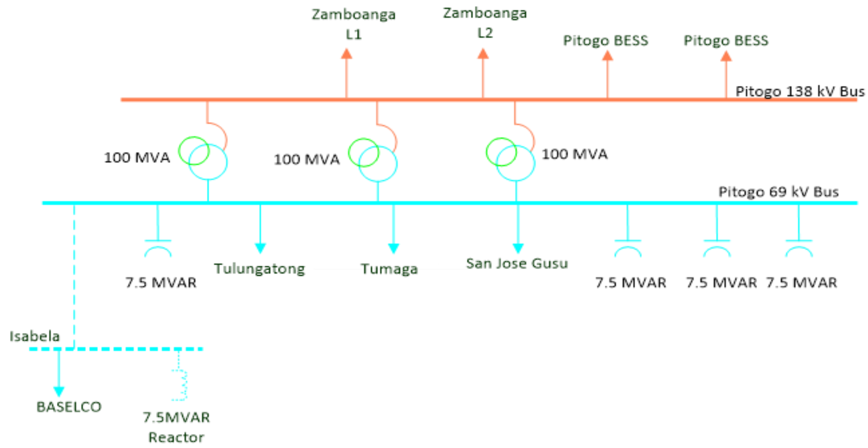
ISLAND / OFF-GRID INTERCONNECTION

Project Name and Description	Project Driver and Status	Project Components: Substation	Project Components: Transmission Line	Project Cost (Million Pesos)	Location	ETC
69 kV PROJECTS						
Claver - Siargao 69 kV Interconnection		• Cagdianao 69 kV SWS (new), 5-69 kV PCB • Socorro 69 kV SWS (new), 7-69 kV PCB, x2.5 MVAR Shunt Capacitor	• Cagdianao–Socorro 69 kV Submarine Cable, 3-Core 500 mm2 XLPE, 22 km	9,531M	Siargao, Surigao Del Sur	Dec 2031

Siargao Electric Cooperative (SIARELCO) is currently connected to the Mindanao Grid thru tap connection of their 20 MVA Cagdianao SS to NGCP Placer – Madrid 69 kV line. Then, 34.5 kV energized submarine cables and overhead line link the island of Bucas Grande and Siargao. As tourism is booming in Siargao, the capacity of the existing power transformer in Cagdianao and 34.5 kV lines will not be sufficient to accommodate the increasing demand. This project aims to provide a 69 kV interconnection facility that increases the power transfer towards the islands and improve the voltage within the franchise area of SIARELCO.



ISLAND / OFF-GRID INTERCONNECTION						
Project Name and Description	Project Driver and Status	Project Components		Project Cost (Million Pesos)	Location	ETC
		Substation	Transmission Line			
Zamboanga-Basilan 69kV Interconnection The power requirement of Basilan is being served by NPC-SPUG through missionary electrification. NPC-SPUG utilizes Basilan Diesel Power Plant and Power Barge 119. The Zamboanga – Basilan interconnection is envisioned to give the province a reliable and efficient power service. Also, this project counts out Basilan from the subsidy recipients of Universal Charge – Missionary Electrification.		• Pitogo 69 kV SS: 1-69 kV PCB • Isabela 69 kV SWS, 4-69 kV PCB, 1x7.5 MVAR Shunt Reactor	• Pitogo SS–Pitogo CTS, SP-SC, 336.4 MCM ACSR, 2 km • Pitogo CTS–Pangasang CTS, 3-Core 500 mm2 XLPE, 27 km • Pangasang CTS–Isabela Switching Station, SP-SC, 336.4 MCM ACSR, 9.5 km	6,672M	Zambaonga, Basilan	Dec 2031



For additional proposed projects in Mindanao from the year 2031 to 2040, the Lala– Malabang–Sultan Kudarat 230 kV TL Project was identified to improve the reliability of transmitting power towards southwestern Mindanao. The project will create a looped system of high voltage power line emanating from Lanao del Norte.

In the long term, the installation of transformers in Matanao 230 kV SS will ensure adequate facility and improved voltage profile for the customers in Davao del Sur.

The identified grid expansion projects in Mindanao by 2040 mainly consider the anticipated demand load. The 230 kV transmission backbone network will be extended towards Zamboanga Sibugay, Davao de Oro, and Southwestern areas to improve system reliability. These high-voltage network expansion projects are the Matanao – Tacurong 230 kV TL and Culaman-Gen. Santos 230 kV TL. 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.

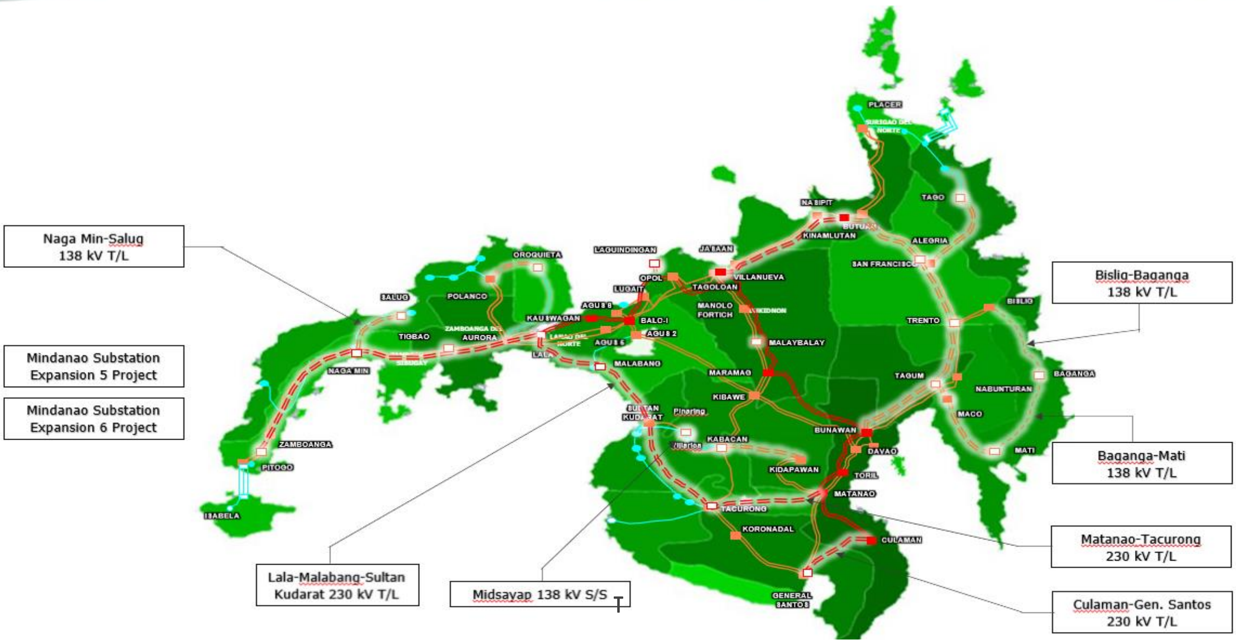


Figure 10.3: Additional Proposed Mindanao Transmission Outlook for 2031-2040

Table 10.3 List of Additional Proposed Projects in Mindanao for the period 2031-2040

TRANSMISSION LINE		
Project Name	Project Description	Location
230 kV PROJECTS		
Lala–Malabang–Sultan Kudarat 230 kV Transmission Line	• The project aims to provide a new transmission corridor that will complete the 230 kV loop in the western part of Maguindanao Island. Also, it will ensure system reliability and operational flexibility in the province of Lanao del Sur and Maguindanao.	Lanao del Norte, Lanao del Sur, Maguindanao
Culaman–General Santos 230 kV Transmission Line	• The project aims to provide a 230 kV transmission corridor towards General Santos City, South Cotabato. General Santos City is one of the major load centers in Mindanao and its demand will exceed the MW capacity of the embedded coal plants and the power flowing through Matanao–General Santos 138 kV TL.	Davao Occidental, South Cotabato
Matanao–Tacurong 230 kV Transmission Line	• The project aims to directly connect the bulk generation of the Davao Region to the SS in southwestern Mindanao thru a new 230 kV corridor.	Davao del Sur, Sultan Kudarat
138 kV PROJECTS		
Naga Min–Salug 138 kV Transmission Line	• The project aims to provide a high voltage transmission corridor towards the Municipality of Salug, Zamboanga del Norte for a more reliable and efficient energy supply.	Zamboanga Sibugay, Zamboanga del Norte
Bislig–Baganga 138 kV Transmission Line	• The project aims to provide a high voltage transmission corridor towards the Municipality of Baganga, Davao Oriental for a more reliable and efficient energy supply.	Surigao del Sur, Davao Oriental
Baganga –Mati 138 kV Transmission Line	• The project aims to loop the 138 kV backbone from the municipality of Baganga to the city of Mati, Davao, Oriental. This will provide a stable and reliable power supply of loads in Davao Oriental	Davao Oriental
69 kV PROJECTS		
Opol–Carmen 69 kV Transmission Line	• The project aims to relieve the overloading of the existing TL to prevent load dropping and power interruptions during peak loading.	Misamis Oriental
Davao–Toril 69 kV Transmission Line	• The project aims to relieve the overloading of the existing TL to prevent load dropping and power interruptions during peak loading.	Davao del Sur
Agus 6–Kiwalan–Lugait 69 kV Transmission Line	• The existing Agus 6–Kiwalan–Lugait 69 kV TL, serving a rapidly increasing demand, has already reaching its full thermal capacity. The project aims to prevent imminent overloading which might entail load curtailment. Also, the additional load due to the possible outage of Agus6–Mapalad–Lugait 69 kV TL cannot be catered by Agus 6–Kiwalan–Lugait due to capacity constraints.	Lanao del Norte, Misamis Oriental
Naga Min–Ipil 69 kV Transmission Line	• The project aims to relieve the overloading of the existing TL to prevent load dropping and power interruptions during peak loading.	Zamboanga Sibugay
Marawi–Malabang 69 kV Transmission Line	• The project aims to relieve the overloading of the existing TL to prevent load dropping and power interruptions during peak loading.	Lanao del Sur
Nabunturan–Monkayo 69 kV Transmission Line	• The project aims to relieve the overloading of the existing TL to prevent load dropping and power interruptions during peak loading.	Davao de Oro

TRANSMISSION LINE		
Project Name	Project Description	Location
Placer–Madrid 69 kV Transmission Line	• The project aims to relieve the overloading of the existing TL to prevent load dropping and power interruptions during peak loading.	Surigao del Norte
SIOM–Sindangan–Salug 69 kV Transmission Line	• The project aims to loop the 69 kV lines serving the municipalities of Zamboanga del Norte for operational flexibility and improved reliability.	Zamboanga del Norte
San Francisco–Barobo 69 kV Transmission Line 2	• The project aims to relieve the overloading of the existing TL to prevent load dropping and power interruptions during peak loading.	Agusan del Sur, Surigao del Sur
San Francisco–Tandag 69 kV Transmission Line	• The project aims to relieve the overloading of the existing TL to prevent load dropping and power interruptions during peak loading.	Surigao del Sur
Naga Min–Malangas 69 kV Transmission Line	• The project aims to relieve the overloading of the existing TL to prevent load dropping and power interruptions during peak loading.	Zamboanga del Sur, Lanao del Norte
Aurora–Kapatagan 69 kV Transmission Line	• The project aims to relieve the overloading of the existing TL to prevent load dropping and power interruptions during peak loading.	Lanao del Norte
Bislig–Barobo 69 kV Transmission Line	• The project aims to relieve the overloading of the existing TL to prevent load dropping and power interruptions during peak loading.	Surigao del Sur
Tumaga–Pitogo 69 kV Transmission Line	• The project aims to relieve the overloading of the existing TL to prevent load dropping and power interruptions during peak loading.	Zamboanga del Sur

SUBSTATION		
Project Name	Project Description	Location
230 kV PROJECTS		
Matanao 230/138 kV Transformer	• The project aims to interconnect the 230 kV and 138 kV switchyards of Matanao SS to avoid possible overloading of the existing transmission corridors towards the north of the Davao Region.	Davao del Sur
138 kV PROJECTS		
MindanaoS SS Expansion 5 Project (MSEP5)	• The project aims to cater the load growth and provide N-1 contingency to various SS in Mindanao. Without the project, the customers being served by these SS will experience load dropping and power interruptions during outage and failure of existing transformers and PCB.	Various Substations in Mindanao
Mindanao Substaton Expansion 6 Project (MSEP6)	• The project aims to cater the load growth and provide N-1 contingency to various SS in NGCP's South Luzon Region. Without the project, the customers being served by these SS will experience load dropping and power interruptions during outage and failure of existing transformers and PCB.	Various Substations in Mindanao
Mindanao Substaton Expansion 7 Project (MSEP7)	• The project aims to cater the load growth and provide N-1 contingency to various SS in NGCP's South Luzon Region. Without the project, the customers being served by these SS will experience load dropping and power interruptions during outage and failure of existing transformers and PCB.	Various Substations in Mindanao
Midsayap 138 kV Substaton	• The project will support the load growth in North Cotabato and will help unload the Sultan Kudarat SS.	North Cotabato

ISLAND INTERCONNECTION

11.1 Island Off-Grid Interconnection

One of the challenges in improving the system reliability and reducing the reserve requirements without adding a new generation is the interconnection of two or more islands using an undersea cable. Major considerations in the implementation of such kind of project yield high reliability and long life of more than 30 years with minimal maintenance are the required investment. The Philippine archipelago with more than 7,100 islands, NGCP's concession is challenged and confronted to energize and interconnect its islands to the main grid. Equipped with vision of a fully interconnected and integrated power grid, and access to state-of-the-art technology, NGCP is well on its way towards this goal.

In pursuit of its goal of building One Grid, NGCP continues to embark on major interconnection projects to realize this vision. Upon completion of its goal, this will prepare the entire Philippine grid to integrate to the proposed ASEAN Power Grid, an era when the country can already share its power resources with the rest of Southeast Asian neighbors because of interconnected power transmission system.

These are some of the salient benefits of island/off-grid interconnections:

- Provide additional power supply like a generator having the ability to import power when required.
- More efficient dispatch to meet demands across different grids while optimizing the most efficient generator.
- Reduce power curtailment by means of exporting power when there is surplus from one island to another: and
- Renewable and indigenous energy sources, such as wind, hydro and geothermal potential sites suitable for energy generation can be optimized, while providing clean and sustainable sources of energy that may become attractive for development by generation proponents.

Detailed studies should be undertaken to quantify the overall benefits to the receiving island. In the long run, considering these salient and many intangibles, benefits the island/off-grid interconnections will become more economically attractive.

11.1.1 Existing Island Interconnections

As of December 2022, 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 Interconnection
- Negros–Panay 138 kV and 230 kV Interconnection
- Cebu–Negros 138 kV Interconnection
- Leyte-Bohol 138 kV Interconnection
- Cebu–Lapu-Lapu 138 kV HVAC Interconnection
- 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 through the implementation of Luzon-Visayas HVDC Bipolar Operation Project.

The Leyte-Cebu interconnection is a 33-km double circuit 230 kV submarine cable, with a transfer capacity of about 400 MW. The first and second circuits were energized in 1997 and 2005, respectively. The double circuit Cebu-Negros Interconnection enables power-sharing of the 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, an 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.

11.2 Transmission Backbone and Major Island Interconnection Projects

To ensure a transmission network that can support growth and competitive electricity prices, NGCP envisioned its goal of One Grid through the implementation of the Transmission Backbone and Major Island Interconnections. Guided by NGCP's vision to build the strongest power grid in Southeast Asia and contribute to the social and economic development of the country and to satisfy its stakeholders' needs. NGCP programmed a significant upgrade in its facilities to expand the transmission backbone to meet the forecasted demand, entry of new and various generating facilities that will allow market competition.

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

Figure 11.1 and Figure 11.2 respectively show the development of transmission backbones and island interconnections as well as the existing and future Philippine network topology of an interconnected grid. While some segments of the transmission backbones are already programmed for implementation within the Fifth Regulatory Period (2021-2025), as discussed in Chapters 8, 9, and 10, other segments will still be subjected to a more thorough system analyses or even Feasibility Study for some big and more complicated backbone projects.

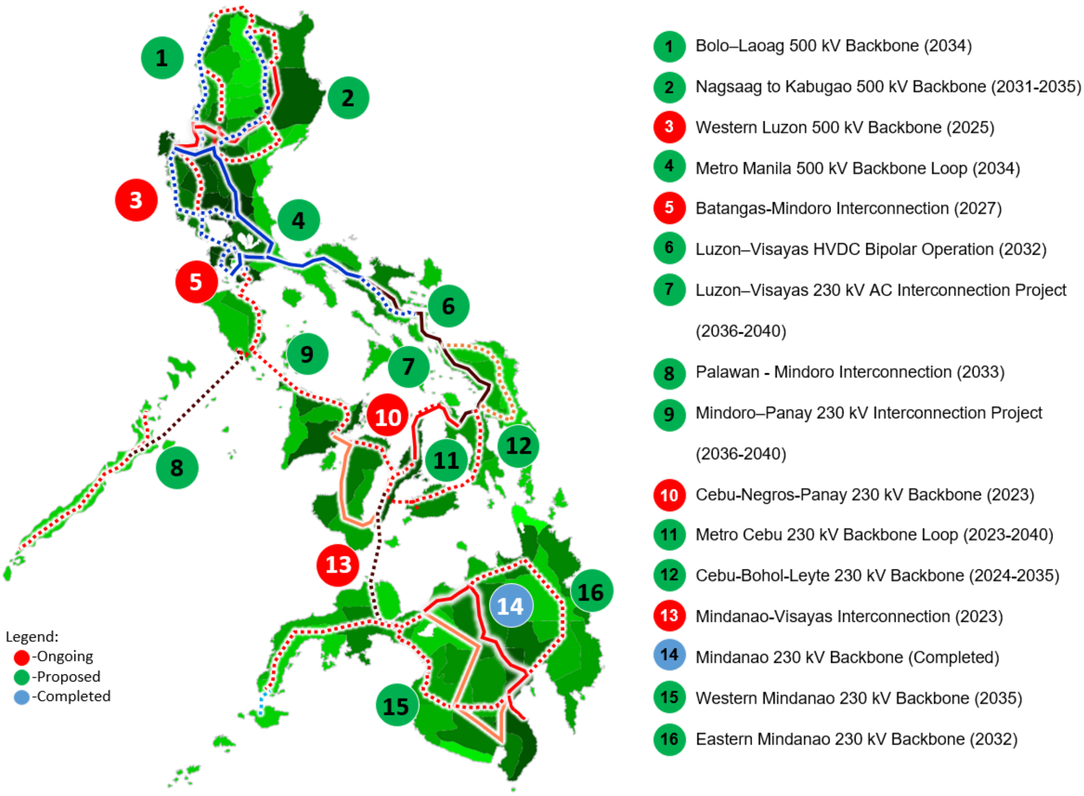


Figure 11.1 : Transmission Master Plan

Table 11.1 Transmission Backbone and Major Island Interconnections

Project Name	Project Description	Major Project Components	ETC
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 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 TL during N-1 contingency event.	•	2034

<table>
<tr><th>Project Name</th><th>Project Description</th><th>Major Project Components</th><th>ETC</th></tr>
<tr><td>Nagsaag to Kabugao 500 kV Backbone</td><td>

- Composed of Nagsaag–Santiago and Santiago–Kabugao 500 kV TL 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 TL.

</td><td></td><td>2031-2035</td></tr>
<tr><td>Western Luzon 500 kV Backbone</td><td>

- Subdivided in two stages: (a) Stage 1 is the construction of Castillejos–Hermosa 500 kV TL (initially energized at 230 kV), which provides a transmission facility to connect the Renewable Energy plants [MFL1] to the Luzon Grid through Hermosa Substation; and (b) Stage 2 is the construction of a 174 km DC 500 kV line from Bolo 500 kV SS to Castillejos. It will also involve the implementation of the Castillejos 500 kV SS to accommodate bulk generation capacities. The Western Luzon 500 kV Backbone will traverse the provinces of Pangasinan and Zambales.

</td><td></td><td>2025</td></tr>
<tr><td>Metro Manila 500 kV Backbone Loop</td><td>

- The development of Metro Manila 500 kV Backbone Loop involves the implementation of the Silang 500 kV SS, which will bus-in to the existing Dasmariñas–Tayabas 500 kV TL; the implementation of Taguig 500 kV SS, which will initially cut-in to the existing San Jose–Tayabas 500 kV TL; the construction of the Silang–Taguig 500 kV TL; and the development of the Baras 500 kV SS, which will bus-in to the existing San Jose–Taguig–Tayabas 500 kV TL. 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 TL Project.

</td><td></td><td>2034</td></tr>
<tr><td>Batangas–Mindoro Interconnection</td><td>

- 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 SS, while Calapan would serve as the interconnection point in Mindoro Island 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.

  The power system of Mindoro Island, which is composed of 69 kV lines connected to several power plants and various LES, 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 2020 was more than 81.56 MW already, based on the combined total load of ORMECO and OMECO.

</td><td>

- Pinamukan–Lobo CTS 230 kV TL, ST-DC 2-795 MCM ACSR, 37 km
- Lobo CTS-Mahal na Pangalan CTS 230 kV Submarine Cable, DC, 1-2,500 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 Switchyard: 2-230 kV PCB, 2-30 MVAR 230 kV Line Reactors and associated equipment
- Calapan 230 kV SS: 2-100 MVA, 230/69-13.8 kV Power Transformers, 9-230 kV PCB, 3-25 MVAR 230 kV Shunt Reactor, 2-30 MVAR 230 kV Line Reactor and associated equipment

Figure 11.2: Batangas - Mindoro Interconnection Project

</td><td>2027</td></tr>
<tr><td>Luzon–Visayas HVDC Bipolar Operation</td><td>

- The project will provide an additional 440 MW transfer capacity between Luzon and Visayas. It involves the construction of Naga 500 kV SS with 2x1000 MVA, 500/230-13.8 kV Power Transformers as well as upgrading of the Naga and Ormoc Converter/Inverter Stations in order to provide an additional transfer capacity between Luzon and Visayas. Upgrading of the 230 kV network between Cebu and Leyte is a requirement in order to fully utilize the transfer capacity of the Luzon–Visayas HVDC System.

</td><td></td><td>2032</td></tr>
<tr><td>Luzon–Visayas 230 kV AC interconnection Project</td><td>

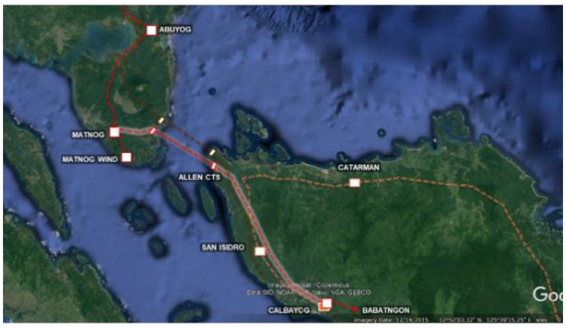
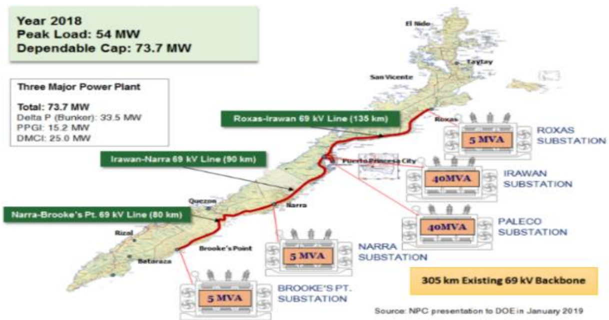
- Currently, Samar Island is highly dependent to Leyte due to the absence of generating power plants in the Island and since the existing Luzon-Visayas HVDC transmission system is terminated in Ormoc in Leyte. Isolation of Samar Island is possible in case of

</td><td>

Substation:

- Calbayog 230 kV SS: 2x70 MVAR 230 kV Line Reactor, 6-230 kV PCB and associated equipment

</td><td>2040</td></tr>
</table>

Project Name	Project Description	Major Project Components	ETC
	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 600 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 Northern part of Sorsogon. This will provide operational flexibility for the loads in Samar. Operationally, some substations in Samar will normally draw supply from Sorsogon.  **Figure 11.3:** Leyte-Luzon Interconnection Project	• Matnog 230 kV SS (Expansion): 2x70 MVAR 230 kV Line Reactor, 4-230 kV PCB and associated equipment Transmission Line: • Allen CTS–Calbayog 230 kV TL, ST-DC, 4-795 MCM ACSR, 80 km • Matnog–Sta. Magdalena CTS 230 kV TL, ST-DC, 4-795 MCM ACSR, 18 km Submarine Cable: • Sta. Magdalena CTS–Allen CTS 230 kV XLPE Submarine Cable, Double circuit with 600 MW transfer capacity per ckt, 23 km • Allen CTS: Cable Sealing End • Sta. Magdalena CTS: Cable Sealing End.	
Palawan-Mindoro Interconnection	• 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 (NPC), 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. 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 provi nce. 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 Project (PMIP). It will also include the preparation of the Mindoro Backbone through the development of Calapan–San Jose 230 kV TL Backbone and San Jose 230 kV SS in Occidental Mindoro; and • 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 HVAC system. This interconnection project aims to provide the Mainland Palawan with a more reliable supply of power and to address	• Desktop, System and Feasibility Studies and Hydrographic Survey of the Mindoro-Palawan Interconnection • Calapan–San Jose 230 kV TL, ST-DC 2-795 MCM ACSR, 154 km • Calapan 230 kV SS: 4-230 kV PCB and associated equipment • San Jose 230 kV SS: 2x100 MVA 230/69 kV Power Transformer, 6-230 kV PCB and associated equipment, 6-69 kV PCB and associated equipment, 2x25 MVAR 230 kV Shunt Reactor and associated equipment  **Figure 11.4**: Palawan-Mindoro Interconnection Project	2033

<table>
<tr><th>Project Name</th><th>Project Description</th><th>Major Project Components</th><th>ETC</th></tr>
<tr><td></td><td>the power quality issues, which result to frequent power interruptions.

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.</td><td>

Figure 11.5: Palawan – Mindoro Hydrographic Survey</td><td></td></tr>
<tr><td>**Mindoro–Panay 230 kV Interconnection Project**</td><td>• The 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.

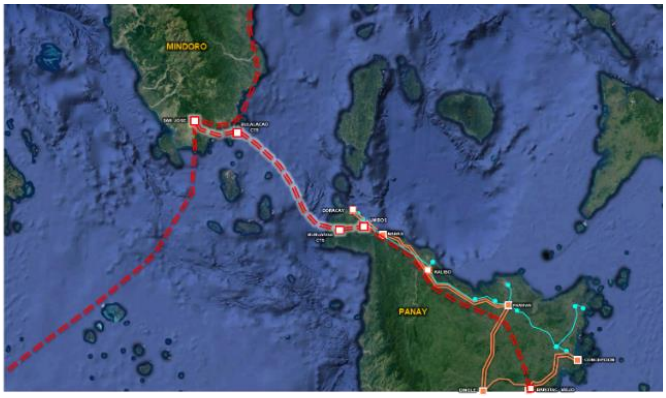


Figure 11.6: Mindoro-Panay 230kV Interconnection Project</td><td>Substation:
• San Jose 230 kV SS: 2x70 MVAR 230 kV Line Reactors,6-230 kV PCB and associated equipment
• Unidos 230 kV SS: 2x70 MVAR 230 kV Line Reactors, 6-230 kV PCB and associated equipment
Transmission Line:
• San Jose SS–Bulalacao CTS 230 kV TL ST-DC, 4-795 MCM ACSR, 15 km
• Buruanga CTS–Unidos SS 230 kV TL, ST-DC, 4-795 MCM ACSR, 22.5 km
Submarince Cable:
• 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</td><td>2036-2040</td></tr>
<tr><td>**Cebu–Negros–Panay 230 kV Backbone**</td><td>• The projecy 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:
  • Stage 1 involves the development of transmission corridor composed of submarine cable system and overhead TL from Barotac Viejo SS in Panay to Bacolod SS in Negros;
  • Stage 2 involves the construction of 230 kV facilities in the existing Cebu 138 kV SS and harmonize its capacity with the 230 kV transmission backbone; and
  • Stage 3 involves the construction of 230 kV facilities from Barotac Viejo SS to Cebu SS.</td><td></td><td>2023</td></tr>
<tr><td>**Metro Cebu 230 kV Backbone Loop**</td><td>• The project 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:
  • Cebu–Lapu-Lapu Transmission Project</td><td></td><td>2023-2040</td></tr>
</table>

Project Name	Project Description	Major Project Components	ETC
	• Cebu–Negros–Panay 230 kV Backbone Project Stages 2 and 3 • Mindanao–Visayas Interconnection Project (MVIP) • Laray 230 kV Substation Project (Initially energized at 138 kV) • Lapu-Lapu 230 kV Substation Project • Laray–Alpaco 230 kV Energization Project • Laray–Cordova 230 kV Interconnection Project • Lapu-Lapu–Cordova 230 kV Interconnection Project		
Cebu–Bohol–Leyte 230 kV Backbone	• The project 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: • Cebu–Bohol 230 kV Interconnection Project • Babatngon–Palo 230 kV TL Project • Ormoc–Babatngon 230 kV TL Project • Cebu–Leyte 230 kV Interconnection Lines 3 and 4 Project • Maasin–Sogod 230 kV TL Project • Palo–Sogod 230 kV TL Project • Bohol-Leyte 230 kV Interconnection Project		2024-2035
Negros–Guimaras–Panay 230 kV Backbone	• This project will involve the laying of double circuit submarine cables from Negros to Guimaras and to Panay. This is to ensure to accommodate the upcoming generation under CREZ in the area of Negros, Panay and Guimaras. This will also provide reliability to the Negros–Panay interconnection. This long-term plan is the basis of the transmission projects in Metro Cebu spread within the 2040 planning horizon namely: • Barotac Viejo–Sta. Barbara 230 kV Transmission Line Project • Negros–Guimaras–Panay 230 kV Interconnection • Calatrava–Granada 230 kV Transmission Line Project		2031-2035
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. 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 have already been interconnected since 1998 and with the 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: • Sharing of system reserve • Lesser investment in power generation in either the Visayas or Mindanao to maintain the one-day Loss of Load Probability (LOLP)	Submarine Cable • Santander CTS–Dapitan CTS, 92 km, ±350 kV HVDC, Bipolar, 1,500 mm^2 HVDC Mass Impregnated (MI) submarine cable. Overhead DC Transmission Lines: • Dumanjug CS–Santander CTS (Visayas Side): 73 km, ±350 kV HVDC OHTL, Bipolar, 3-795 MCM ACSR Condor • Dapitan CTS (Mindanao Side)–Lala CS: 138 km, ±350 kV HVDC OHTL, Bipolar, 3-795 MCM ACSR Condor Overhead AC Transmission Lines: • Dumanjug CS–Magdugo Substation: 52 km, 230 kV, ST-DC, 4-795 MCM ACSR • Bus-in of Dumanjug to Colon–Samboan 138 kV OHTL, 138 kV, ST-DC, 1-795 MCM ACSR, 2x8 km Electrode Line Stations: • Lala CS–Kolambugan ES: 20 kV OHTL (2 lines), 20 km, 2-795 MCM ACSR Condor • Dumanjug CS–Alegria ES: 20 kV OHTL (2 lines), 20 km, 2-795 MCM ACSR Condor. Converter Stations (Conventional Bipolar): *Dumanjug Converter Station:*	2023

Project Name	Project Description	Major Project Components	ETC
	• Reduction of operating cost due to economic dispatch of generators The intangible benefits in the implementation of MVIP: • Attractiveness of MVIP to power generation investments due to the bigger market through an interconnected power network; • 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; • Optimized utilization of indigenous energy sources, such as natural gas in Luzon, geothermal in the Visayas and hydro in Mindanao as well as, this will reduce the overall generation of pollution and dependency on the importation of fossils fuel, where its availability and price are sensitive to the price in the world market.	• 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 138/69-13.8 kV Power Transformers and accessories • PCB: 14-230 kV PCB and associated equipment, 10-138 kV PCB and associated equipment, 5-69 kV PCB and associated 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 • PCB: 8-230 kV PCB and associated equipment Substations: • Umapad GIS SS (New): 2x300 MVA, 230/69-13.8 kV Power Transformers and accessories, 9-230 kV PCB (GIS), 9-69 kV PCB (GIS) and associated equipment. • Magdugo SS (Expansion): 2-230 kV PCB and associated equipment • Other Equipment/Facilities identified based on the result of GIS, e.g., power compensating equipment, etc.	

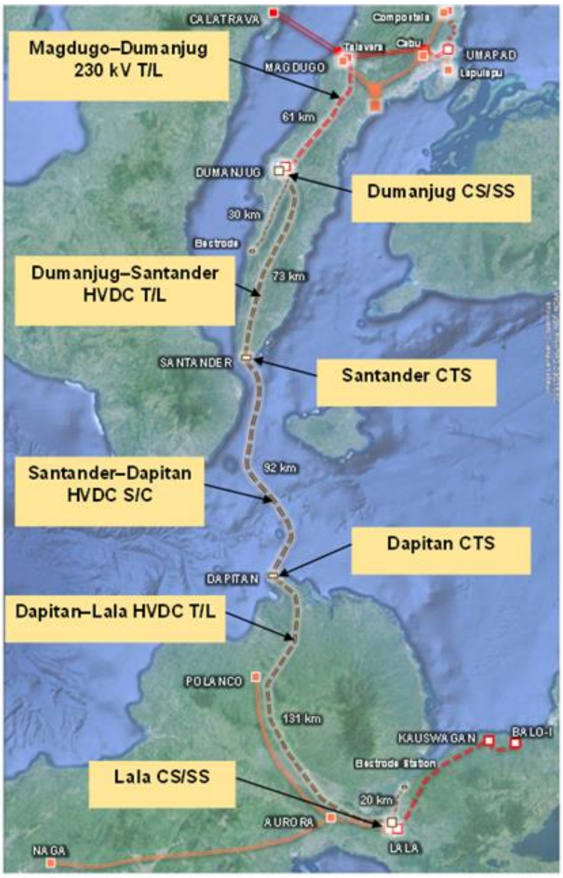


Figure 11.7: Connection Configuration of MVIP

Project Name	Project Description	Major Project Components	ETC
Mindanao 230 kV Transmission Backbone	• This project mainly concentrates on strengthening the existing transmission backbone in Mindanao. As a major transmission highway that delivers both renewable and conventional energies to load centers, it ensures the stability, reliability, and efficiency of power supply in the island. While the existing 138 kV transmission backbone is already inadequate to accommodate the increasing capacity from the new power plants, the energization of the project to 230 kV level increases the thermal capacity of the existing line allowing the transfer of huge power capacity coming from north or south of the island.		Completed
Western Mindanao 230 kV Backbone	• The project completes the envisioned 230 kV transmission extension and looping at the western side of the island. It		2035

Project Name	Project Description	Major Project Components	ETC
	provides an alternate transmission corridor to far-flung and radially connected areas for much reliable power supply.		
Eastern Mindanao 230 kV Backbone	• The Eastern Mindanao 230 kV Backbone loops 230 kV transmission corridor in the eastern side of Mindanao. It increases the power transfer capacity of the grid between CARAGA and Davao Region. In addition, its new transmission corridor serves as reinforcement to the existing Butuan – San Francisco – Bislig – Nabunturan 138 kV SC line.		2032
North Luzon 230 kV Backbone Loop	• The project aims to complete the 230 kV loop in the Northern part of Luzon, while also providing a new transmission corridor to accommodate the integration of renewable energy sources and other power plants within the region.		2031

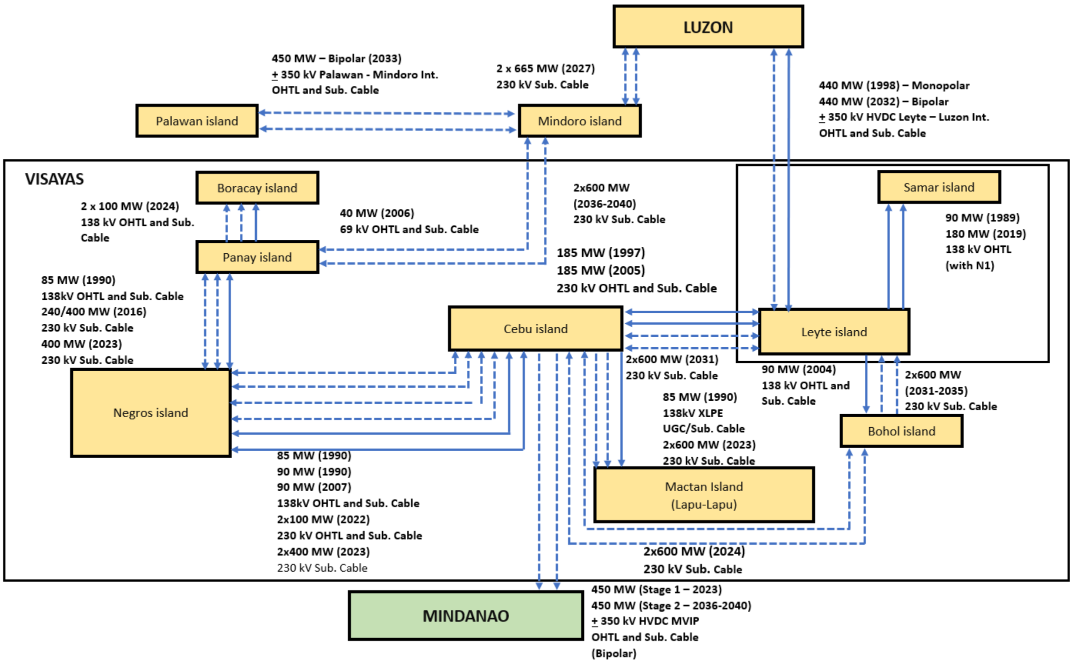


Figure 11.8: Existing and Future Philippine Network Topology

11.3 Small Island/Off-Grid Interconnection

As part of the country's power transmission 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" with the following objectives:

- Improve the reliability and adequacy of power supply
- Reduce power rates
- Lead to the graduation of UC-ME subsidy

NGCP through its endeavor will undertake the conduct and overall due diligence to shortlist island/off-grid areas to be interconnected to the grid and document a Techno-Economic Feasibility Study (Techno-Eco FS) for the shortlisted island/off-grid areas. Further, NGCP will submit an annual program for the interconnection of off-grid areas to the network that will be included in project prioritization and annual updating of the TDP in compliance to Rule 9 of the said DOE Circular.

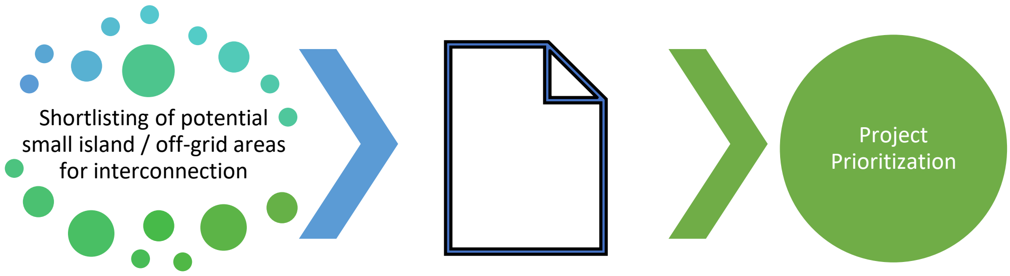


Figure 11.9: Small Island / Off-Grid Prioritization Process

Table 11.2 Small Island / Off-grid Interconnection

Project Name	Staus	Project Description	Major Project Components	ETC
Quezon – Marinduque 69kV Interconnection (QMIP)	Filed to ERC	• The proposed QMIP aims to address the expected long-term development in the island province of Marinduque. This project enables the province to have access to a more reliable and competitive generation sources in the Luzon Grid. In addition, the current energy mix in the province, which is mainly oil-based, is seen to improve due to the access of power supply from various generation sources in the Luzon Grid.	Substation: • Gumaca 230 kV SS: 2x300 MVA Power Transformers and 13-69 kV PCB and associated equipment • General Luna Switching Station: 11-69 kV PCB and associated equipment • Sta. Cruz Switching Station: 2x2.5 MVAR Line Reactors and 7-69 kV PCB and associated equipment • Gasan 69 kV Load End SS: 4x2.5 MVAR Shunt Capacitors and 4-69 kV PCB and associated equipment Transmission Line: • General Luna-General Luna CTS 69 kV Transmission Line, ST-SC, 1-795 MCM ACSR, 1.5 km • Sta. Cruz-Sta. Cruz CTS 69 kV TL, ST-SC, 1-795 MCM ACSR, 9 km • Gumaca-General Luna 69 kV TL, ST-DC, 1-795 MCM ACSR, 37.5 km Submarine Cable: • General Luna CTS-Sta. Cruz CTS 69 kV XLPE Submarine Cable, 3-Core 500 mm^2, 22 km	Dec 2030

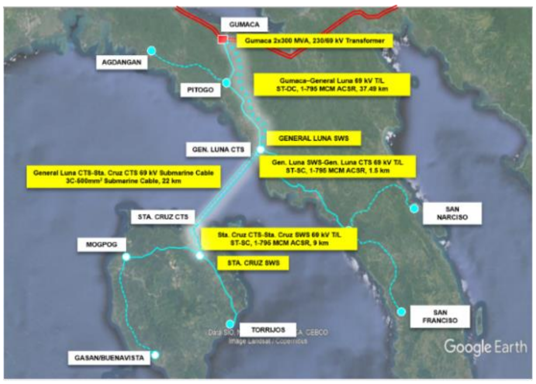


Figure 11.10: Quezon-Marinduque Interconnection Project

Camarines Sur – Catanduanes 69kV Interconnection (CCIP)		• The CCIP aims to link the Catanduanes Island to the Luzon Grid and provide Catanduanes access to a more reliable and competitive generation sources. Presently, the island of Catanduanes is being served by the First Catanduanes Electric Cooperative, Inc. (FICELCO). On the other hand, the transmission system is being supervised by the NPC. The island's transmission system has a total existing line length of 47.0 circuit-kilometers and an existing SS capacity of 20 MVA.	Substation: • Naga 69 kV S/S, 2-69 kV PCB • Presentacion 69 kV Switching Station, 3x2.5 MVAR 69 kV Capacitor, 3x2.5 MVAR 69 kV Shunt Reactor, 12-69 kV PCB • San Andres 69 kV Switching Station, 1x5 MVAR 69 kV Line Reactor, 6-69 kV PCB • Marinawa 69 kV SS, 3x5 MVAR 69 kV Capacitor, 3-69 kV PCB Transmission Line: • Naga–Presentacion 230 kV Line, ST-DC, 1-795 MCM ACSR, 70 km • Presentacion–Bitaogan CTS 69 kV Line, ST-SC, 1-795 MCM ACSR, 12 km • Asgad CTS–San Andres 69 kV Line, ST-SC, 1-795 MCM ACSR, 1 km Submarine Cable: • Bitaogan CTS–Asgad CTS 69 kV Line, SC, 3 Core 500 mm^2 XLPE Submarine Cable, 23 km	Dec 2030

Figure 11.11: Camarines Sur – Catanduanes Interconnection Project

Project Name	Staus	Project Description	Major Project Components	ETC
Claver - Siargao 69kV Interconnection		• Siargao Electric Cooperative (SIARELCO) is currently connected to the Mindanao Grid thru tap connection of their 20 MVA Cagdianao Substation to NGCP Placer – Madrid 69 kV line. Then, 34.5 kV energized submarine cables and overhead line link the island of Bucas Grande and Siargao. As tourism is booming in Siargao, the capacity of the existing power transformer in Cagdianao and 34.5 kV lines will not be sufficient to accommodate the increasing demand. This project aims to provide a 69 kV interconnection facility that increases the power transfer towards the islands and improve the voltage within the franchise area of SIARELCO.		Dec 2031
Zamboanga-Basilan 69kV Interconnection		• The power requirement of Basilan is being served by NPC-SPUG through missionary electrification. NPC-SPUG utilizes Basilan Diesel Power Plant and Power Barge 119. The Zamboanga – Basilan interconnection is envisioned to give the province a reliable and efficient power service. Also, this project counts out Basilan from the subsidy recipients of Universal Charge – Missionary Electrification.		Dec 2031

11.4 Potential Small Island Interconnections

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 11.3 below are the potential small island interconnections 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 11.3 below are the potential small island interconnections indicating the length of the required facilities. Further details for the potential small island interconnection and other small island and off-grid areas will be discussed on the succeeding TDP issuance:

Table 11.3 Potential Small Island Interconnections

Island	Interconnection Point	Length (km)		
		Submarine	Overhead	Total
LUZON				
Ticao	Abuyog	20	35	55
Masbate	San Jacinto	16	16	32
Tablas	San Jose	61	36	97
Lubang	Calaca	54	20	74
Busuanga	San Jose	84	52	136
VISAYAS				
Bantayan	Medellin	21	24	45
Siquijor	Bacong	20	24	44
Camotes	Isabel	18	8	26
Semirara	San Jose	33	0	33
MINDANAO				
Dinagat	Canlanipa	30	15	45
Camiguin	Esperanza	30	37	67
Siasi	Parang	43	32	75
Sulu	Taberlongan	100	34	134
Tawi-Tawi	Pagatpat	84	60	144

OPERATION AND MAINTENANCE PROGRAM

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 2022 to 2040 with the objective of increasing the reliability of the Grid and improving the transmission system and facilities throughout the country for reliable, adequate, secure, and stable service for all users of the nationwide electricity transmission system.

NGCP has an estimated total of around 159,596 operational assets[7]. These assets vary from substation primary equipment, protection relays, secondary devices to transmission line towers and other structures. To evaluate the condition of these assets, proper asset management must be observed.

The 19-year operation and maintenance program cover the major categories of expenditures enumerated below:

- Installation, replacement, rehabilitation and relocation of HVE.
- Acquisition, Installation and replacement of Protection and Secondary Devices.
- Rehabilitation of Transmission Lines and Sub-transmission Lines which were not divested.
- Acquisition and replacement of Test & Measuring Equipment, Maintenance Tools and Maintenance Vehicles
- Acquisition of Spares for HVE, Transmission Lines, and Secondary Device.
- Construction and rehabilitation of Substation and Support Facilities that include projects to:
    - Control and mitigate the effects of Fire and Flood
    - Preserve and Protect the Environment
    - Resiliency Projects

12.1 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.

12.1.1 Substation Reliability Program

This program covers acquisition, installation, and replacement works for HVE, 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 4.

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, the foreseen adverse effects 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

[7] as of August 2021

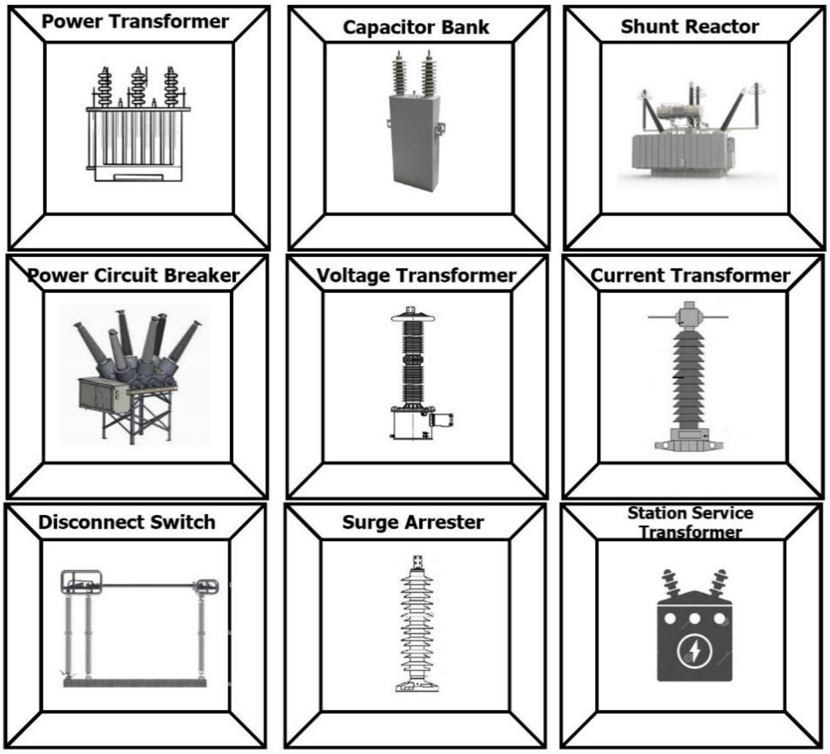


Figure 12.1 High Voltage Equipment Components

b. Replacement of Protection and Secondary Devices

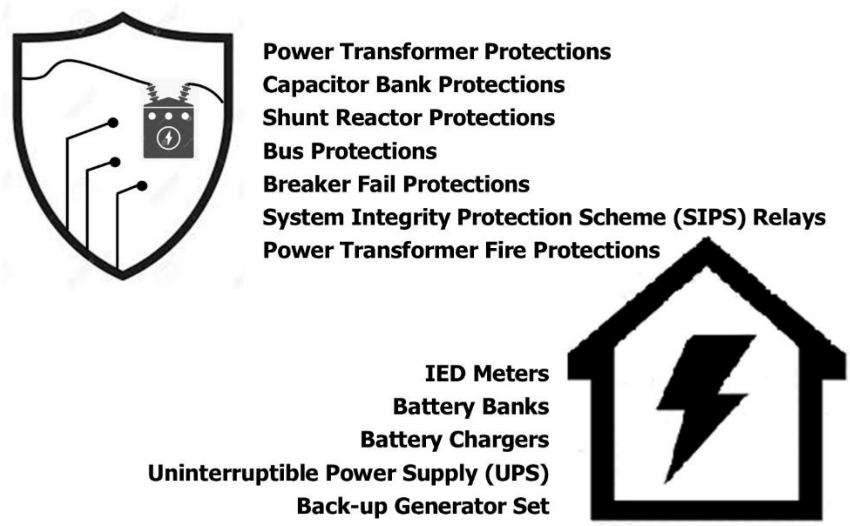


Figure 12.2 Protection and Secondary Devices Components

c. Substation Automation Program

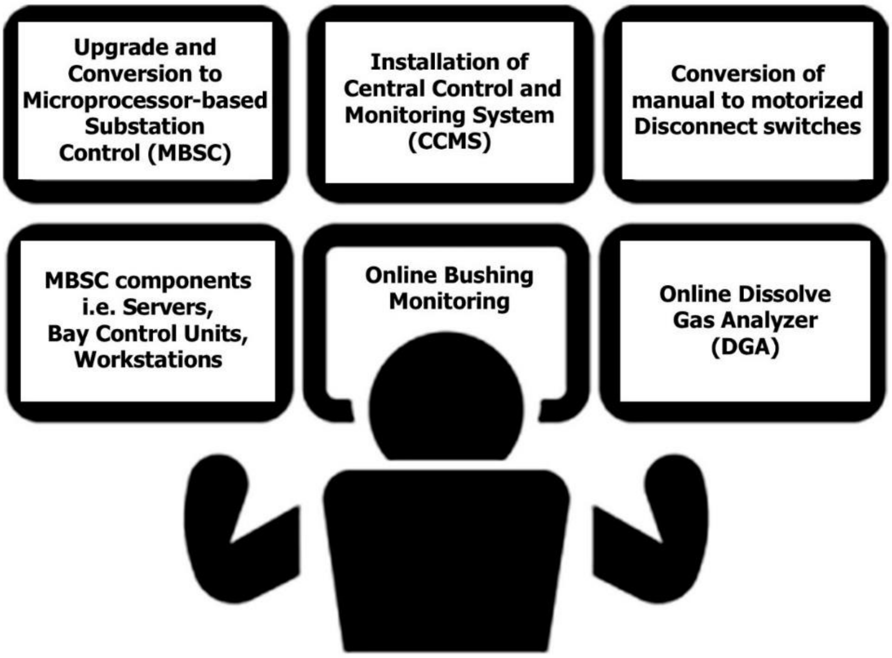


Figure 12.3 Substation Automation Program Components

d. Resilient Operation

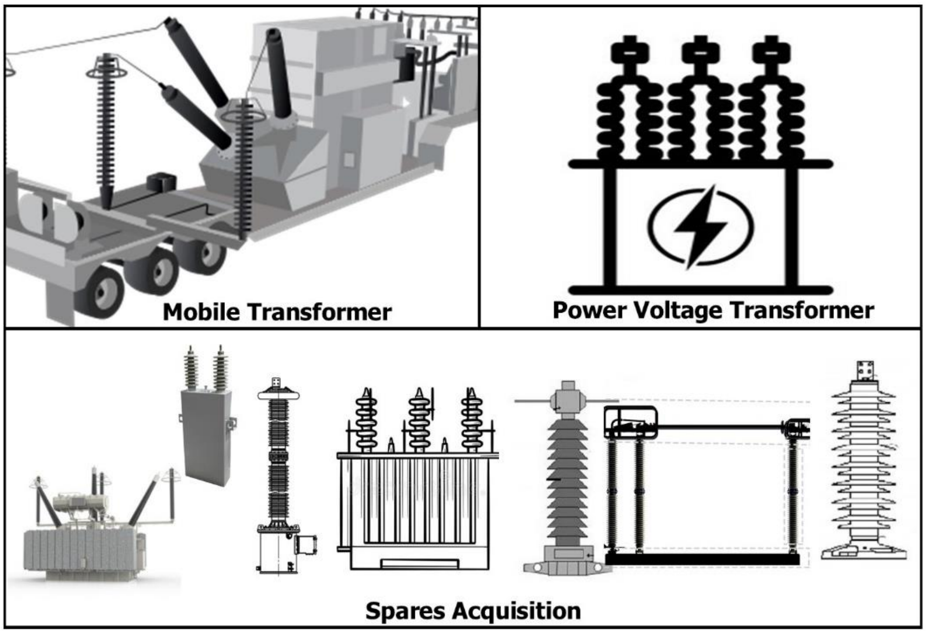


Figure 12.4 Resilient Operation Components

Program Disbursement
These projects will extend within the next 19 years.
The project has a total estimated cost of 34.019 Bn.

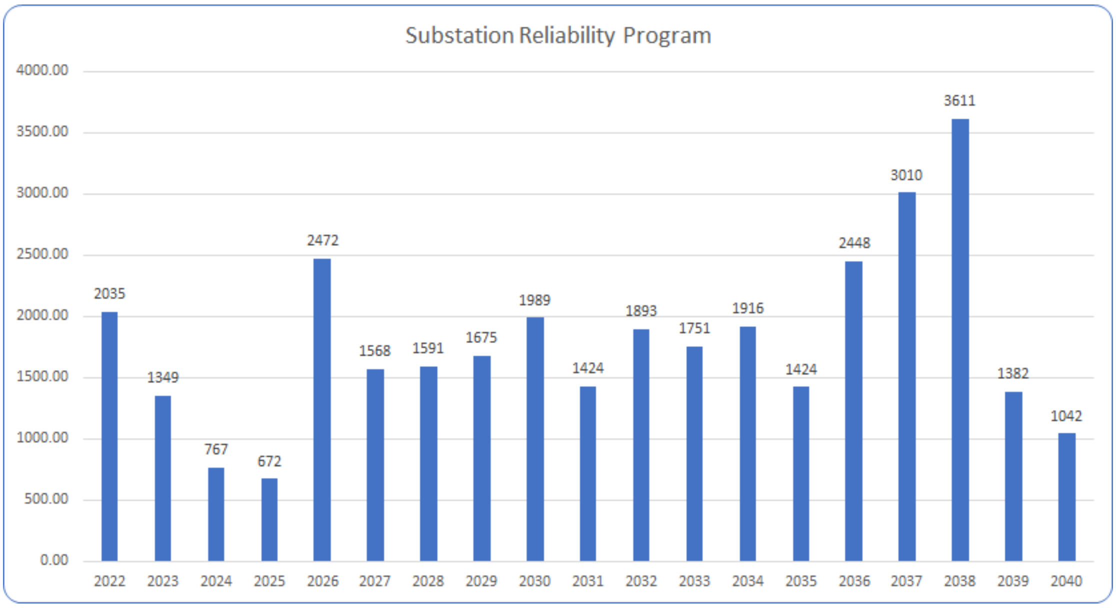


Figure 12.5 Substation Reliability Program Disbursement (in Mn Php)

12.1.2 Transmission Line Reliability Program

These projects include replacement of line-associated HVE, secondary devices and other accessories that are classified as transmission assets. All Transmission Lines which are subject to maintenance will require a 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.

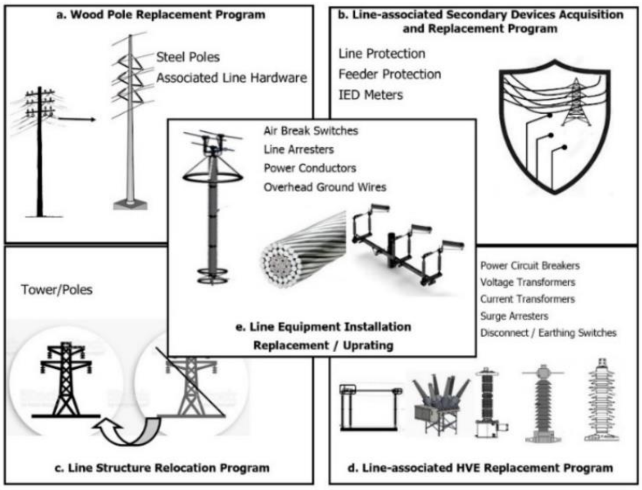


Figure 12.6 Transmission Line Reliability Program Components

Program Disbursement
These projects will extend within the next 19 years.
The project has a total estimated cost of 17.223 Bn.

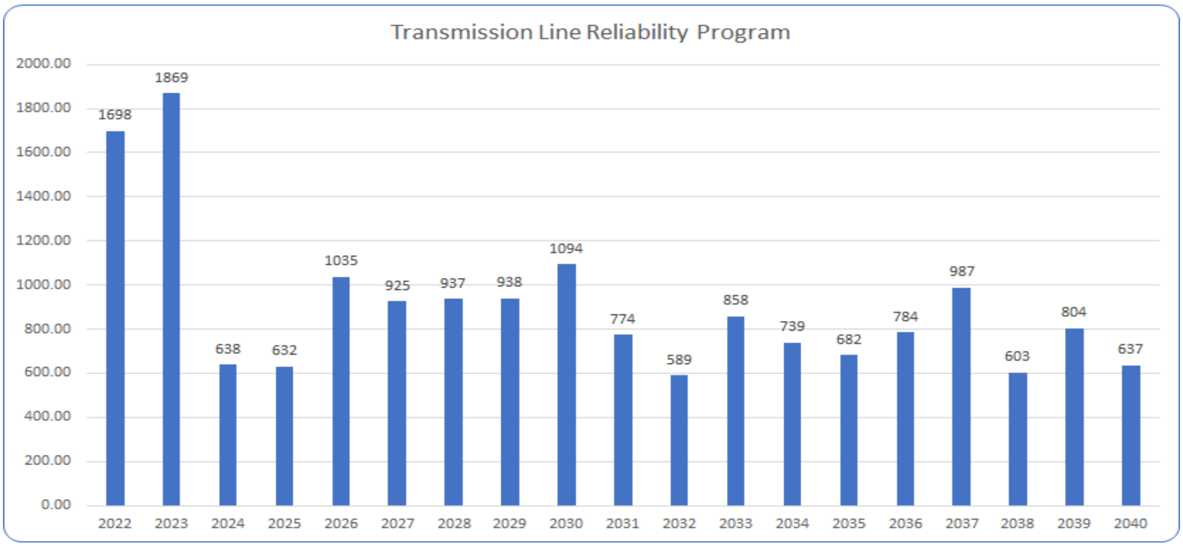


Figure 12.7 Transmission Line Reliability Program Disbursement (in Mn Php)

12.1.3 Sub-transmission Line Reliability Program

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

NGCP has identified sub-transmission 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.

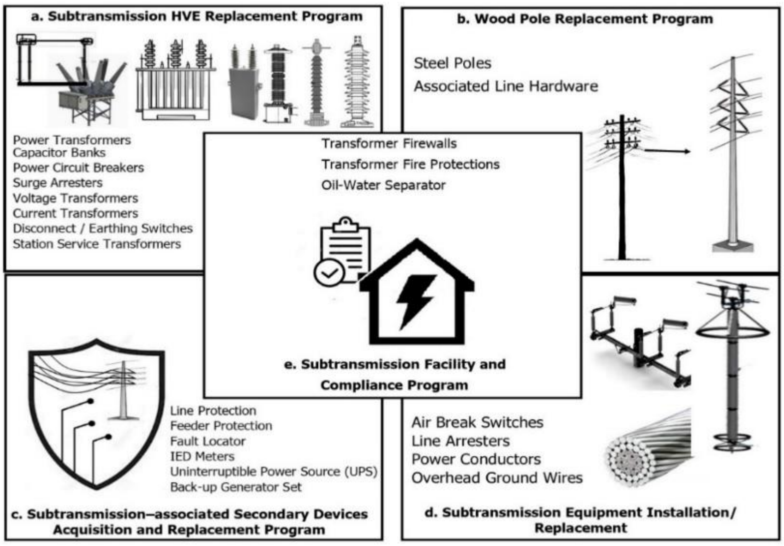


Figure 12.8: Sub-transmission Line Reliability Program Components

Program Disbursement
These projects will extend within the next 19 years.
The project has a total estimated cost of 7.433 Bn

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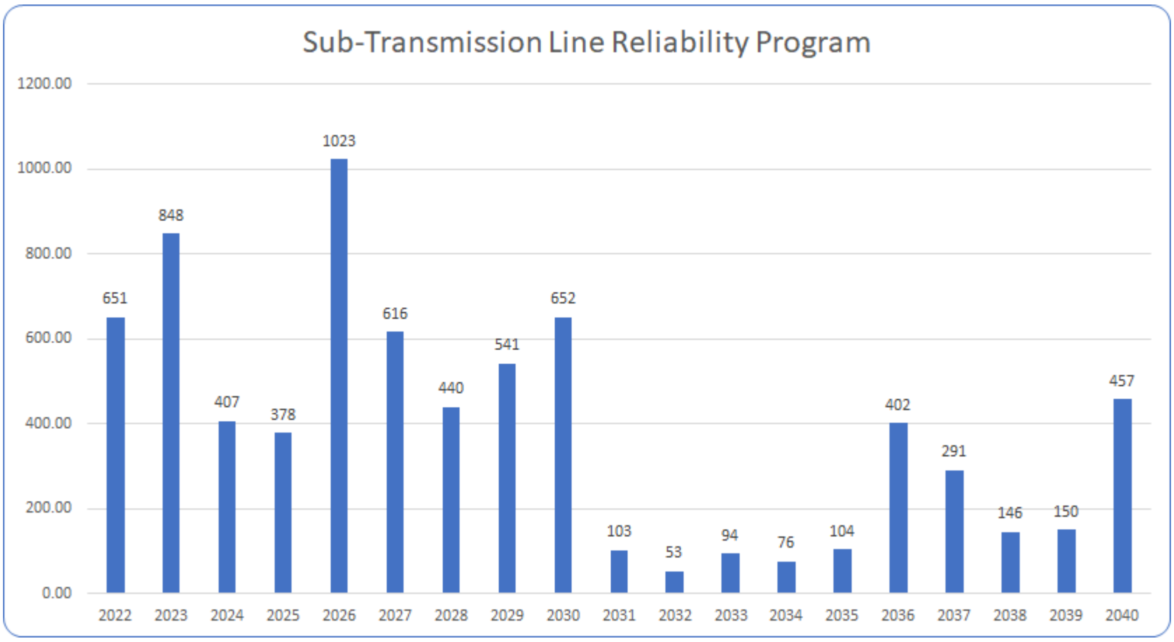

Figure 12.9: Sub-transmission Line Reliability Program Disbursement (in Mn Php)

12.1.4 Tools and Equipment Program

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

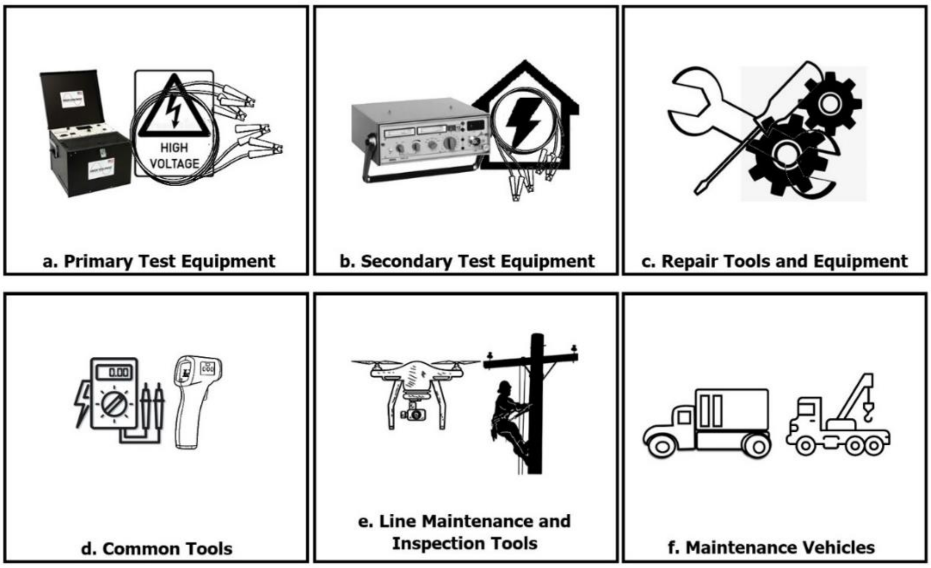

Figure 12.10 Tools and Equipment Program Components

Program Disbursement
These projects will extend within the next 19 years.
The project has a total estimated cost of 7.151 Bn.

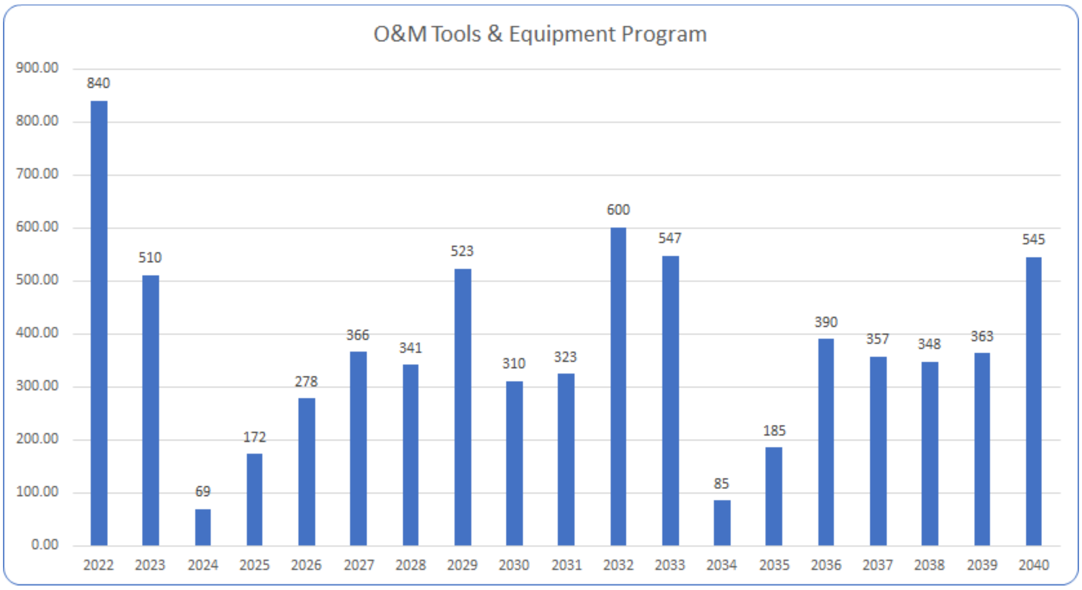

Figure 12.11 Tools and Equipment Program Disbursement (in Mn Php)

12.1.5 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 is 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.

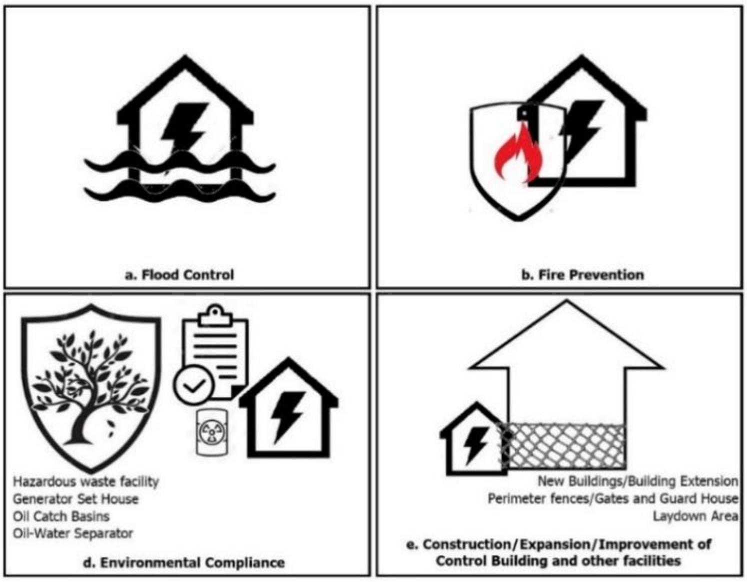

Figure 12.12 Network Facility Improvement Program Components

Program Disbursement
These projects will extend within the next 19 years.
The project has a total estimated cost of 0.818 Bn.

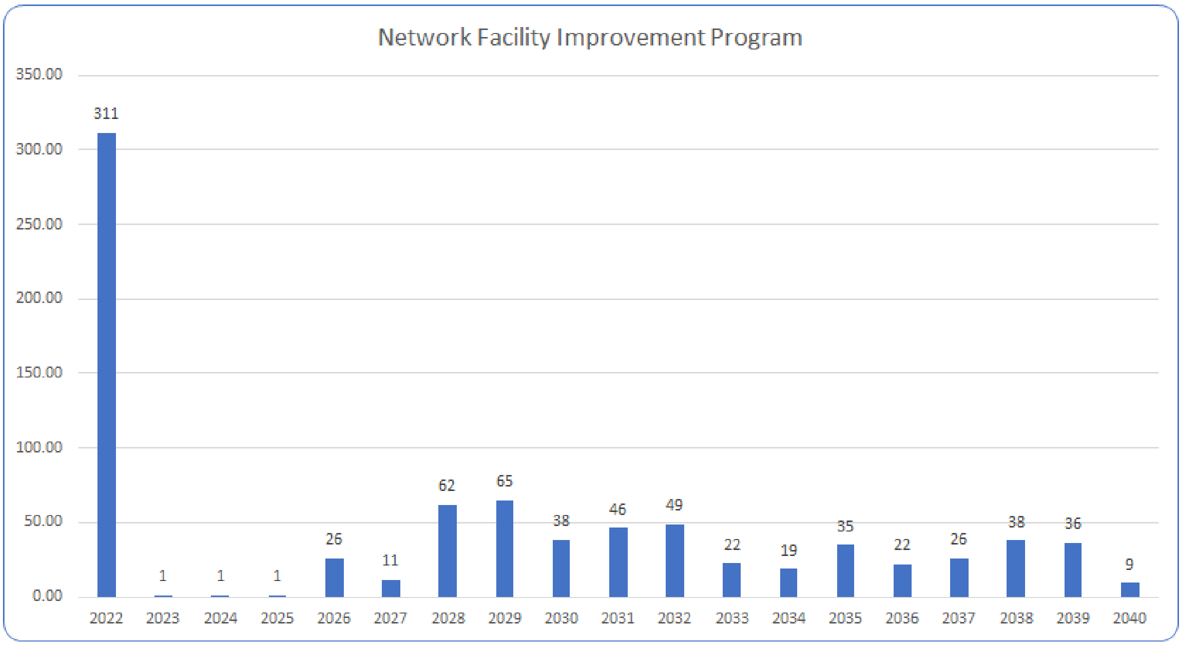

Figure 12.13 Network Facility Improvement Program Disbursement (in Mn Php)

12.1.6 Summary of 2022 - 2040 CAPEX Budget Requirements

The estimated CAPEX Budget for the TDP 2022-2040 is shown in Table 12.1
.

Table 12.1: Summary of CAPEX Cost 2023-2040, in Million (PhP)

TDP 2023-2040 O&M PROJECTS	Asset Replacement	Compliance to Standards	Technology Installation	Maintenance Equipment	Resilient Operation	TOTAL
Substation Reliability Program	16,666.01	1,831.44	2,403.97	-	7,856.78	**28,758.20**
Transmission Line Reliability Program	8,149.96	2,486.92	415.73	-	2,670.00	**13,722.61**
Sub-transmission Line Reliability Program	2,687.13	1,119.93	20.40	-	18.37	**3,845.83**
Improvement of Substation Facilities and Non-Network Assets Program	3.05	1,288.60	-	-	141.15	**1,432.80**
Tools & Equipment Acquisition Program	-	-	106.72	7,816.17	-	**7,922.89**
TOTAL	27,506.14	6,726.90	2,946.82	7,816.17	10,686.31	55,682.33

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 safe, secure, reliable system operations.

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

12.2 Metering Facilities

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

NGCP, the entity granted by the ERC with the Certificate of Authority as WESM Metering Service Provider (WMSP), 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 is defined under Article III of ERC Resolution 28 Series of 2006.

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.

The PGC 2016 Edition also states that a metering facility may only be declared as ready for revenue metering service when regulatory conditions are satisfied as certified by the WMSP.

a. Revenue Metering Capital Projects

To satisfy these obligations, NGCP is required to continuously undertake metering capital projects classified into two major categories, namely:

Regulatory Requirements Compliance Projects

The main driver for this project category is compliance to metering requirements prescribed by the applicable rules governing WESM. This project is classified into four sub-categories.

NEW METERING FACILITIES
New connections to the Grid

RELOCATION OF METERING FACILITIES
Metered with respect to the prescribed connection points

COMPLIANCE OF METERING FACILITIES
Equipment compliant to WESM technical requirements

MEASUREMENT ASSURANCE PROGRAM
Calibration Traceability of measurements

Metering Systems Reliability Projects

The main drivers for this project category are security and reliability of metering facilities to maintain a state of compliance to regulatory requirements. This project group is classified into two sub-categories.

METERING REPLACEMENT PROGRAM
Timely replacement of deteriorated assets

METERING SPARES
Timely replacement of failed assets

AMR SYSTEM UPGRADE
Timely delivery of accurate data for WESM Settlement

b. Revenue Metering Capital Assets

The following table provides the rationale for the NGCP metering Capital Projects and the necessary revenue metering Capital Assets required to implement the projects.

Table 12.2 Metering Capital Asset Requirements

Project Sub-Categories	Capital Asset Requirements	Governing Rules
New Metering Facilities a. Generators b. Load Customers	Meters Combined Instrument Transformers Current Transformers Voltage Transformers Lightning Arresters Communication Devices Meter Enclosure Test Switches Cablings Grounding System Conduit System Mounting Structures Concrete Foundations Metering Perimeter	OATS Rules ▪ E2.1 ▪ E3.2 ▪ E11.1 ▪ E11.3 ▪ F(AIII) 3 WESM Metering Manual ▪ 2.3.1 PGC 2016 Edition ▪ GRM 9.2.2.3 ▪ GRM 9.2.4.3 ERC Resolution 23 S2016 ▪ Sec. 6.0
Relocation of Metering Facilities a. Transmission Customers b. NGCP Station Services	Meters Combined Instrument Transformers Current Transformers Voltage Transformers Lightning Arresters Communication Devices Meter Enclosure Test Switches Cablings Grounding System Conduit System Mounting Structures Concrete Foundations Metering Perimeter	OATS Rules ▪ E2.1 ▪ E3.2 ▪ E11.1 ▪ E11.3 ▪ E11.7 ▪ F(AIII) 3 WESM Metering Manual ▪ 2.2 ▪ 2.3.1 PGC 2016 Edition ▪ GRM 9.2.1 ▪ GRM 9.2.2.3 ERC Resolution 23 S2016 ▪ Sec. 6.0 DOE DC 2018-05-0015 ▪ (c) WESM Rules Clause 3.2.2.2 DOE DC2016-05-0007 Sec. 2

Project Sub-Categories	Capital Asset Requirements	Governing Rules
Compliance of Metering Facilities a. Non-compliant HVE b. Conversion to Full Metering	Meters Combined Instrument Transformers Current Transformers Voltage Transformers Lightning Arresters Concrete Foundations	OATS Rules ▪ E3.2 ▪ E11.3 ▪ F(AIII) 3 WESM Metering Manual ▪ 2.3.1 ▪ 2.4-2.11 PGC 2016 Edition ▪ GRM 9.2.2, GRM 9.2.3 DOE DC2016-05-0007 ▪ Sec. 1
Measurement Assurance Program a. Laboratory Standards b. Field Test Instruments c. Other Tools and Equipment	CMCL Standards Multi-meters Clamp Meters CT/PT Test Sets Meter Test Sets Insulation Testers Earth Testers Thermal Scanners Tools and Equipment	OATS Rules ▪ E5.1 (a) WESM Metering Manual ▪ 2.5.4.4 (a) PGC 2016 Edition ▪ GRM 9.2.4.1 ▪ 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 ▪ Sec. 1
Metering Replacement Program a. High Voltage Equipment b. Meters and accessories	Meters Combined Instrument Transformers Current Transformers Voltage Transformers Lightning Arresters Meter Enclosures Meter Test Switches	OATS Rules ▪ E3.2 ▪ E11.3 PGC 2016 Edition ▪ GRM 9.2.4.1 (e) (f) (g) ▪ GRM 9.2.4.3 ▪ GRM 9.2.8.4 ERC Resolution 23 S2016 ▪ Sec. 6.0 ERC Resolution 28 S2006 ▪ 3.4.5
Metering Spares a. High Voltage Equipment b. Meters and accessories	Meters Combined Instrument Transformers Current Transformers Voltage Transformers Lightning Arresters Communication Devices	OATS Rules ▪ E3.2 ▪ E11.3 PGC 2016 Edition ▪ GRM 9.2.4.1 (e) (f) (g) ▪ GRM 9.2.4.3 ▪ GRM 9.2.8.4 ERC Resolution 23 S2016 ▪ Sec. 6.0 ERC Resolution 28 S2006 ▪ 3.4.5
AMR System Operation a. Hardwares b. Softwares	AMR Servers (Main and Back-up) AMR Workstations AMR Softwares Communication Devices	OATS Rules ▪ E6.2 ▪ F(AIII) 3 WESM Metering Manual ▪ 2.9.2 ▪ Sec. 5 PGC 2016 Edition ▪ GRM 9.3.2 ERC Resolution 28 S2006 ▪ 2.2.2.3.4 ▪ 2.2.2.4.3.8

12.2.2 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 governing WESM Metering through the OATS Rules, WESM Metering Manual, PGC and guidelines issued by ERC or DOE.

a. New Metering Facilities

This project covers the installation of Metering Facilities for new Generator and/or Load Customer connections to the Grid.

Based on the newly released 2022 Edition of OATS Rules, the Meter Only option, wherein the Transmission Customers provide some of the metering equipment except for the meters, is no longer available. The responsibility of providing all the required WESM metering equipment is now the sole responsibility of the Metering Service Provider. This requirement is consistent with the provision of ERC Resolution 23 Series of 2016 which excludes the metering equipment used for Metering Services from the connection assets of Transmission Customers and requires Transmission Customers to dispose or transfer assets with transmission function in favor of the Transmission Provider.

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

- Requirements for new metering facilities for Transmission Customers which have already been communicated to NGCP through requests for facility studies et. al.
- Private Sector Initiated Power Projects as published at the DOE Website
- 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/s.

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:

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

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

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

- Connection point/s as defined by ERC Resolution 23 Series of 2016
- Metering points located more than 500 meters from the connection points
- Existing NGCP Station Service Transformers and corresponding locations of temporary metering points

Compliance of Metering Facilities

This 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:

- Metering Equipment or Facilities not meeting required specifications
- 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.

In addition to the above-mentioned non-compliances, the conversion of existing Meter Only metering to Full metering facilities which are not covered by other metering project groups shall be incorporated to this project category. Consistent with OATS Rules 2022 Edition requiring the WESM MSP to provide all Metering Equipment, NGCP will either acquire or replace all customer-supplied Instrument Transformers subject to the results of negotiations with the equipment owner.

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

- NGCP Internal audit results
- External audit results by PEMC, ERC and others

Measurement Assurance Program

This project covers the procurement of Tools and Equipment to support compliance to the Measurement Assurance System requirements:

- Laboratory Standards
- Field Test Instruments
- Other Tools and Equipment

The WMSP is required by ERC to operate and maintain a measurement assurance system consisting of procedures, meter calibration standards and testing equipment and a central meter calibration laboratory. The purpose 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 is determined based on the following Considerations:

- Calibration traceability requirements for field test instruments and installed metering equipment
- Operational requirements per field metering offices (existing vs. required test instruments and tools)
- Triggers such as end of asset life, obsolescence, asset condition and failures

Metering Replacement Program

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

- End of Asset Life

Since the likelihood of failure of older equipment is higher due to natural deterioration process, NGCP has incorporated the replacement of ageing assets to its asset management system consistent with ERC policies. In consideration of the newly issued 2022 edition of OATS Rules requiring the WMSP to provide all metering equipment and ERC Resolution 23 Series of 2016 which excludes the metering equipment from the customer connection assets of Transmission Customers, NGCP shall undertake the replacement of fully aged assets including those provided by the transmission customer. Consequently, meter only metering facilities will be converted to full metering upon replacement of their equipment with NGCP-owned assets.

The metering replacement program requirements are determined based on the following considerations:

- Age of metering assets.
- Present condition of assets.
- Procurement lead time.

Metering Spares

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

- Equipment Failure

A metering equipment which failed the accuracy test or malfunctioned is required to be replaced immediately. 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. This is consistent with the requirements of OATS Rules 2022 Edition and ERC Resolution 23 Series of 2016.

The metering spares levels are determined based on the following considerations:

- Present asset conditions
- Historical failure rates
- Procurement lead time
- Geographic locations of spares storage facilities
- Installed equipment specifications

AMR System Upgrade/Operation

This project covers the replacement and/or upgrade of Automatic Meter Reading (AMR) which is composed of hardware, software, and communication infrastructures necessary for the delivery of settlement-ready meter data to WESM at the prescribed delivery schedules.

The timelines and activities are determined based on the following considerations:

- Age and conditions of AMR system hardware
- Maintenance contract with the AMR system provider
- Availability of alternative AMR system in the market
- Availability of new communication technologies in the market

12.2.1 Project Development

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 about 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 12.3 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 served as reference for the anticipated metering points for load customers proposed in this TDP 2023-2040.

Relocation of Metering Facilities

Transmission Customers: Table 12.4 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 served as reference for the relocation projects for the TDP 2023-2040. Unless there will be space and security constraints at the proper connection points, NGCP will undertake and target the completion of relocation projects by 2027.

Table 12.3: Annual Growth Forecast for new Load Customer Connections

Metering Points/ Year	Luzon	Visayas	Mindanao
115kV	1	0	0
69kV	7	7	5
Total	8	7	5

Table 12.4 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	615	408	207	66.34%	117	525
Visayas	294	188	106	63.95%	61	249
Mindanao	252	161	91	63.89%	53	214
Total	1,161	757	404	65.20%	231	988

NGCP Station Service: Majority of station service consumptions of NGCP Substations are presently being metered using temporary WESM meters installed in series with the statistical meters of the substations. 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 12.5 provides the list of Station Service Transformers requiring proper metering. These figures served as reference for the NGCP Station Service Permanent Metering proposed in this TDP 2023-2040. Unless there will be space constraints at the proper connection points, NGCP will undertake and target the completion of relocation projects by 2027.

Table 12.5 Metering Facilities for NGCP Station Service

Region	Existing Temporary Metering Points	Compliant	For Relocation
Luzon	106	28	78
Visayas	51	4	47
Mindanao	53	18	35
Total	210	50	160

Compliance of Metering Facilities

The Philippine Electricity Market Corp. (PEMC) conducts Review of Metering Installation Arrangements 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 which were found non-compliant with the WESM standards demand 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 12.6 provides the statistics of Metering Points with Non-compliances based on the audit reports. Included also in the table are the statistics of meter only facilities which are programmed for conversion to Full metering as required by OATS Rules 2022. These figures served as reference for the compliance projects for the TDP 2023-2040. NGCP will undertake and target the completion of compliance projects for both Full and Meter Only Metering Facilities by 2027.

Table 12.6 Remaining Metering Facilities for Compliance

Region	Correction of Non-compliance	Conversion to Full metering	Total
Luzon	25	171	196
Visayas	14	89	103
Mindanao	10	70	80
Total	49	330	379

Measurement Assurance Program

Laboratory standards, field test instruments, tools and equipment bought during the 2nd, 3rd and 4th regulatory period will reach the end of their asset life by the 5th, 6th and 7th regulatory period:

- Laboratory Standards – asset life of 12 years
- Field Test Instruments – asset life of 10 years
- Tools and equipment – asset life of 10 years

Metering Assets are expected to go through natural wear-and-tear. Our experience shows that the established asset life accurately defines the economic and technical performance of this asset category. Majority of the test instruments procured during the 2nd and 3rd regulatory periods have shown signs of deterioration around the time they have reached their assigned regulatory life including, but not limited to, the following:

- Accuracy and Performance Issue
- Power Supply and Component Failure
- Firm Ware Error

Existing instruments are 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. The run-to-failure approach is implemented for fully aged serviceable instruments. These assets are utilized for redundancy purposes.

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.

Metering Replacement Program

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

- Voltage Transformers – asset life of 30 years
- Current Transformers – asset life of 30 years
- Combined Instrument Transformers – asset life of 30 years
- Lightning Arresters – asset life of 30 years

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

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 served as primary reference for the replacement program for installed metering equipment included in this TDP 2023-2040.

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:

- Unexpected failure of some metering equipment (meters and modems) prior to assigned asset life
- Transmission customers' failure to provide spares for customer-owned metering facility in case of equipment defect.
- 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.

To address this, NGCP has implemented some improvements in the spares program to better support the operational requirements of NGCP.

AMR System Upgrade/Operation

The proposal for this TDP 2023-2040 project sub-category will include:

- **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.
- **AMR System communication infrastructure:** will be replaced as they reach their assigned Asset Life (5-years) or when they become obsolete or fail in service.

12.2.2 Summary of 2023- 2040 CAPEX Budget Requirements

The estimated CAPEX Budget for the TDP 2023-2040 is shown in Table 12.7.

Table 12.7 2023-2040 CAPEX Budget

Project Sub-Category	Estimated Cost in Millions (PhP) 2023-2040
New Metering	2,623.549
Relocation	670.767
Compliance	1,298.024
MAP	595.745
Replacement	870.400
Spares Program	214.076
AMR System	117.774
Total	**6,390.335**

SYSTEM OPERATIONS

13.1 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 2023–2040 planning horizon and the respective major CAPEX issues of interest.

- Migration to Efficient Technologies
  - Shift to IP-based transport/network
  - Completion of optical telecom backbone
  - Adoption of Smart Grid model; implementation of IEC 61850 standard
  - Use of hybrid power supplies
  - Supervision/monitoring functions employing public infrastructure
- Sustenance of Systems to Maximize Economic Lives
  - Stagger the retirement/replacement of systems running through obsolescence
  - Technological prudence: specified functions and upgradability should be realized within expected service life
  - Manage maintenance and replenishment of battery banks
  - Employ remote fiber monitoring systems for quick detection of damaging factors
- Prioritization of Infra Expansion/Upgrade to Areas of Most Benefits at Least Cost
  - Enhanced EMS applications, with emphasis on VRE management
  - OPGW retrofitting to enable access to bandwidth
  - Upgrade of power supply systems and other support infra
  - Compliance with data center standards
- Address Deficiencies that Prevent Optimized Network Performance
  - Completion of network synchronization system
  - Integration of telecom network management systems
  - Securing RCC interfacing to HVDC control system
  - Equipping RTUs with IP interfaces
- Compliance with Grid Code and Regulatory Directions
  - Monitoring and control of embedded generators
  - VRE forecasting
  - Consistency with Protection, SCADA and Telecommunication Philosophies
  - Meeting power quality and system availability requirements
  - Grid resiliency measures
  - Real-time monitoring and control at connection points
  - Cyber Security

13.2 Situational Analysis

13.2.1 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 must be retrofitted to interconnect the already-fiber-embedded lines in the new installations.

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

- 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

- Required upgrades or replacements to address capacity/bandwidth issues resulting from a particular element's deficiency
- Additional facilities that will provide element and path redundancy in compliance with our N-1 philosophy
- 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 2023–2040 CAPEX projects identified in this report 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:

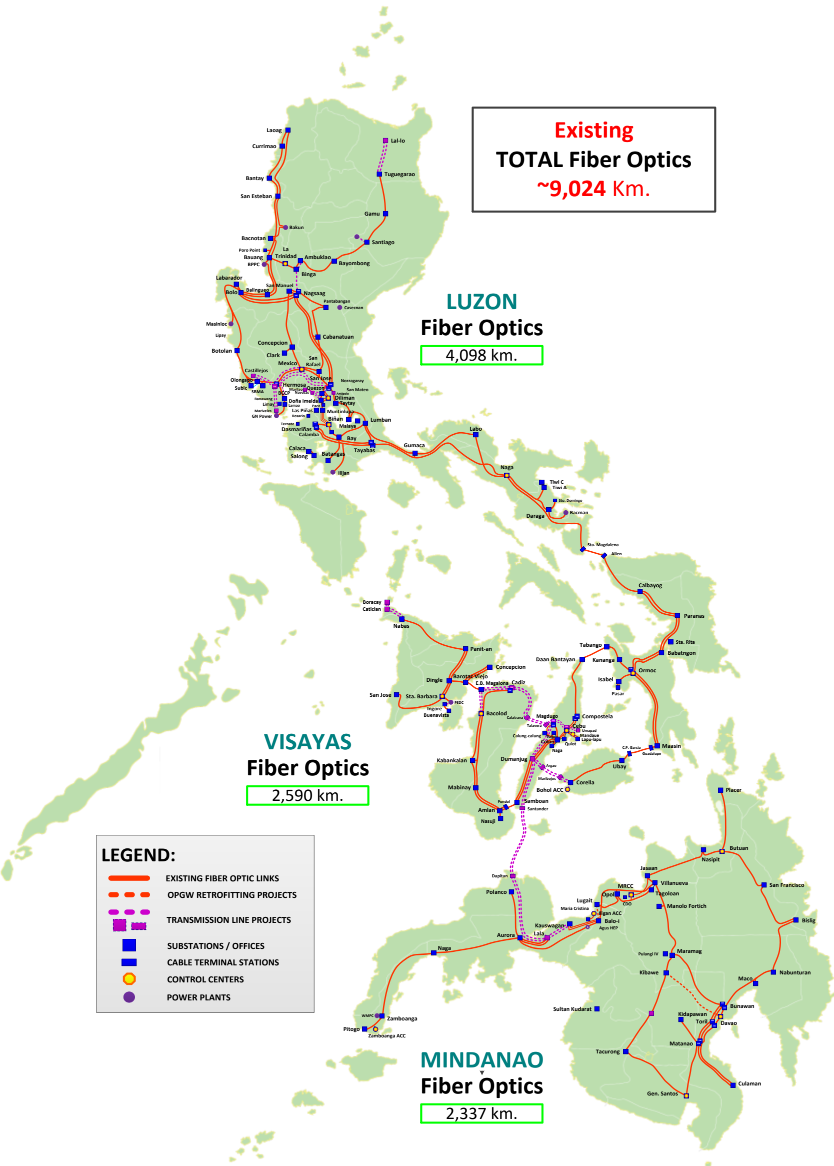

Figure 13.1: Fiber Optic network

13.2.2 SCADA-EMS

NGCP's Regional Control Centers (RCCs) are responsible for monitoring and control of the transmission systems in each of the three power grids: Luzon, Visayas and Mindanao. Backup RCCs were also established to take over the functionalities of RCCs during contingency events. Several Area Control Centers (ACCs) are situated in each Region to supervise other parts of the transmission network not directly managed by the RCCs and to coordinate with the customers in their respective areas of responsibility.

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:

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

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 2023–2040 CAPEX projects are in line with this development trend.

Figure 13.2 is an illustration of the pertinent SO-MO process flow involving NGCP's SCADA-EMS and its interface to the Market.

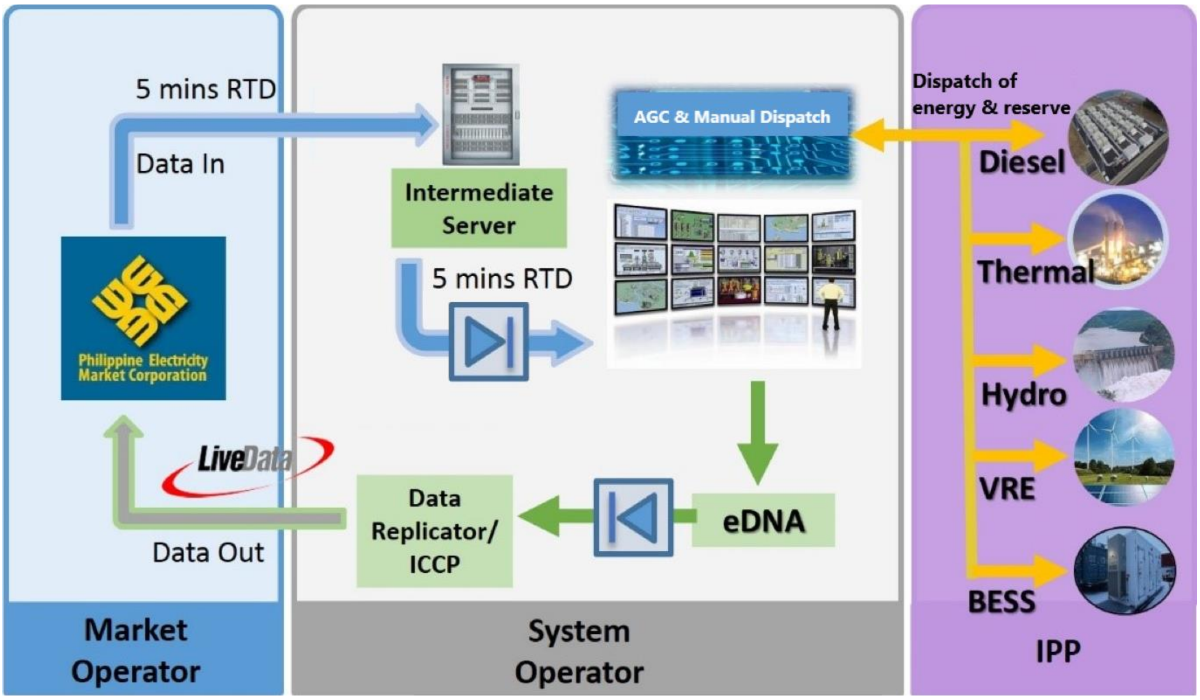

Figure 13.2: SO-MO Process Flow

13.2.3 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:

- Replacement of obsolete protection equipment—which has no more manufacturer support and lacks modern communication features—has to be accelerated to minimize equipment failures as well as to consolidate (remote) management and maintenance.
- Redundancy requirements to meet the N-1 objective necessitate the 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.
- Strategic deployment of NDME and PQA to ensure quick and accurate diagnostics of network disturbances and power quality issues in compliance with PGC requirements.

The 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 2023–2040 CAPEX for protection builds up on relay, NDME, and PQA equipment—the lack of which compromises NGCP's performance objectives.

13.3 Summary of CAPEX Costs

CAPEX Costs 2021–2040 (In Million Pesos)

Table 13.1 CAPEX Proportion by Function

Function	Replenishments	Rehab/Upgrades	Expansions	Total
Telecoms	7,678	690	4,141	12,509
SCADA	5,075	871	3,008	8,954
Protection (NDME/PQA)	1,226	28	173	1,427
Connection Point Monitoring/Control	0	0	3,877	3,877
TOTAL (Nom, MPhp)	13,979	1,589	11,198	26,767

Table 13.2 CAPEX Proportion by Region

Region	Replenishments	Rehab/Upgrades	Expansions	Total
Luzon	5,516	525	4116	10,157
Visayas	4,088	662	3,006	7,756
Mindanao	4,376	402	4,076	8,854
TOTAL (Nom, MPhp)	13,979	1,589	11,198	26,767

Table 13.3: Telecom Projects According to Nature of Facilities

Telecom Facilities	Luzon	Visayas	Mindanao	Total
Fiber Optics and OPGW	1,930	1,144	2,301	5,375
Microwave Radio	296	201	274	770
Network Management and Synchronization	559	677	503	1,738
Teleprotection Equipment	138	107	118	364
WAN and Access Equipment	673	256	603	1,532
Power Supply and Auxiliary	787	439	836	2,062
Cyber Security	242	22	16	280
Mobile Radio Network	65	27	68	160
Test Equipment	69	65	94	228
TOTAL (Nom, MPhp)	4,759	2,938	4,812	12,509

Table 13.4: SCADA/EMS Projects Categorized by Component Function

SCADA/EMS Components	Luzon	Visayas	Mindanao	Total
SCADA	2,694	2,402	1,927	7,023
EMS Applications	45	7	69	121
Cyber Security	284	84	118	486
WAMS	409	439	528	1,376
TOTAL (Nom, MPhp)	3,432	2,932	2,642	9,006

13.4 Strategies

- **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 more efficient ones for the sake of improved performance and economics. Thus, the need to reduce and eventually end the acquisition of spares and maintenance support for the assets due for retirement and investing on their replacements, as follows:

Table 13.5 CAPEX Proportion by Function

Decreasing Functionality	Current Paradigm
▪ 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.
▪ 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.
▪ 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.
▪ 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.
▪ 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.
▪ 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.
▪ User owned telecommunication facilities to reach remote IPPs will be less favored especially when no tele-protection 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.
▪ 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.

- **Timing of Projects.** Given the interdependence of technology and infrastructure—as well as the role of organizational evolution adapting to market trend—on 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.

- **CAPEX Priorities**. As shown in the above schedule, 59% 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 because of transmission regulation, prevailing demand for pertinent applications shall be prioritized.

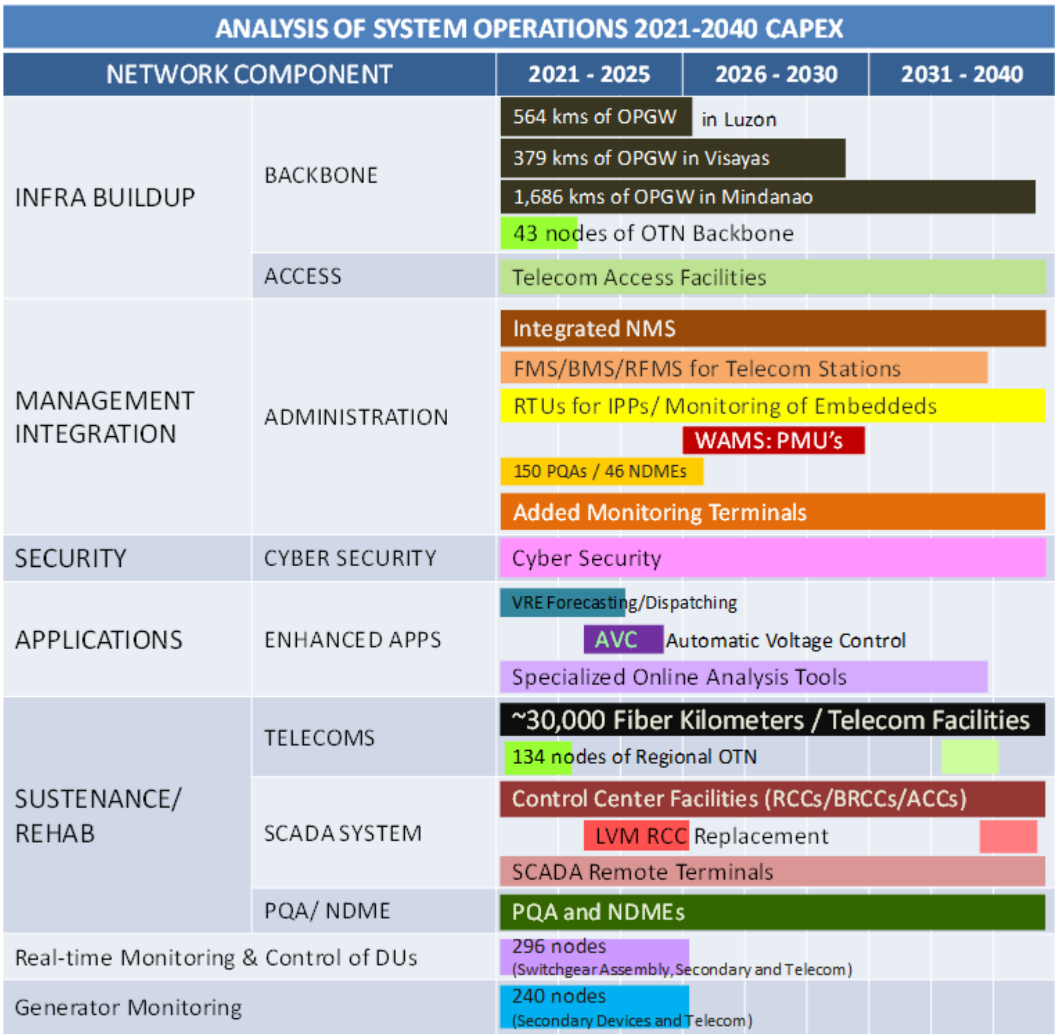

Figure 13.3: Analysis of SO 2021-2040 CAPEX

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.

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Table 13.6 CAPEX Summary

PROJECT LIST	5th REG					6th REG	7th REG	8th REG	TOTAL
	2021	2022	2023	2024	2025	2026-2030	2031-2035	2036-2040	2021-2040
iber Optic and Microwave Radio Equipment Replacement	23	10	59	385	382	410	1,401	166	2,834
eleprotection Equipment Replacement	21	18	30	19	15	71	122	69	364
Telecom Access and Remote Management Component Replacement	62	29	30	95	39	900	692	915	2,761
ower Supply and Auxiliary Equipment Replenishment	89	81	58	239	105	559	538	549	2,219
ifra and IT Support Facilities Replacement	68	100	77	87	123	761	367	361	1,944
CADA/EMS Facilities Replacement	44	86	375	873	236	1,352	377	849	4,192
DME and PQA Replacement	44	73	39	66	50	224	536	224	1,254
CADA Expansion—Added RTUs and Monitoring Points	106	24	13	70	50	131	135	105	633
Telecom Access for Added Locations, Subscribers and Application Points	40	82	12	41	33	76	44	41	370
iber Optic and Microwave Radio Expansion	519	351	128	133	239	888	578	402	3,238
ubmarine Fiber Optic Link	0	0	0	0	0	0	0	0	0
yber Security	96	49	48	168	107	204	70	24	766
etwork Synchronization System	0	0	0	0	0	0	0	0	0
Network and Facilities Management System and IT Support Facilities	56	193	76	21	20	154	70	55	645
MS Enhancements	2	0	0	0	0	17	85	17	121
/ide Area Measurement System (WAMS)	0	0	0	0	0	814	562	0	1,376
DME and PQA Expansion Program	52	22	57	7	0	8	25	4	173
lonitoring and Control of DUs	61	4	213	319	478	2,052	0	0	3,127
enerator Monitoring	0	0	0	365	153	232	0	0	750
TOTAL	1,282	1,121	1,213	2,888	2,029	8,852	5,602	3,779	26,767
	8,534								

13.5 Telecommunications

13.5.1 Fiber Optic Network Expansion

The following are diagrams for the 2023–2040 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 transmission lines programmed in this section:

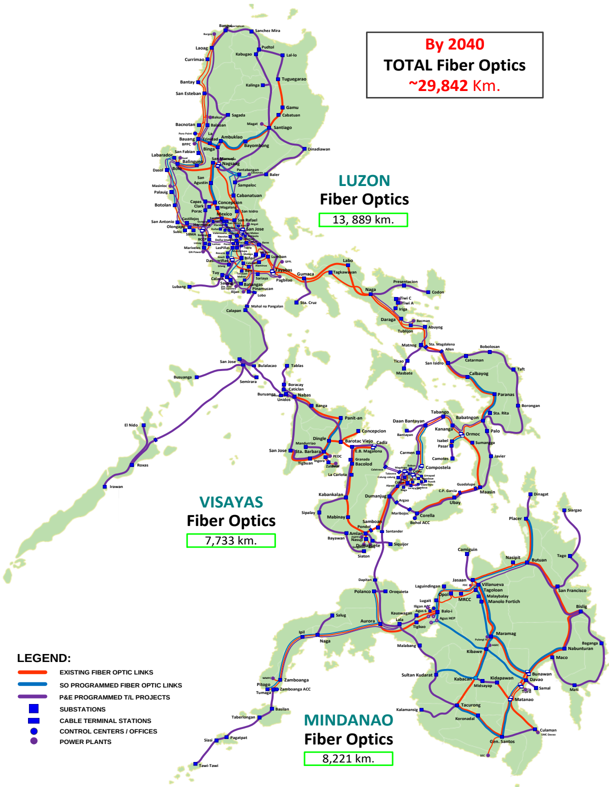

Figure 13.4: FO Network by 2040

13.5.1 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 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 networks 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.

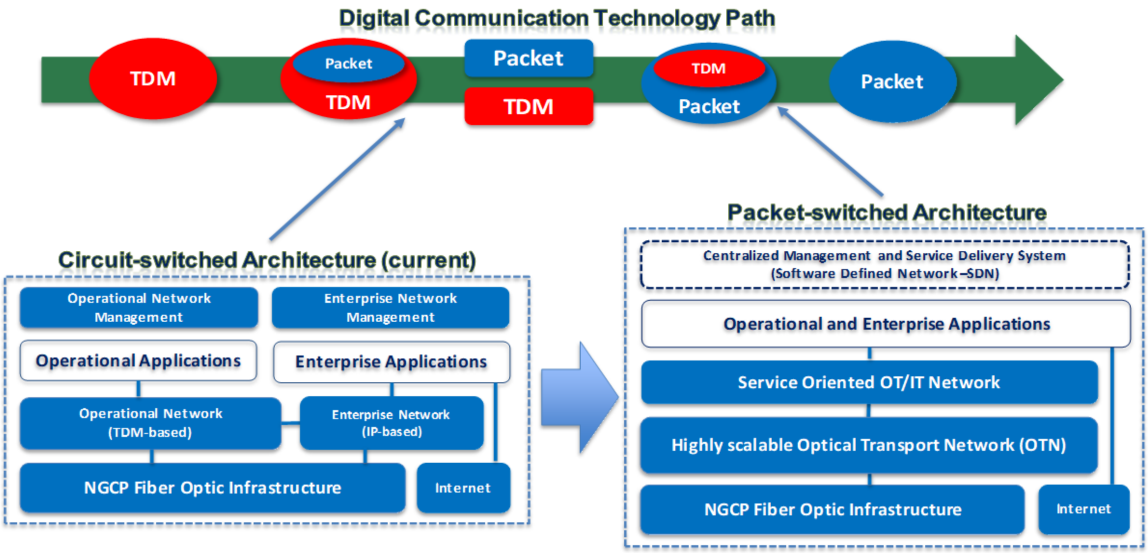

Figure 13.6: NGCP ICT Infrastructure Migration Path

13.5.2 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
- **SCADA/EMS** - Data monitoring/recording especially those from synchro phasor 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
- **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 has been 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 sync system shall continue to provide legacy timing protocols such as IRIG-B, 1PPS and 1PPM to old but functional network elements requiring such.

The installation of synchronization clocks at 138kV, 230kV and 500kV substations has been completed (refer to Appendix 6) and all network elements are currently being integrated for unified clock reference.

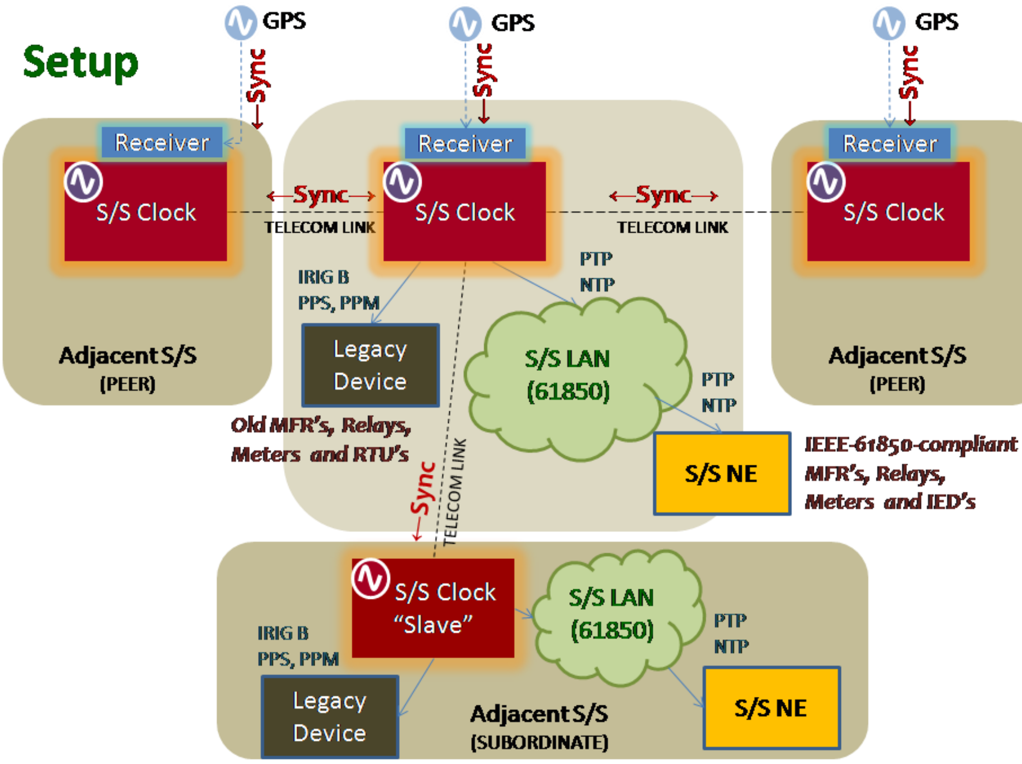

Figure 13.7: Synchronization Arrangement

13.6 SCADA Programs

13.6.1 National System Operations

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

The replacement of the near obsolete SCADA/EMS System should be timely in anticipation of the integration of the WESM operation among Luzon, Visayas and Mindanao to ensure continuous exchange of information between a unified SO and the Market Operator. The replacement/upgrade of SCADA/EMS for the three RCCs will realize the implementation of a National SO – the control center of which would be co-located with Luzon's. These replacement programs are harmonized with the implementation timeline of the MVIP towards the planned unification of the Philippine Grid against a nationwide resource-optimization objective.

The NSO would be responsible to carry out the following Grid-management lookouts:

- 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

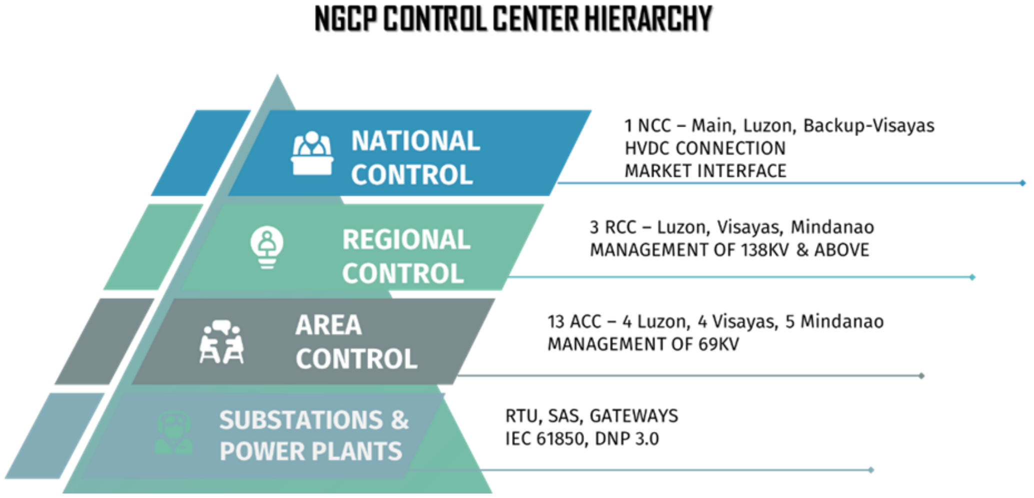

Figure 13.8: National System Operations Conceptual Framework

The backup RCC's would continue to operate using the existing platform in parallel operation with the upgraded SCADA-EMS systems to serve as redundant control center facilities for the purpose of business continuity.

13.6.2 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:

- 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.
  - Efficient dispatch means less cost of electricity.
- 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.
  - Greater bandwidth and less latency in IP communications afford access to more network elements, thereby facilitating greater control.
  - Improve Performance 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:

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

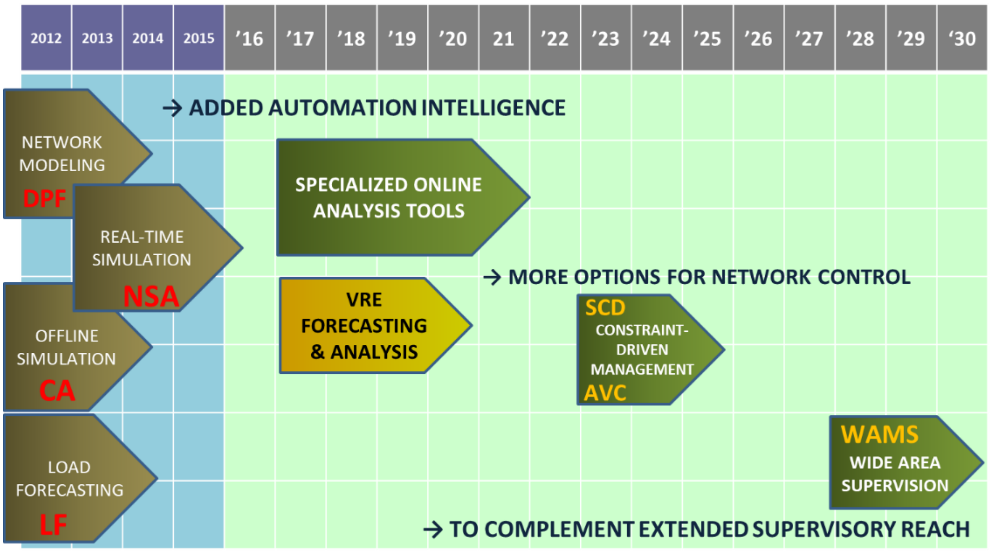

Figure 13.9: EMS Development Road Map

13.6.3 Cyber Security

As SCADA and SS automation systems increasingly play a vital role in NGCP as it works towards efficient operations, the need to protect these network elements from unauthorized access and threats becomes an increasingly significant task. The risks of security breaches are great if not attended to properly. Securing these systems, however, is not so simple: these systems are exposed at all times to access by a multitude of personnel and the need for data exchange with other systems requires interconnection to external networks. A comprehensive cyber-security system should be employed to address all possible threats to the system and cyber-security principles shall be considered in all aspects from planning and design to operations and maintenance.

The continuous cyber security implementation and improvement aims to enhance protection of NGCP's facilities from internal and external cyber threats and to prevent unauthorized access of SCADA facilities to ensure utmost degree of security for a more reliable power grid. This is also in compliance with the Department of Information and Communications Technology (DICT) National Cyber Security Plan 2022 wherein Critical Infostructure (CII), including the energy sector, should assure continuous operation and implement cyber resiliency measures to enhance the ability to respond to threats before, during, and after attacks.

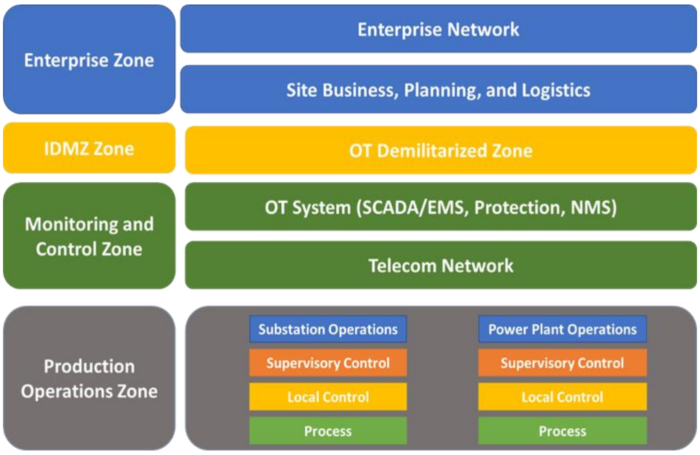

Figure 13.10: SO ICS Network Model based on layered security level

Figure 13.11: Cyber-Security Protection Layers

13.6.4 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.

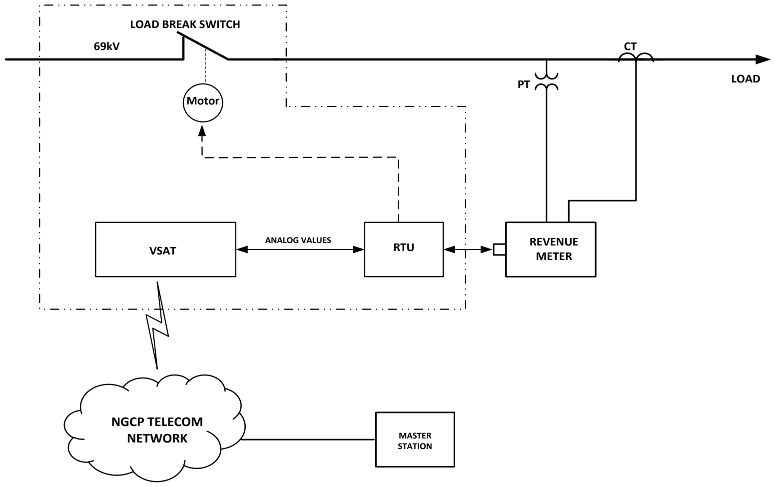

Figure 13.12: Connection Diagram for DUs

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.

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

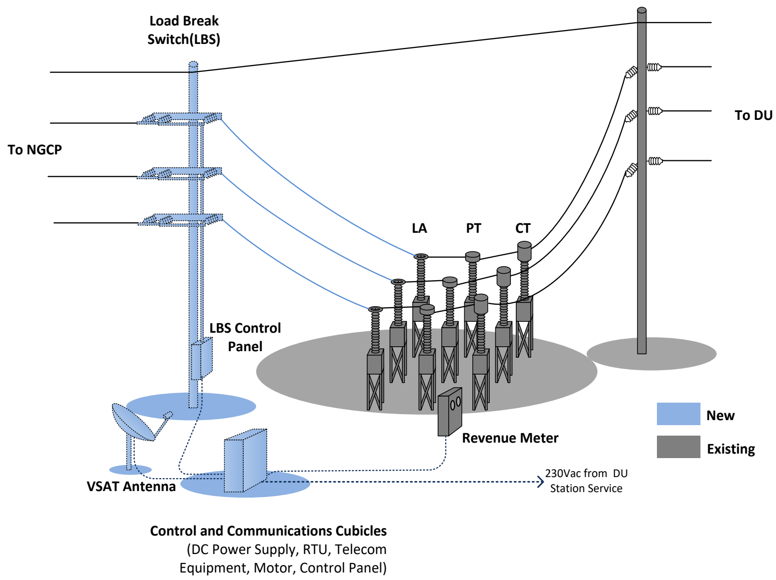

Figure 13.13: Physical Setup for DU Monitoring and Control

13.7 *Network Protection and Power Quality*

13.7.1 Network Disturbance Monitoring Equipment and Power Quality Analyzer Program

The undesired tripping of transmission lines and HVE 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 because 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.

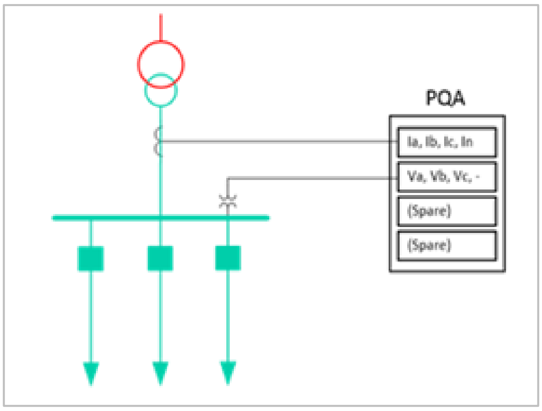

Figure 13.14: PQA installation at the secondary side of transformer

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 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 13.14. The use of portable PQAs for deeper investigation into the customer side would complement this arrangement.

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.

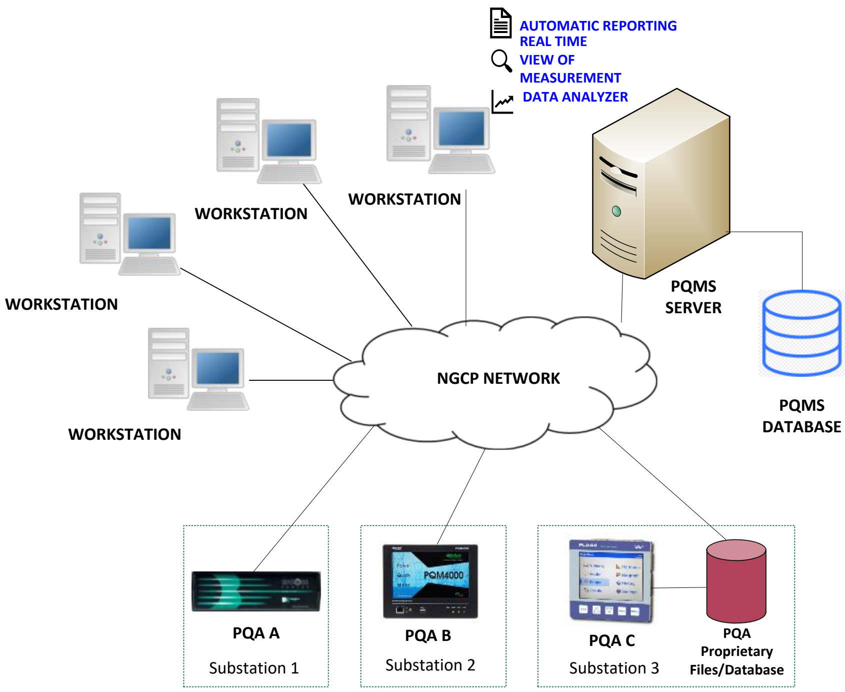

Figure 13.15: Proposed System Architecture

13.7.2 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 13.7 Overall Priority Table for Replay Replacement Program

Category of Replacement	Line Protection	Transformer Protection	Bus Protection	Breaker Fail Protection	Feeder Protection	Reactor Protection	Total
No Main 1	0	0	4	17	0	0	21
No Main 2	0	28	31	n/a	0	0	59
Non-Compliant	169	33	32	39	0	0	273
Obsolete	361	78	52	384	2	10	887
Defective	7	0	0	0	0	0	7
Total	537	139	119	440	2	10	1,247

APPENDICES

Appendix 1 – Ancillary Service Agreement Procurement Plan

a. Background: State of Ancillary Services (AS) in the Grid

As System Operator, NGCP determines the levels of AS 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 AS 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 every two 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 1 lists the plants with existing Ancillary Service Procurement Agreement (ASPA); Table 2 lists prospective AS providers not yet certified by NGCP.

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Table 1: Plants with existing ASPA

Regulating Reserve		
AS Provider	Firm (MW)	Non-Firm (MW)
Luzon Grid	**237**	**525**
PANASIA	60	300
SNAP - Magat	90	90
PSALM/NPC - KPSPP		90
MPPCL AES BESS	20	
PMPC	45	45
Visayas Grid	**40**	**50**
SPESCL-Kabankalan BESS	40	30
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
SNAP - Binga		136
SNAP - Magat	60	60
PSALM/NPC - KPSPP		85
Therma Luzon - Pagbilao	60	
First Gen - Pantabangan		54
Visayas Grid	56	86
SIPC - PDPP3		30
CEDC	30	30
PEDC	26	26
Mindanao Grid	0	297
PSALM/NPC - Agus 1		30
PSALM/NPC - Agus 2		30
PSALM/NPC - Agus 4		30
PSALM/NPC - Agus 5		35
PSALM/NPC - Agus 6		30
PSALM/NPC - Agus 7		16
PSALM/NPC - Pulangui 4		30
TMI (PB108)		48
TMI (PB108)		48

Dispatchable Reserve		
AS Provider	Firm (MW)	Non-Firm (MW)
Luzon Grid	**145**	**901**
PANASIA		80
SNAP - Magat		95
TAOEDC - One Subic		108
TAPGC - Bulacan DPP		48
PSALM/NPC - KPSPP		360
1590 EC		190
CIP II		20
Therma Mobile, Inc.		145
Visayas Grid	**83.8**	**120.4**
SIPC - PDPP1		5

Reactive Power Support
AS Provider
Luzon Grid
PANASIA
SNAP - Ambuklao
SNAP - Binga
SNAP - Magat
PSALM/NPC - KPSPP
First Gen - Pantabangan
APRI - MakBan A
APRI - MakBan B
Therma Luzon - Pagbilao
Therma Mobile, Inc.

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

SIPC - PDPP3		50
SIPC - BDPP	16	
PHINMA (PB101)		32
PPC - Nabas	6.8	
TPC - Carmen	40	
SIPC - PB104	21	7
CENPRI		26.4
Mindanao Grid	7.5	327.8
TMI (PB107)		98
TMI (PB108)		98
WMPC		100
KEGI 2 - Panaon		15.6
KEGI 3 - Jimenez		16.2

Pagbilao Energy Corp.
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
WMPC
KEGI 2 - Panaon
KEGI 3 - Jimenez

Mindanao Grid
PSALM/NPC - Pulangui 4
WMPC

Table 2: List of Prospective Ancillary Service Providers not yet certified by NGCP

Company	Power Plant	Remarks
Luzon Grid		
CE Casecnan Water & Energy Co.,Inc	Casecnan Units 1 and 2	For AS testing.
Pagbilao Energy Corporation	Pagbilao Unit 3	Certified for CR and RPS; With ASPA for RPS only.
GNPower Mariveles Co. Ltd.	Mariveles CFPP	Certified for CR but w/o ASPA.
Ingrid Power Holdings Inc.	Malaya Modular Diesel PP	Certified for RR, CR, DR, RPS but w/o ASPA.
Bac-Man Geothermal Inc. (BGI)	Bac-Man Units 1, 2 and 3	Certified for BSS but w/o ASPA.
Belgrove Power Corporation (BPC)	Malaya Thermal Plant	Not yet tested for AS
Giga Ace 4, Inc.	Alaminos BESS	AS tested; Certification not yet released pending completion of GCT
Universal Power Solutions, Inc.	San Manuel BESS	AS tested; Certification not yet released pending completion of GCT
GN Power Dinginin	Dinginin CFPP	AS testing completed
Universal Power Solutions, Inc.	Bataan BESS	For AS testing.
Universal Power Solutions, Inc.	Concepcion BESS	For AS testing.
Universal Power Solutions, Inc.	Gamu BESS	For AS testing.
Universal Power Solutions, Inc.	Lamao BESS	For AS testing.
Universal Power Solutions, Inc.	Magapit BESS	For AS testing.
Millennium Energy, Inc.	Gas Turbine Plant	Certified for RR, DR, RPS but w/o ASPA
Southwest Luzon Power Generation Corp.	SLPGC 3-GT 1 & SLPGC 4-GT 2	Certified for DR, RPS, BSS,but w/o ASPA.
First NatGas Power Corporation	San Gabriel Combined Cycle	Certified for RR but w/o ASPA
Visayas Grid		
Therma Visayas, Inc. (TVI)	TVI	Certified for CR and RPS but w/o ASPA.
Therma Power Visayas, Inc. (TPVI)	TPVI	Certified for DR, RPS, and BSS but w/o ASPA.
East Asia Utilities Corporation (EAUC)	EAUC	Certified for DR, RPS, BSS to expire 12/31/22
Cebu Private Power Corporation (CPPC)	CPPC	Certified for DR, RPS, BSS but w/o ASPA.
Green Core Geothermal Inc. (GCGI)	PGPP1	AS Accreditation is pending upon the completion of GCT.
Green Core Geothermal Inc. (GCGI)	TGPP	For AS testing.
Panay Power Corporation	PPC 1 and 2	PP1 – Certified for CR, DR, RPS, BSS to expire 11/30/22 PPC2 – Certified for DR, RPS to expire 11/30/22
Isabel Ancillary Services Co. Ltd.	Isabel Modular DPP	Certified for RR, CR and RPS but w/o ASPA.
Universal Power Solutions, Inc.	Ormoc BESS	For AS testing.
Universal Power Solutions, Inc.	Tabango BESS	For AS testing.
Universal Power Solutions, Inc.	Ubay BESS	Certified for RR, CR, RPS but w/o ASPA
Universal Power Solutions, Inc.	Toledo BESS	Certified for RR, CR but w/o ASPA
KEPCO SPC Power Corporation	KSPC Power Plant Units 1 & 2	Certified for RPS but w/o ASPA
Palm Concepcion Power Corporation	CFPP	Certified for RR but w/o ASPA
Panay Energy Dev. Corporation	Coal Fired Thermal Plant 3	Certified for RPS but w/o ASPA. With ASPA for PEDC 1 & 2
Mindanao Grid		

Company	Power Plant	Remarks
Therma Marine Inc. (TMI)	TMI Mobile 1 and 2	With ASPA for CR and DR. Certified for RPS (M1 & M2); Certified for BSS (M2).
GNPower Kauswagan Ltd. Co	Kauswagan Power Plant	Certified for CR but w/o ASPA.
Therma South Inc. (TSI)	TSI CFPP	Certified for CR but w/o ASPA.
King Energy Generation Inc. (KEGI)	KEGI Tandag	ASPA for DR pending issuance of PA by ERC.
Universal Power Solutions, Inc. (UPSI)	Malita BESS	Certified for RR and CR.
Universal Power Solutions, Inc.	Jasaan BESS	For AS testing.
Universal Power Solutions, Inc.	Villanueva BESS	For AS testing.
Universal Power Solutions, Inc.	Maco BESS	Certified for RR and CR but w/o ASPA
Fort Pilar Energy, Inc.	Pitogo BESS	
Fort Pilar Energy, Inc.	Sangali BESS	
Southern Philippines Power Corporation	Diesel Power Plant	Previously certified for DR, RPS, BSS – expired 2019

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.

Consistent with the Department of Energy's instruction to NGCP to fully contract all AS capacities with Firm Contracts, NGCP plans to convert all existing non-firm contracts to firm contracts through a public bidding and subsequent procurement will be through DOE's Competitive Selection Process (CSP). In the event that the reserve market will be operational, NGCP will procure all additional capacities required to fulfill all the required levels of AS in case the contracted capacities are insufficient.

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 2 – Generation and Load Distribution Per Area as of Feb 2023

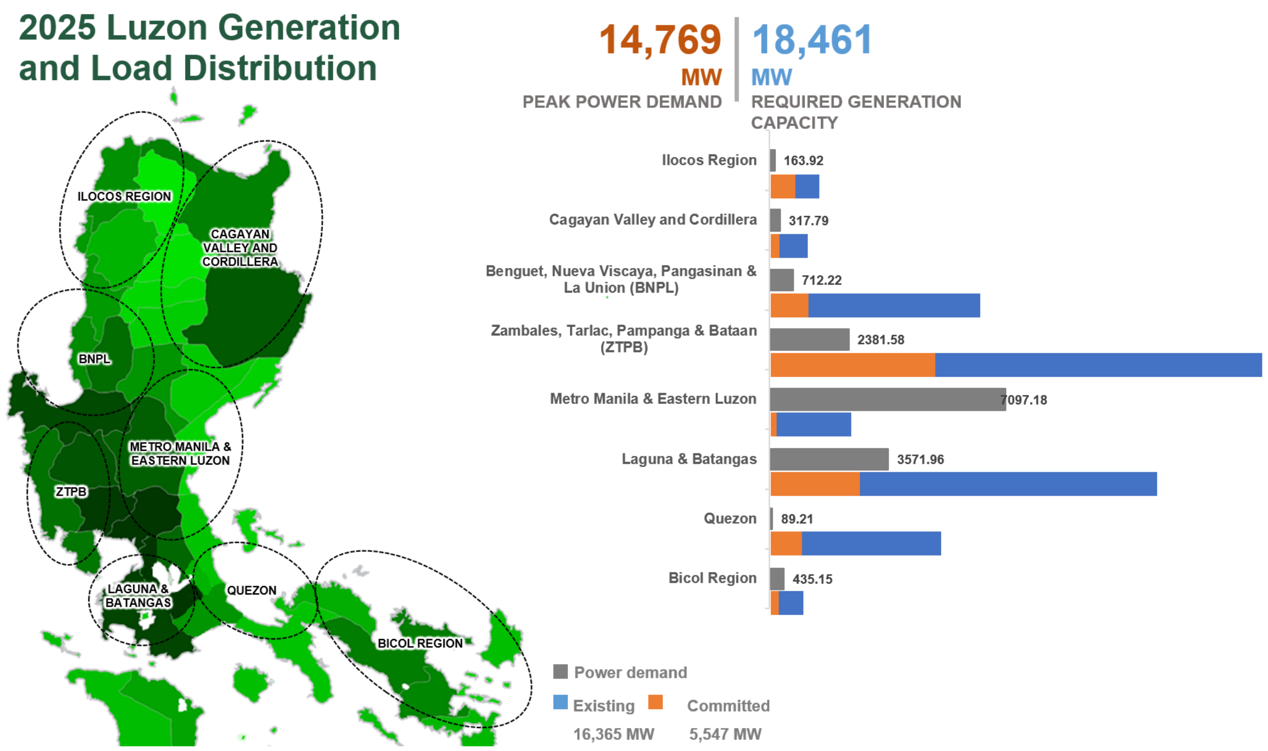

Figure 1 – Projected Luzon Grid Generation and Load Distribution in 2025

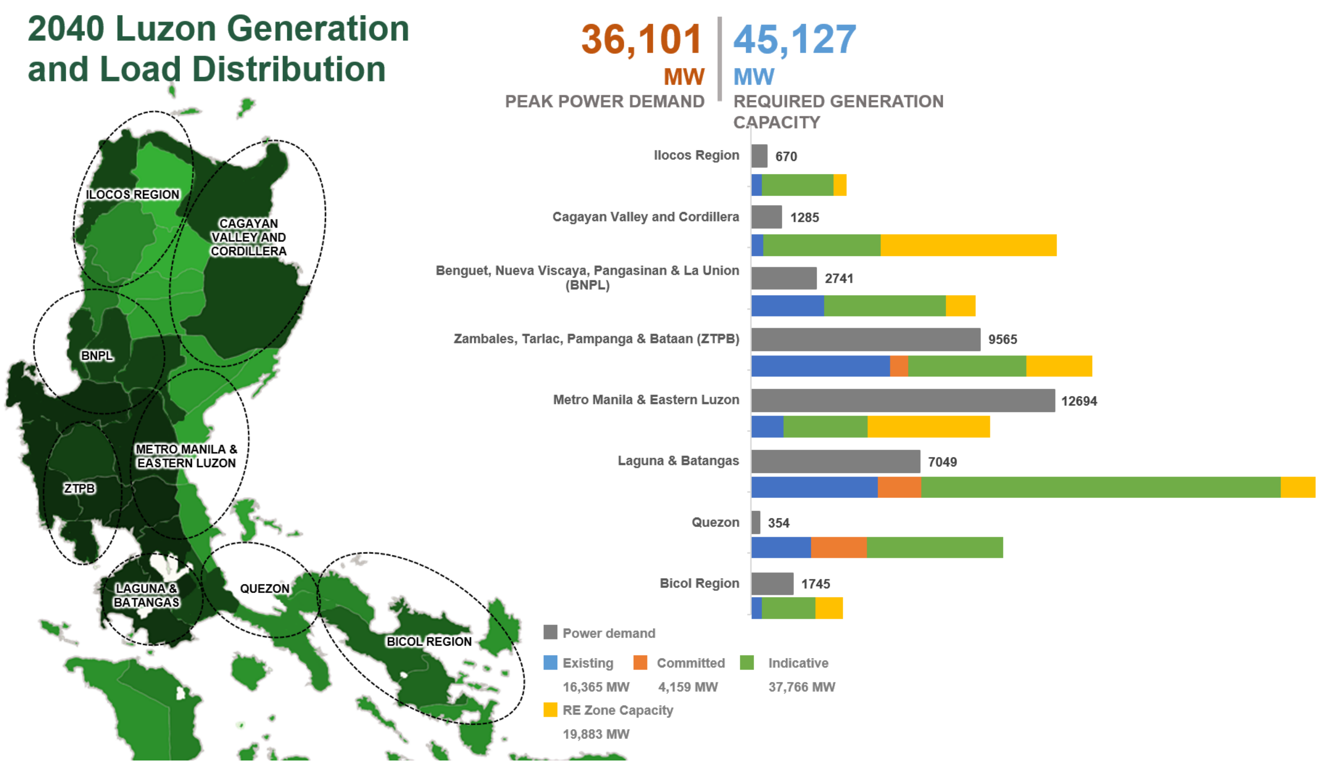

Figure 2 – Projected Luzon Grid Generation and Load Distribution in 2040

2025 Visayas Generation and Load Distribution

3,111 MW PEAK POWER DEMAND | **4,139 MW** GENERATION CAPACITY

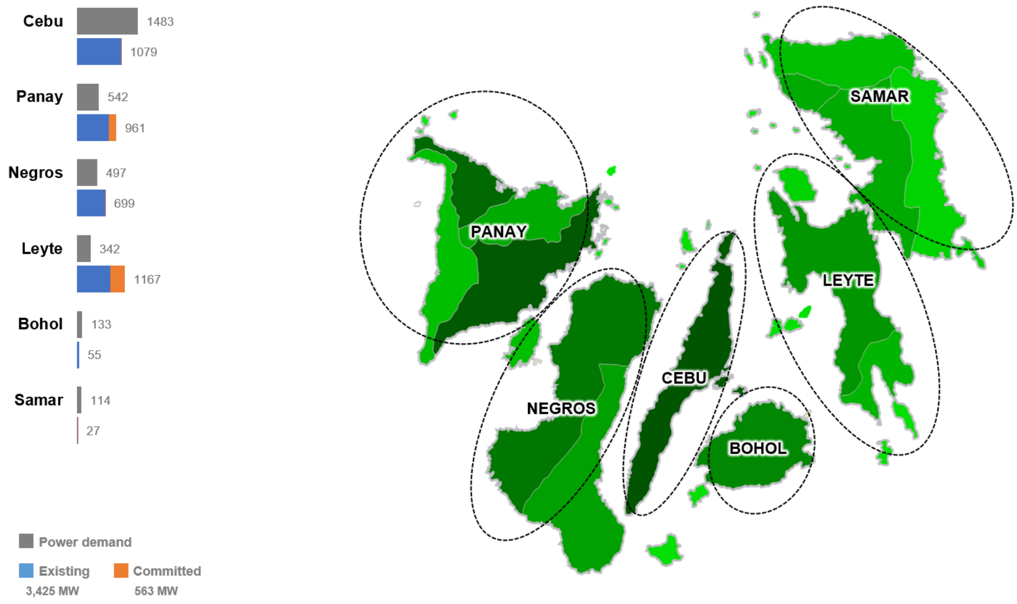

Figure 3 – Projected Visayas Grid Generation and Load Distribution in 2025

2040 Visayas Generation and Load Distribution

8,827 MW PEAK POWER DEMAND | **11,034 MW** GENERATION CAPACITY

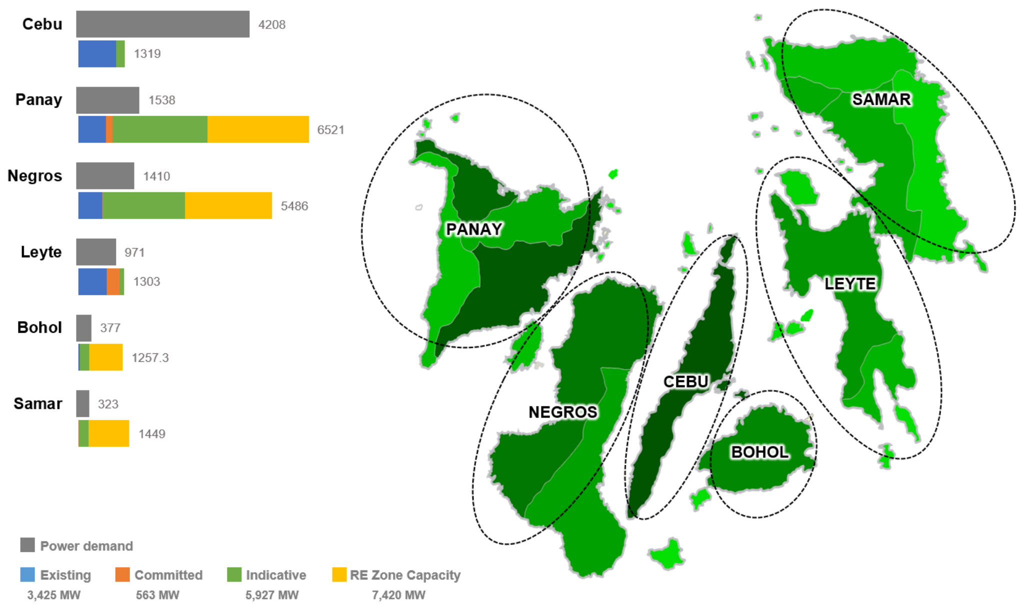

Figure 4 – Projected Visayas Grid Generation and Load Distribution in 2040

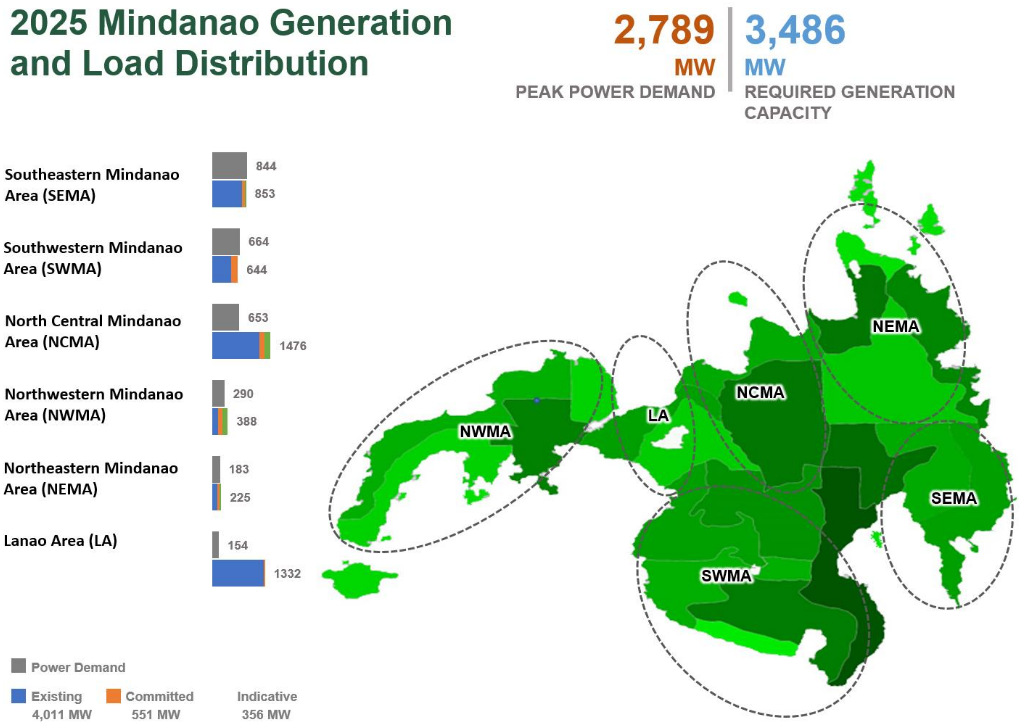

Figure 5 – Projected Mindanao Grid Generation and Load Distribution in 2025

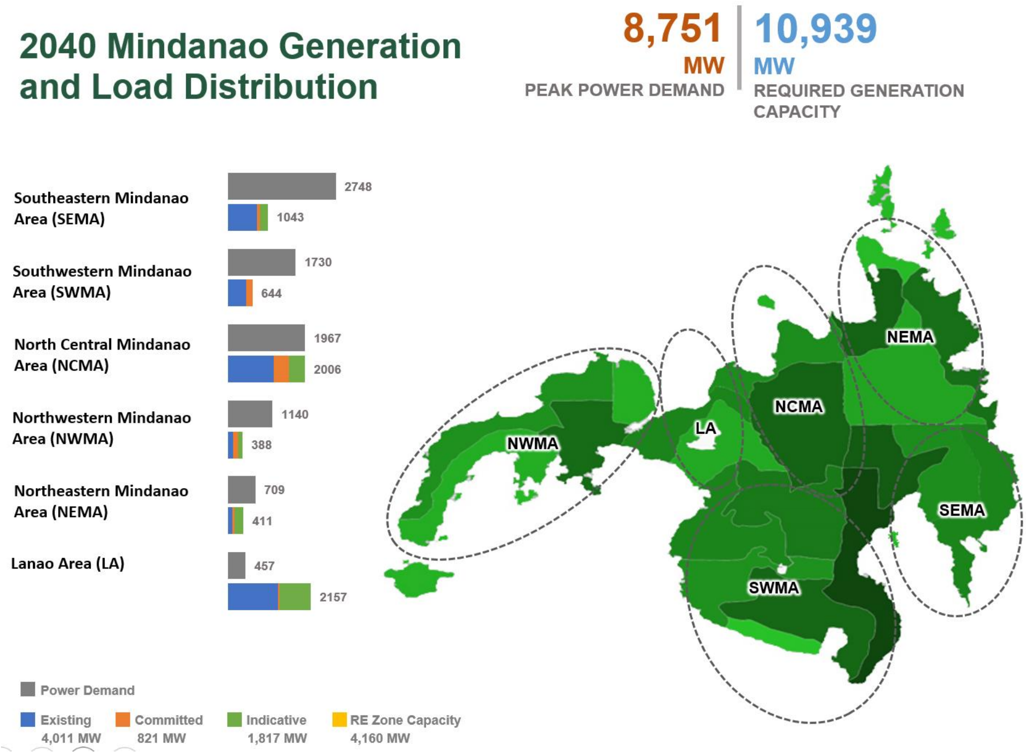

Figure 6 – Projected Mindanao Grid Generation and Load Distribution in 2040

Appendix 3 – Prospective Power Plants

Proponent	Projects	Installed Capacity (MW)	Year of Entry	Location
Luzon				
2 Barracuda Energy Corporation (2BEC)	Bay Floating SPP Project	150	2024	San Benito, Bay, Laguna
3 Barracuda Energy Corp	Currimao Energy Storage Project	50	2022	Currimao, Ilocos Norte
5 Barracuda Energy Corporation (5BEC)	Laguna Lake - Los Banos SPP Project	300	2024	
CELL Power Energy Corporation (CPEC)	Labo Energy Storage Project	±20	2024	
JBD Management and Consulting Services, Inc	Pakil Pumped Storage HEPP	S350		Pakil, Laguna
Matuno River Development	Matuno River HEPP	8.661		Bambang, Nueva Vizcaya
Pristine Green Fuel Solutions Corp. (PGFSC)	Sunshine SPP Project	10 MW	2023	
Rizal Wind Energy Corp. (RWEI)	Real WPP Phase 1 Project	45	2023	
Rizal Wind Energy Corp. (RWEI)	Real WPP Project Phase 2	205	2024	
Rizal Wind Energy Corp. (RWEI)	Real WPP Project Phase 3	250	2025	
Sindicatum C-Solar Power Inc. (SCSPI)	Capas SPP Project	31.25	2024	
Solar Philippines Commercial	SM City Tuguegarao SPP Project	5		Tuguegarao, Cagayan
Solar Philippines Tanauan	Maragondon 1 SPP Project	1200		Maragondon, Cavite
Solar Philippines Commercial Rooftop Project, Inc. (SPCRPI)	Botolan Hybrid Power Plant Project	300	2023	
Solar Philippines Commercial Rooftop Projects, Inc. (SPCRPI)	Sta. Rosa Nueva Ecija 3 SPP Project	1200		Sta. Rosa and Cabanatuan City, Nueva Ecija
Solar Philippines Commercial Rooftop Projects, Inc. (SPCRPI)	General Santos SPP Project	1200		General Santos, South Cotabato
Solar Philippines Commercial Rooftop Projects, Inc. (SPCRPI)	Padre Garcia SPP Project	1200		Lipa and Padre Garcia Batangas
Solar Philippines Commercial Rooftop Project, Inc. (SPCRPI)	Calamba Hybrid Power Plant Project	600	2025	
Solar Philippines Commercial Rooftop Project, Inc. (SPCRPI)	Iba-Palauig Hybrid Power Plant Project	1200	2025	
Solar Power Utilities Generator Corporation (SPUGC)	Bato SPP Project	45	2023	
Sunwest Water and Electric Co.	Daraga Ancillary Reserve Diesel Power Plant	50		Daraga, Albay
Sunwest Water and Electric Co.	Kiwalo DPP	100		Kiwalo, Daraga, Albay
Sunwest Water and Electric Co.	Namantao DPP	50		Daraga, Albay
Excellent Energy Resources Inc.	Ilijan Natural Gas Fired Plant Project	1,200		Brgy. Dela Paz Proper, Batangas City
Greencore Power Solutions 3, Inc.	Arayat SPP Project	60		Arayat and Mexico, Pampanga
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.	Concepcion	40		Brgy. Sta. Rosa, Concepcion, Tarlac
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
VISAYAS				
Cell Power Energy Corp.(CPEC)	Padayon BESS	±20	2023	Cebu City, Cebu
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				
SMC Global Power Corporation (SMGPC)	Villanueva BESS	20		Villanueva, Misamis Oriental
SMC Global Power Corporation (SMGPC)	Malita BESS	20		Malita, Davao Occidental

Appendix 4 – Private Sector Initiated Power Projects

Table 1: Private Sector Initiated Power Projects in Luzon as of 28 February 2023

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
COMMITTED POWER PLANTS			
COAL			
Mariveles CFPP* Phase I - Units 1	150	Mariveles, Bataan	Aug 2023
Phase I - Unit 2	150	Mariveles, Bataan	Sep 2023
Phase I- Unit 3	150	Mariveles, Bataan	Jan 2024
Phase I - Unit 4	150	Mariveles, Bataan	May 2024
Phase II - Unit 5	150	Mariveles, Bataan	Dec 2025
Phase II - Unit 6	150	Mariveles, Bataan	Mar 2026
Phase II- Unit 7	150	Mariveles, Bataan	Jun 2026
Phase II - Unit 8	150	Mariveles, Bataan	Sep 2026
Masinloc Power Plant - Unit 4*	350	Masinloc, Zambales	Jun 2025
- Unit 5*	350	Masinloc, Zambales	Dec 2025
A1E CFPP - Unit 1*	668	Brgy. Villa Ibaba, Atimonan, Quezon Province	TBD
A1E CFPP - Unit 2*	668	Brgy. Villa Ibaba, Atimonan, Quezon Province	TBD
Refinery Solid Fuel-Fired Boiler Project - Phase 3*	44.4	Brgy. Alangan, Limay, Bataan	Mar 2023
Sub-Total Coal	**3,280.4**		
OIL-BASED			
11.04 MW Capas Bunker C-Fired DPP*	11.04	Brgy. Sto. Rosario, Capas, Tarlac	Jun 2023
Sub-Total Oil-based	**11.04**		
NATURAL GAS			
Energy World Corporation 650 MW Gas Fired CCPP*	650	Brgy. Ibabang Polo, Grande Island, Pagbilao, Quezon	TBD
Batangas CCPP - Phase 1, Unit 1*	437.5	Brgy. Dela Paz Proper, Batangas City	Sep 2024
Batangas CCPP - Phase 1, Unit 2*	437.5	Brgy. Dela Paz Proper, Batangas City	Sep 2024
Batangas CCPP - Phase 1, Unit 3*	437.5	Brgy. Dela Paz Proper, Batangas City	Dec 2024
Batangas CCPP - Phase 2	437.5	Brgy. Dela Paz Proper, Batangas City	TBD
BCEI Natural Gas-Fired Power Plant	1,100	Brgys. Libjo and Malitam, Batangas City	Jan 2027
Sub-Total Natural Gas	**3,500**		
GEOTHERMAL			
Palayan Binary Power Plant*	29	Brgy. Nagotgot, Manito, Albay	Jun 2023
Tanawon GPP*	20	Brgy. Capuy, Sorsogon City	Dec 2024
Tiwi Binary Geothermal Project	17	Tiwi, Albay	Dec 2023
Sub-Total Geothermal	**66**		
HYDROELECTRIC			
Biyao HEPP	0.8	Balbalan, Kalinga	Dec 2023
Colasi HEPP	4	Mercedes, Camarines Norte	Apr 2023
Matuno HEPP*	8.66	Bambang, Nueva Vizcaya	Apr 2023
Laguio (Laginbayan) Malaki 1 HEPP	1.6	Mauban, Quezon	Aug 2023
Mariveles HEPP	0.6	Mariveles, Bataan	Mar 2023
Ibulao HEPP*	4.5	Lagawe, Ifugao	Apr 2023
Labayat River (Lower Cascade) HEPP*	1.4	Real, Quezon	May 2023
Lalawinan HEPP*	3	Real, Quezon	Dec 2024
Tibag HEPP*	5	Real, Quezon	May 2023
Rangas HEPP	2.4	Goa & Tigaon, Camarines Sur	Dec 2025
Dupinga HEPP	4.8	Gabaldon, Nueva Ecija	Jul 2023
Kapangan HEPP*	60	Kapangan and Kibungan, Benguet	Dec 2025
Tignoan River (Upper Cascade) HEPP*	1.5	Real, Quezon	Dec 2025
Daet HEPP	5	Daet, Camarines Norte	Dec 2025
Tubao HEPP	1.5	Tubao, La Union	Dec 2025
Likud 2 HEPP	0.56	Asipulo, Ifugao	Jul 2023
Asin-Hungduan HEPP	9.8	Kiangan, Ifugao	Jun 2024
Ibulao 1 HEPP	7.6	Kiangan, Ifugao	Apr 2023
Dipalo HEPP	4.15	San Quintin, Pangasinan	Dec 2025

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Sablan 1 HEPP	20	Sablan, Benguet	Nov 2025
Sub-Total Hydro	**146.87**		
BIOMASS			
Isabela Rice Husk-Fired BPP Project	5	Isabela	May 2023
FEAC Biogas Power Plant Project	2.4	Apalit, Pampanga	Aug 2023
FQBC Biogas Power Plant Project	1.2	Candelaria, Quezon	Jan 2024
Sub-Total Biomass	**8.6**		
SOLAR POWER PROJECT			
Concepcion 1 SPP - Phase 3	33.34	Concepcion, Tarlac	May 2023
•Phase 4	108.4	Concepcion, Tarlac	May 2023
Concepcion Tarlac 2 SPP	171.6	Concepcion and Tarlac City, Tarlac	Dec 2025
Ilocos Norte SPP*	87.594	Burgos, Ilocos Norte	Apr 2023
Cayanga-Bugallon SPP*	75.088	Bugallon, Pangasinan	May 2023
Raslag III Solar PV Power Project	13.6	Mabalacat, Pampanga	May 2023
Lal-lo Hybrid SPP	82.488	Lal-lo and Gattaran, Cagayan	Sep 2023
Pinugay SPP	67.5	Baras, Rizal	Apr 2023
Arayat-Mexico SPP - Phase 2	30.933	Arayat, Mexico, Pampanga	Apr 2023
Currimao SPP	48.118	Currimao, Ilocos Norte	Jun 2023
PAVI Green Naga SPP Project	40.4	Naga City, Camarines Sur	Dec 2024
Bulacan 2 SPP*	17.603	Brgy. Casalat & Brgy. Pasong Bangkal, San Ildefonso, Bulacan	May 2023
Talugtug SPP	99.98	Talugtug, Nueva Ecija	Mar 2025
Concepcion Tarlac 2 SPP	200	Concepcion and Tarlac City, Tarlac	Dec 2025
Santa Rosa Nueva Ecija 2 SPP - Phase 1A		Penaranda, Nueva Ecija	
- Phase 1B	108.4	Penaranda, Nueva Ecija	
- Phase 2	171.6	Penaranda, Nueva Ecija	
Tayabas SPP	450	Tayabas, Pagbilao	Dec 2025
San Marcelino SPP - Phase 1	224	San Marcelino, Zambales	Aug 2023
•Phase 2	80	San Marcelino, Zambales	Aug 2023
Sapang Balen Solar 1 PP	96.236	Mabalacat City, Pampanga	Dec 2025
Sapang Balen Solar 2 PP- Phase 1	92.799	Mabalacat City and Magalang, Pampanga and Concepcion, Tarlac	Dec 2024
- Phase 2	92.799	Mabalacat City and Magalang, Pampanga and Concepcion, Tarlac	Dec 2024
- Phase 3	92.799	Mabalacat City and Magalang, Pampanga and Concepcion, Tarlac	Dec 2025
- Phase 4	92.799	Mabalacat City and Magalang, Pampanga and Concepcion, Tarlac	Jun 2025
- Phase 5	92.799	Mabalacat City and Magalang, Pampanga and Concepcion, Tarlac	Dec 2026
Sub-Total Solar	**2,432.883**		
WIND			
Caparispisan II WPP	70	Pagudpud, Ilocos Norte	Mar 2024
Calatagan WPP	30	Calatagan, Lian, Batangas	Dec 2025
Balaoi and Caunayan WPP Project - Phase 1	80	Pagudpud, Ilocos Norte	May 2023
- Phase 2	30	Pagudpud, Ilocos Norte	Aug 2023
•Phase 3	25	Pagudpud, Ilocos Norte	Jan 2024
•Phase 4	25	Pagudpud, Ilocos Norte	Dec 2025
Sub-Total Wind	**260**		
BATTERY			
Lamao BESS	20	Brgy. Lamao, Limay, Bataan	Jul 2023
Lamao Phase 2 BESS	30	Brgy. Lamao, Limay, Bataan	Jul 2023
BCCP Limay BESS Project	40	BCCPP, Limay, Bataan	Jul 2023
San Manuel BESS*	20	San Manuel, Pangasinan	Jul 2023
San Manuel BESS Phase 2*	30	San Manuel, Pangasinan	Jul 2023
Gamu BESS*	20	Gamu, Isabela	Jul 2023
Gamu BESS Phase 2*	20	Gamu, Isabela	Jul 2023

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Magapit BESS*	20	Magapit, Cagayan	Jul 2023
Magapit BESS Phase 2*	20	Magapit, Cagayan	Jul 2023
Concepcion BESS*	20	Concepcion, Tarlac	Jul 2023
Concepcion BESS Phase 2*	30	Concepcion, Tarlac	Jul 2023
Lumban BESS*	40	Lumban, Laguna	Jul 2023
Lumban BESS Phase 2*	20	Lumban, Laguna	Jul 2023
Mexico BESS*	50	Mexico, Pampanga	Aug 2023
Mexico BESS Phase 2*	20	Mexico, Pampanga	Aug 2023
Mahabang Parang BESS	40	Mahabang Parang, Batangas	Dec 2023
Daraga BESS Project	40	Daraga, Albay	Jan 2024
Bauang BESS*	40	Bauang, La Union	Sep 2023
Labrador BESS Project	40	Labrador, Pangasinan	Sep 2023
San Rafael BESS*	20	San Rafael, Bulacan	Sep 2023
Cabanatuan BESS	40	Cabanatuan, Nueva Ecija	Sep 2023
Hermosa BESS Project	40	Hermosa, Bataan	Sep 2023
Laoag BESS Project*	40	Laoag, Ilocos Norte	Sep 2023
Navotas BESS Project*	40	Navotas, Metro Manila	Sep 2023
Mexico SJM BESS	20	Barangay San Jose Matulid, Mexico, Pampanga	Sep 2023
Magat BESS	24	Ramon, Isabela	Mar 2024
Pagbilao BESS	40	Pagbilao, Quezon	Sep 2024
Bacnotan BESS Project	40	Brgy. Cabugao, Bacnotan, La Union	Sep 2024
Subic BESS Project	40	Sitio Agusuhin, Cawag, Subic, Zambales	Sep 2024
San Jose del Monte BESS Project	40	Brgy. San Jose del Monte City, Bulacan	Sep 2024
Bolo BESS Project	40	Brgy. Bolo, Labrador, Pangasinan	Sep 2024
Tuguegarao BESS Project	40	Brgy. Libag Norte, Tuguegarao City, Cagayan	Sep 2024
Bayombong BESS Project	40	Brgy. Busilac, Bayombong, Nueva Vizcaya	Sep 2024
Calamba BESS Project	40	Brgy. Prinza, Calamba, Laguna	Sep 2024
Labo BESS Project	40	Brgy. Mahawan-hawan, Labo, Camarines Norte	Jul 2024
Naga BESS Project	40	Brgy. Del Rosario, Naga, Camarines Sur	Jul 2024
San Rafael BESS Phase 2	20	San Rafael, Bulacan	Mar 2025
Sual BESS	60	Sual, Pangasinan	Mar 2025
Urdaneta BESS	40	Urdaneta, Pangasinan	Mar 2025
Dasmarinas BESS	40	Dasmarinas, Cavite	Mar 2025
Ilijan BESS Project	40	Ilijan, Batangas	Mar 2025
Gumaca BESS Project	40	Brgy. Progreso, Gumaca, Quezon	Mar 2025
La Trinidad BESS Project	40	Beckel, La Trinidad, Benguet	Mar 2025
BCCP Limay BESS Project Phase 2	20	BCCPP, Limay, Bataan	Mar 2025
Angat BESS Project*	20	Angat, Bulacan	Mar 2025
Sub-Total BESS	1,504		
TOTAL COMMITTED	11,209.793		
TOTAL COMMITTED W/O BESS	9,705.793		

* with SIS

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
INDICATIVE POWER PLANTS			
COAL			
H & WB PCB Supercritical CFPP - Unit 1*	350	Jose Panganiban, Camarines Norte	TBD
SRPGC CFPP Project*	350	Brgy. San Rafael, Calaca, Batangas	TBD
SRPGC CFPP Project*	350	Brgy. San Rafael, Calaca, Batangas	TBD
H & WB PCB Supercritical CFPP - Unit 2*	350	Jose Panganiban, Camarines Norte	TBD
Sub-Total Coal	1,400		
OIL-BASED			
Kiwalo Ancillary Reserve DPP*	100	Brgy. Kiwalo, Daraga, Albay	Aug 2023
Namantao Ancillary Reserve DPP*	50	Brgy. Namantao , Daraga, Albay	Aug 2023
Malaya 2 x 30 DPP	60	Malaya, Pililla, Rizal	Dec 2023

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Sub-Total Oil-Based	**210**		
NATURAL GAS			
Mariveles Gas to Power Project (Mariveles LNG)*	1,200	Brgy. Biaan, Mariveles, Bataan	Jun 2027
GNPower Sisiman LNG CCPP	1,200	Barangays Alas-asin and Sisiman, Mariveles, Bataan	Dec 2028
LNG-Fired CCPP	1100	Barangays Nalvo Sur and Carisquis, Luna, La Union	2023
Combined Cycle Gas-fired Turbine San Francisco Power Plant	1,200	Barangays Cagsiay 1 and Cagsiay 2, Mauban, Quezon Province	2026
VIRES Natural Gas Floating Power Plant	450	Barangay Simlong, Batangas City, Batangas	Mar 2026
Quezon CCPP	1,200	Barangay Laurel, Tagkawayan, Quezon	Dec 2026
Pagbilao 4 & 5 CCGT Power Plant	1,310	Barangay Ibabang Polo, Pagbilao Quezon	Nov 2028
Sub-Total Natural Gas	**8,920**		
GEOTHERMAL			
Maibarara3 GPP	20	Laguna/Batangas	2025
Bacman 4 Botong - Rangas GPP	20	Bacon District, Sorsogon, Sorsogon City	2026
Kayabon GPP	30	Manito, Albay	2026
Kalinga GPP - Phase 1*	40	Lubuagan, Pasil and Tinglayan, Kalinga	2027
Kalinga GPP - Phase 2*	40	Lubuagan, Pasil and Tinglayan, Kalinga	2029
Kalinga GPP - Phase 3*	40	Lubuagan, Pasil and Tinglayan, Kalinga	2031
Sub-Total Geothermal	**190**		
HYDRO			
ARIIS 1 (NIA Station 4+283) HEPP	0.90	San Manuel, Pangasinan	2025
ARIIS 2 (NIA Stn 5+437.50) HEPP	0.75	San Manuel, Pangasinan	2025
ARIIS 3 (NIA Stn 5+898.50) HEPP	0.50	San Manuel, Pangasinan	2025
ARIIS 4 (Stn 4+808) HEPP	0.67	San Manuel, Pangasinan	2025
Bacolan HEPP	3	San Clemente, Tarlac & Mangatarem, Pangasinan	2025
Boga HEPP	1	Bauko, Mt. Province	2025
Coto 2 HEPP*	3.5	Masinloc, Zambales	2025
Camiling River 3 HEPP	4.2	Mayantoc, Tarlac	2025
Ilaguen HEPP*	19	San Mariano & San Guillermo, Isabela	2025
Matuno 1 HEPP*	7.4	Ambaguio, Nueva Vizcaya	2025
Lower Chico HEPP	2.1	Bauko, Mt. Province	2025
Upper Chico HEPP	2	Bauko, Mt. Province	2025
Lower Siffu HEPP	3	Natonin, Mt. Province	2025
Upper Siffu HEPP	2.75	Natonin, Mt. Province	2025
Piapi River HEPP	4.5	Real, Quezon	2025
Pampang HEPP*	26	Sta. Fe Nueva Vizcaya	2025
Tublay 3 HEPP	1	Tublay, Benguet	2025
Tumauini (Upper Cascade) HEPP	11.3	Tumauini, Isabela	2025
Camiling 1 HEPP	7	Mayantoc, Tarlac	2026
Coto 1 HEPP*	9	Masinloc, Zambales	2026
Ibulao 2 HEPP*	7.4	Kiangan, Ifugao	2026
Kabayan 2 HEPP*	52	Kabayan, Benguet	2026
Matuno 2 HEPP*	15	Ambaguio, Nueva Vizcaya	2026
Matuno 2 HEPP*	7.9	Bambang, Nueva Vizcaya	2026
Tinoc 1 HEPP	3	Tinoc, Ifugao	2026
Tinoc 2 HEPP	6.5	Tinoc, Ifugao	2026
Tinoc 3 HEPP	5	Tinoc, Ifugao	2026
Tublay 2 HEPP	1	Tublay, Benguet	2026
Olilicon HEPP*	20	Ilagan, Ifugao	2026
Tinglayan HEPP	22.5	Tinglayan, Kalinga	2026
Ilaguen 2 HEPP*	14	Echague, Isabela	2026
Alimit HEPP*	120	Lagawe, Ifugao	2026
Nabuangan River HEP	10	Conner, Apayao	2026
Tamdangan HEPP	7.4	Vintar, Ilocos Norte	2026
Tamdangan 2 HEPP	5.15	Vintar, Ilocos Norte	2026
Kennon HEPP	5	Tuba, Benguet	2026
Camiling 2 HEPP	4	Mayantoc, Tarlac	2027

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Chico River HEPP*	52	Tabuk, Kalinga	2027
Chico HEPP	150	Tabuk, Kalinga	2027
Lamut HEPP*	6.8	Asipulo, Ifugao	2027
Pakil Pumped Storage HEPP	1,400	Itogon, Benguet	2027
Pasil B HEPP	15.684	Pasil, Kalinga	2027
Pasil C HEPP	9.754	Pasil, Kalinga	2027
Pinacanauan River HEPP	6	Peñablanca, Cagayan	2027
Wawa Pumped Storage 1 HEPP*	500	Rodriguez, Rizal	2027
Wawa Pumped Storage 2 HEPP	100	Rodriguez, Rizal	2027
Wawa Pumped Storage 3 HEPP	50	Rodriguez, Rizal	2027
Aya Pumped Storage HEPP	120	Pantabangan, Nueva Ecija	2028
Alimit-Pumped Storage HEPP	250	Lagawe & Mayoyao, Ifugao	2028
Calanan HEPP*	60	Tabuk City, Kalinga	2028
Dalimuno HEPP*	58	Tabuk City, Kalinga	2028
Gened - 2 HEPP*	50	Kabugao, Apayao	2028
Kibungan 2 HEPP	40	Kibungan, Benguet	2028
Masiway 2 HEPP	9	Pantabangan, Nueva Ecija	2028
Saltan D HEPP	49	Balbalan and Pinukpuk, Kalinga	2028
Saltan River Site E HEPP	45	Balbalan and Pinukpuk, Kalinga	2028
Santol-Sugpon HEPP	52	Sugpon, Ilocos Sur	2028
Tignoan (Lower) HEPP*	8	Real, Quezon	2028
Tublay 1 HEPP	1.9	Tublay, Benguet	2028
Pantabangan (Pump Storage) HEPP*	600	Pantabangan, Nueva Ecija	2029
Calanasan 1 HEPP	30	Calanasan, Apayao	2030
San Roque Upper East Pump Storage HEPP	600	Itogon, Benguet	2030
San Roque West Pump Storage HEPP	400	Itogon, Benguet	2030
Dingalan Pumped Storage HEPP	500	Dingalan, Aurora	2032
San Roque Lower East Pump Storage HEPP	400	Itogon, Benguet	2032
Kibungan Pumped Storage HEPP	500	Kibungan, Benguet	2037
Sub-Total Hydro	**6,683.558**		
BIOMASS			
12-MW Waste-to-Energy Power Plant Project	12	Pampanga	Jun 2024
5.082-MW Biomass Power Plant Project	5.082	Pampanga	Jan 2025
Sub-Total Biomass	**17.082**		
SOLAR			
74.131 MWp / 51.555 MW Calabanga SPP Project*	51.555	Calabanga, Camarines Sur	May 2023
Bugallon SPP Project	20.622	Bugallon, Pangasinan	Dec 2023
Lucanin SPP Project	178.72	Brgy. Lucanin, Mariveles, Bataan	Oct 2023
RASLAG IV SPP Project	24.2	Talimundoc, Magalang, Pampanga	Sep 2023
PAVI Green Orion SPP Project	16.2	Sitio Damulog, Brgy. Daan Pare, Orion, Bataan	Dec 2023
Santo Domingo SPP Project	44.2	Brgys. Santo Domingo and Lapalo, San Manuel, Pangasinan	Jun 2023
Santa SPP Project*	16	Santa, Ilocos Sur	Oct 2023
Armenia SPP Project	35.2	Tarlac City and San Jose, Tarlac	Jul 2024
Bagac SPP Project	121.5	Quinawan, Bagac, Bataan	Jan 2024
Bugallon SPP Project	530.4	Bugallon, Pangasinan	Apr 2024
Clark SPP Project*	35	Clark International Airport, Mabalacat, Pampanga	Dec 2024
Cordon SPP Project	50	Cordon, Isabela	Dec 2024
Giga Ace 8 SPP Project	79.051	Palauig, Zambales	Jan 2024
Gamu SPP Project	41.244	Gamu, Isabela	Dec 2024
Hermosa SPP Project	22.398	Hermosa, Bataan	Dec 2024
Infanta 1 SPP Project	140.917	Infanta, Pangasinan	Jun 2024
Laguna Bay 2 SPP Project*	150	Pililla and Laguna de Bay, Rizal	Oct 2024
Mapannuepe Lake Floating SPP Project	250.894	San Marcelino, Zambales	Mar 2024
PAVI Green San Vicente SPP Project	28.6	Brgy. Cabanbanan, San Vicente, Camarines Norte	Jan 2024
Ramon SPP Project	5	Ramon & Santiago, Isabela	Dec 2024
San Marcelino SPP Project	96	San Marcelino, Zambales	Oct 2024

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
San Pablo SPP Project	104	San Pablo, Isabela	Jun 2024
San Manuel 1 SPP Project	56	San Manuel, Pangasinan	Dec 2024
San Manuel SPP Plant	67.07	San Manuel, Pangasinan	Oct 2024
SolarAce3 SPP Project	200	Buguey, Cagayan	Jun 2024
San Ildefonso SPP Project*	44	San Ildefonso, Bulacan	Dec 2024
Palauig SPP Project*	49.5	Iba-Palauig, Zambales	Feb 2024
98.136 MWp/81.780MW Laoag SPP Project*	57.8	Laoag,Aguilar, Pangasinan	Jun 2025
Cabangan Solar Project	43.75	Brgy. Mabanglit, Cabangan, Zambales	Sep 2025
Isabela Ground Mounted Solar PV Project	336.826	City of Ilagan, Isabela	Dec 2025
Olongapo SPP Project	171.85	Olongapo, Zambales	Mar 2025
Samal SPP Project	48.118	Gugo and San Juan, Samal, Bataan	Dec 2025
San Marcelino SPP Project	120.295	San Marcelino, Zambales	Oct 2025
Trust SPP Project	20.622	Mabalacat, Pampanga	Dec 2025
Bongabon SPP Project	18.375	Bongabon, Nueva Ecija	Jun 2026
Bongabon SPP Project	30.933	Bongabon, Nueva Ecija	Oct 2026
Maragondon 1 SPP Project	44.681	Maragondon and General Emilio Aguinaldo, Cavite	Dec 2026
Magat Floating SPP Project	54.08	Magat Reservoir, Alfonso Lista and Aguinaldo in Ifugao; and Santiago City and Ramon in Isabela	May 2026
TITAN I SPP Project	240	Cambitala and San Juan, Pantabangan, Nueva Ecija	Dec 2026
Bagac 1 SPP Project	121.5	Brgy. Quinawan, Bagac, Bataan	Jun 2027
Laoag 2 SPP Project*	71.4	Laoag,Aguilar, Pangasinan	May 2027
Lal-lo SPP Project	95	Brgy. Maxingal, Lal-lo, Cagayan	Jan 2028
Subic New PV SPP Project	86.199	Morong and Hermosa, Bataan	Feb 2028
Currimao SPP	0.8	Currimao, Ilocos Norte	2026
Luntal-Bayudbod SPP	50	Tuy, Batangas	2027
Sub-Total Solar	**4,019.70**		
WIND			
Ilocos Norte Wind Power Project	144	Burgos and Pasuquin, Ilocos Norte	Dec 2029
Camarines Sur WPP	71.4	Mt. Bernacci, Libmanan, Camarines Sur	Oct 2024
Kalayaan 4 North WPP*	125	Provinces of Laguna and Quezon	Jun 2024
Kalayaan 4 South WPP*	125	Provinces of Laguna and Quezon	Jun 2024
Talim WPP	198	Rizal	Jun 2024
Koala WPP	150	Laguna Lake and Provinces of Laguna and Rizal	Feb 2025
Panda WPP	150	Pililla and Jalajala, of Rizal and Mabitac, Pangil and Pakil of Laguna	Mar 2025
Tanay WPP	96	Antipolo and Tanay, Rizal	Dec 2025
Tayabas North Wind Energy Project	80	Tayabas City and Lucban, Quezon	Sep 2025
Burgos 1 WPP	60	Burgos, Ilocos Norte	Dec 2026
Caraga WPP Phase 1	36	Surigao City, San Francisco, Malimono, Sison, Placer and Mainit, Surigao del Norte	Dec 2026
Tayabas South Wind Energy Project	150	Tayabas City and Pagbilao, Quezon	Mar 2025
Quezon II Plaridel WPP	50	Plaridel and Atimonan, Quezon	Dec 2026
Quezon WPP	600	Quezon, Laguna and Rizal	Jun 2026
Aguilar WPP	99	Bugallon and Aguilar Pangasinan	Dec 2027
Dalupiri Island WPP	500	Dalupiri Island, Calayan, Cagayan	Dec 2027
Kalayaan 2 WPP*	100	Pakil, Paete and Kalayaan, Laguna and Mauban, Quezon	Dec 2027
Lubang and Looc Island WPP	600	Offshore and Onshore of Occidental Mindoro	Apr 2027
Presentacion 2 WPP	54	Presentacion, Camarines Sur	Dec 2027
Rizal WPP	603	Antipolo and Tanay, Rizal	Dec 2027
Tayabas Bay WPP	275	Offshore of Quezon	Apr 2027
Aparri Bay WPP	600	Offshore of Aparri, Cagayan	Dec 2029
Burgos 4 WPP	100	Burgos, Ilocos Norte	Dec 2029PP
Calatagan Offshore WPP	1,024	Offshore and onshore of Batangas	Dec 2029

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Ilocos Norte WPP	144	Burgos and Pasuquin, Ilocos Norte	Dec 2029
Isla WPP	335	Municipalities of Paete, Pakil and Kalayaan, Province of Laguna; and in the Municipality of Mauban, Province of Quezon	Dec 2029
Frontera Bay (Offshore) WPP	450	Offshore of Cavite Province	Dec 2029
Manila Bay Offshore WPP	1,248	Offshore of Bataan, Cavite and Batangas	Dec 2029
Pasuquin WPP	90	Pasuquin, Ilocos Norte	Dec 2029
Presentacion WPP	42	Presentacion and Garchitorena	Dec 2029
Real Ace WPP	175	Province of Quezon	Dec 2029
San Miguel Bay (Offshore) WPP	600	Offshore of Camarines Norte/Sur Provinces	Dec 2029
Bulalacao Offshore WPP	3,100	Offshore and onshore of Oriental Mindoro; and Offshore of Antique	Aug 2030
Calatagan Offshore Wind Farm	1400	Offshore of Batangas and Occidental Mindoro	Apr 2030
Claveria Offshore Wind Farm	1,600	Offshore of Cagayan and Ilocos Norte	Apr 2030
Mariveles Offshore Wind Farm	1,500	Offshore of Bataan, Batangas and Cavite and	Jun 2030
Northern Luzon Offshore WPP	2,000	Offshore of Ilocos Norte	Dec 2030
San Nicolas WPP	100	San Nicolas, Pangasinan	Feb 2030
Lucena WPP	475	Offshore and Onshore of Province of Quezon	2031
San Miguel Bay WPP	500	Offshore of Camarines Sur	2031
Bulalacao Bay Offshore WPP	1,200	Offshore and Onshore of Oriental Mindoro and Antique	2031
San Enrique Bank Offshore WPP	420	Offshore of Guimaras and Negros Occidental	2031
Sub-Total Wind	**21,225.400**		
BATTERY			
Cruz na Daan (CND) BESS*	40	Balagtas Bypass Road, Mabalasbalas, San Rafael Bulacan	Dec 2023
Ambuklao BESS	40	Brgy. Ambuklao, Bokod, Benguet	Dec 2024
Bay BESS Project*	20	Calauan, Laguna	Mar 2024
Bay BESS Project	50	Bay, Laguna	Sep 2024
Bugallon Energy Storage Project	200	Bugallon , Pangasinan	Mar 2024
Bac-Man Energy Storage System	30	Manito, Albay	Dec 2024
Enerhiya Central BESS	40	Concepcion, Tarlac	Dec 2024
Enerhiya Sur II Battery Energy StoBESSrage Project	40	Lumban, Laguna	Dec 2024
Panda Energy Storage Project	150	Pililla, Rizal	Mar 2024
Pililla BESS Project	50	Pililia, Rizal	Mar 2024
Enerhiya Sur I BESS Project	40	Lemery and Tuy, Calaca, Batangas	Dec 2025
Labo BESS Project	20	Labo, Camarines Norte	Mar 2025
Laoag BESS*	20	Laoag, Ilocos Norte	2025
Lumban BESS*	20	Lumban, Laguna	2025
Nagsaag BESS	20	Nagsaag, Pangasinan	2025
Concepcion BESS*	20	Concepcion, Tarlac	2026
Labrador BESS	20	Labrador, Pangasinan	2026
Binga BESS	40	Itogon, Benguet	Mar 2026
Currimao BESS Project	50	Currimao, Ilocos Norte	Dec 2027
Lumban BESS	20	Lumban, Laguna	TBD
Sub-Total Battery	**930**		
TOTAL INDICATIVE	43,595.740		
TOTAL INDICATIVE W/O BATTERY	42,665.740		

* with SIS

Table 2: Private Sector Initiated Power Projects in Visayas as of 28 February 2023

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
	COMMITTED POWER PLANTS		
COAL			
Palm Concepcion CFPP Unit II*	135	Brgy. Nipa, Concepcion, Iloilo	Mar 2025
Sub-Total Coal	135		
OIL-BASED			
11.174 MW Calbayog Bunker C-Fired DPP*	11.174	Purok 1, Sitio Looc, Brgy. Carayman, Calbayog City, Western Samar	Feb 2023
Sulzer DPP	5.5	M.L. Quezon National Highway, Barangay Pajo, Lapu-lapu City, Cebu	Sep 2023
Caterpillar DPP	2	M.L. Quezon National Highway, Barangay Pajo, Lapu-lapu City, Cebu	Sep 2023
Cummins DPP	1	M.L. Quezon National Highway, Barangay Pajo, Lapu-lapu City, Cebu	Sep 2023
Sub-Total Oil-Based	19.674		
GEOTHERMAL			
Northern Negros Geothermal Project	5	Bago and Murcia, province of Negros Occidental	Feb 2024
Biliran GPP - Unit 1	2	Biliran, Biliran	Mar 2023
- Unit 2	6	Biliran, Biliran	Nov 2024
- Unit 3	10	Biliran, Biliran	2025
- Unit 4	10	Biliran, Biliran	2026
- Unit 5	22	Biliran, Biliran	2027
Sub-Total Geothermal	55		
HYDRO			
Timbaban HEPP*	18	Madalag, Aklan	Jun 2023
Igbulo (Bais) HEPP*	8.1	Igbaras, Iloilo	Apr 2023
Sub-Total Hydro	26.1		
BIOMASS			
CASA Biomass Cogeneration Plant (Expansion Project)	8	Passi City. Iloilo	Jun 2023
HDJ BPP Project	6	Bayawan City, Negros Oriental	Apr 2023
Sub-Total Biomass	14		
SOLAR			
Kananga-Ormoc Solar Power Project	300	Kananga and Ormoc City, Leyte	Dec 2025
Sub-Total Solar	300		
WIND			
Nabas-2 Wind Power Project	13.2	Nabas, Malay, Aklan	May 2025
Sub-Total Wind	13.2		
BATTERY			
Toledo BESS Project	20	Toledo City, Cebu	Jul 2023
Ubay BESS Project	20	Ubay, Bohol	Jul 2023
Ormoc BESS Project	20	Ormoc, Leyte	Jul 2023
Ormoc BESS Project Phase 2	20	Ormoc, Leyte	Jul 2023
Tabango BESS Project	20	Tabango, Leyte	Jul 2023
Dingle BESS Project	20	Dingle, Iloilo	Dec 2023
Samboan BESS Project	20	Samboan, Cebu	Sep 2023
Compostela BESS Project	20	Compostela, Cebu	Sep 2023
Nabas BESS Project	20	Nabas, Antique	Sep 2024
Calbayog BESS Project	20	Brgy. Carayman, Calbayog, Samar	Sep 2024
Tabango BESS Project Phase 2	20	Tabango, Leyte	May 2025
Toledo BESS Project Phase 2	20	Toledo City, Cebu	May 2025
San Carlos BESS Project	20	San Carlos City, Negros Occidental	May 2025
Mactan BESS Project	20	Mactan, Cebu	May 2025
Ubay BESS Project Phase 2	20	Ubay, Bohol	May 2025
Sub-Total BESS	300		
TOTAL COMMITTED	862.974		
TOTAL COMMITTED W/O BESS	562.974		

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
INDICATIVE POWER PLANTS			
OIL			
95.2MW In-Island Baseload Plant	95.2	Brgy. Imelda, Ubay, Bohol	Feb 2024
Bohol DPP Capacity Expansion*	30	Brgy. Dampas, Tagbilaran City, Bohol	TBD
Sub-Total Oil	**125.2**		
GEOTHERMAL			
Mahanagdong Geothermal Brine Optimization Plant*	36	Barangay Tongonan, Ormoc City, Leyte	2024
Dauin GPP	40	Dauin, Negros Oriental	2025
Sub-Total Geothermal	**76**		
HYDRO			
Lower Himogaan HEPP	4	Sagay, Negros Occidental	2026
Malugo HEPP	6	Silay City, Negros Occidental	2027
Maslog HEPP*	40	Maslog, Eastern Samar	2028
Upper Taft HEPP	14.1	Taft, Eastern Samar	2028
Ilog HEPP*	21.6	Mabinay, Negros Occidental	2029
Aklan Pumped-Storage HEPP*	300	Malay, Aklan	2030
Casapa HEPP*	10	Maslog, Eastern Samar	2030
Sub-Total Hydro	**395.7**		
SOLAR			
Biliran SPP	20	Biliran, Biliran	Dec 2023
SAMELCO II – Paranas SPP	1	Paranas, Samar	Dec 2023
San Miguel SPP*	80	San Miguel, Leyte	Dec 2023
Bohol SPP	17.5	Ubay, Bohol	Jan 2024
Cadiz City SPP*	56	Cadiz City, Negros Occidental	Dec 2024
Calatrava SPP	137.48	Calatrava, Negros Occidental	Dec 2024
Manapla SPP	120.295	Manapla, Negros Occidental	Mar 2024
Medellin SPP*	240	Medellin, Cebu	Dec 2024
Victorias SPP	85.925	Victorias City, Negros Occidental	Mar 2024
Bacolod City SPP II	130	Bacolod City, Negros Occidental	Aug 2025
Vista Alegre SPP*	41.6	Bacolod City, Negros Occidental	Oct 2025
All Home All Builders Bacolod SPP	0.24	Negros Occidental, Bacolod, Mandalagan	Dec 2026
Dagohoy SPP	20.622	Dagohoy, Bohol	Dec 2027
Sub-Total Solar	**950.662**		
WIND			
San Isidro WPP*	200	San Isidro, Northern Samar	Jun 2024
East Panay Offshore WPP	1000	Offshore of Iloilo and Guimaras	Oct 2026
Pulupandan WPP*	50	Pulupandan, Negros Occidental	Feb 2026
Iloilo 1 WPP	54	Batad & San Dionisio, Iloilo	Dec 2027
Tanjay WPP*	50	Bais, Negros Oriental	Jan 2027
Bohol I (Ubay) WPP*	100	Ubay, Alicia, Mabini, Bohol	Dec 2029
Guimaras Strait II WPP*	600	Offshore of Negros Occidental and Iloilo Provinces	Dec 2029
Guimaras 1 Offshore WPP	582	Offshore and Onshore of Guimaras	Dec 2029
Guimaras – Negros Occidental Offshore WPP	768	Onshore and Offshore of Negros Occidental and Offshore of Guimaras	Dec 2029
Guimaras Onshore WPP	100	Buenavista, San Lorenzo, Sibunag, and New Valencia, Guimaras	Dec 2029
Iloilo-Guimaras Offshore WPP	996	Offshore of Iloilo, Negros Occidental, and Guimaras, onshore of Iloilo	Dec 2029
Sub-Total Wind	**4,500**		
BATTERY			
Cadiz Energy Storage Project	50	Cadiz City, Negros Occidental	Jun 2024
Naga (Pandora) BESS*	20	Naga City, Cebu	Sep 2024
Ormoc Energy Storage Project	50	Ormoc, Leyte	Oct 2024
Padayon (CPPC) Energy Storage Project	20	Brgy. Ermita, Cebu City	Dec 2024
Tongonan ESS	30	Kananga, Leyte	Dec 2024
Southern Negros ESS	30	Valencia, Negros Oriental	Dec 2024
BESS Installation - PDPP	9.35	Brgy. Tabugon, Dingle, Iloilo City	Sep 2025

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
BESS Installation – PB 104	2	Tapal Wharf, Ubay, Bohol	Sep 2025
Bohol BESS Power Plant	20	Brgy. Dampas, Tagbilaran City, Bohol	Sep 2022
Compostela BESS	7.5	Compostela, Cebu	2025
Daanbantayan Energy Storage Power Project	30	Daanbantayan, Cebu	Mar 2025
Enerhiya Delas Islas I BESS Project	15	Amlan, Negros Oriental	Dec 2025
Enerhiya Delas Islas II BESS Project	15	Ormoc, Leyte	Dec 2025
Enerhiya Delas Islas III BESS Project	15	Compostela, Cebu	Dec 2025
Northern Negros Energy Storage System	30	Bago City and Murcia, Negros Occidental	Dec 2025
Panay BESS Power Plant	40	Brgy. Tabugon, Dingle, Iloilo City	Sep 2025
San Isidro BESS Project	200	Brgy. Palanit, San Isidro, Northern Samar	Dec 2026
Toledo BESS	20	Toledo City, Cebu	2026
Dingle BESS	20	Dingle City, Iloilo	2027
Tabango BESS	7.5	Tabango City, Leyte	2027
Tinampa-an Energy Storage	50	Brgy. Tinampa-an, Cadiz City, Negros Occidental	Jun 2027
Ubay BESS	20	Ubay City, Bohol	TBD
Calbayog BESS Power Plant	30	Calbayog, Samar	TBD
Pandora 2 Integrated Energy Storage Project*	42	Barangay Colon, Naga City, Cebu	TBD
Sta. Barbara BESS Project*	20	Sta. Barbara, Iloilo	TBD
Santander Energy Storage Project	30	Santander Cebu	TBD
Santa Rita Energy Storage Project	30	Santa Rita, Samar	TBD
Tabango Energy Storage Project	30	Tabango, Leyte	TBD
Sub-Total Battery	**873.35**		
TOTAL INDICATIVE	6,920.912		
TOTAL INDICATIVE W/O BATTERY	6,047.562		

* with SIS

Table 3: Private Sector Initiated Power Projects in Mindanao as of 28 February 2023

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
		COMMITTED POWER PLANTS	
COAL			
Misamis Oriental 2 x 135 MW Circulating Fluidized Bed CFPP Thermal*	270	PHIVIDEC Industrial Estate, Villanueva, Misamis Oriental	Mar 2027
Sub-Total Coal	**270**		
OIL-BASED			
SPC DPP*	11.04	Libudon Road, Lower Dawan, Mati City, Davao Oriental	TBD
Sub-Total Oil-Based	**11.04**		
HYDRO			
Lake Mainit HEPP*	24.9	Jabonga, Agusan del Norte	Apr 2023
Alamada HEPP	3	Alamada, North Cotabato	Jun 2023
Sipangpang HEPP	1.8	Cantilan, Surigao del Sur	Jun 2023
Maramag HEPP	2.04	Maramag, Bukidnon	Apr 2023
Liangan HEPP*	18	Bacolod, Lanao del Norte	Apr 2023
Siguil HEPP	14.5	Maasim, Sarangani	Jun 2023
Tagpangi HEPP	1.7	Vitali, Zamboanga City	Dec 2023
Osmeña HEPP	1	Governor Generoso, Davao Oriental	Dec 2023
Gakaon HEPP	2.23	Impasugong, Bukidnon	Dec 2024
Maladugao (Upper Cascade) HEPP	8.4	Kalilangan & Wao, Bukidnon	Jan 2025
Titunod HEPP	3.6	Kolambogan, Lanao del Norte	Dec 2024
Malitbog HEPP	3.7	Malitbog, Bukidnon	Sep 2024
Silo-o HEPP	3.7	Malitbog, Bukidnon	Oct 2024
Mat-i 1 HEPP	4.85	Claveria, Cagayan de Oro	Nov 2025
Clarin HEPP	6.9	Clarin, Misamis Occidental	Nov 2025

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Mangima HEPP	12	Manolo Fortich, Bukidnon	Jan 2025
Sub-Total Hydro	**100.32**		
BIOMASS			
CSCCI 10 MW Biomass Cogeneration Plant	10	Matalam, North Cotabato	Nov 2023
DSCCI 10 MW Biomass Cogeneration Plant	10	Hagonoy, Davao del Sur	Dec 2023
6 MW Biomass Power Plant Project	6	Aurora, Zamboanga del Sur	Dec 2023
Sub-Total Biomass	**26**		
SOLAR			
General Santos Solar Power Project	120	General Santos City, South Cotabato	Dec 2023
Sub-Total Biomass	**120**		
BESS			
Pitogo BESS	60	Sitio Pitogo, Brgy. Sinunuc, Zamboanga City	Oct 2023
Sangali BESS	20	Sitio Malasugat, Brgy. Sangali, Zamboanga City	Aug 2023
Malita BESS	20	Malita, Davao	Jul 2023
Maco BESS	20	Maco, Davao	Jul 2023
Villanueva BESS	20	Tagoloan, Misamis Oriental	Jul 2023
Jasaan BESS	20	Jasaan, Misamis Oriental	Jul 2023
Tagum BESS	20	Tagum, Davao del Norte	2023
Aurora BESS	20	Brgy. Cabilinan, Aurora, Zamboanga del Sur	May 2025
Tagoloan BESS Project Phase 2	20	Tagoloan, Misamis Oriental	May 2025
Placer BESS Project	20	Placer, Surigao del Norte	May 2025
Maramag BESS Project	20	Maramag, Bukidnon	May 2025
General Santos BESS Project	20	General Santos, South Cotabato	Jul 2023
Sub-Total BESS	**280**		
TOTAL COMMITTED	819.36		
TOTAL COMMITTED W/O BESS	539.60		

* with SIS

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
		INDICATIVE POWER PLANTS	
COAL			
San Ramon Power, Inc. CFPP Station	120	ZamboEcozone, Brgy. Talisayan, Zambanga City	Jun 2026
Sub-Total Coal	**120**		
NATURAL GAS			
GNPower Kauswagan LNG CCPP	600	Barangay Tacub, Kauswagan, Lanao del Norte	Dec 2028
Sub-Total Natural Gas	**600**		
HYDRO			
Pulanai River HEPP	15	Valencia, Bukidnon	2025
Maladugao River (Lower Cascade) HEPP	15	Kalilangan and Wao, Bukidnon	2025
Bubunawan HEPP	32	Baungon, Bukidnon	2025
Limbatangon HEPP	9	Cagayan de Oro City, Misamis Occidental	2025
Casauman HEPP*	34	Manay, Davao Oriental	2026
Cateel HEPP*	16	Baganga, Davao Oriental	2026
Davao HEPP	140	Davao City	2027
Culaman HEPP*	10	Manolo Fortich, Bukidnon	2025
Agus III HEPP	225	Pantar, Lanao del Norte & Baloi/Saguiaran, Lanao del Sur	2029
South Pulangi HEPP*	250	Damulog, Bukidnon	2031
Sub-Total Hydro	**746.7**		
BIOMASS			
12 MW BMP Project	12	Manolo Fortich, Bukidnon	Dec 2023
50 MW BMP Project	50	Surigao del Sur	Jun 2026
Sub-Total Biomass	**62**		
SOLAR			
Camiguin SPP	5	Liong, Guinsiliban Camiguin Province, Mindanao	Jul 2023

Proposed Generation Facility / Name of the Project	Capacity (MW)	Location	Commissioning Year
Bukidnon SPP	1.56	San Vicente, Sumilao, Bukidnon	Aug 2023
Hayes SPP*	21.6	Villanueva, Misamis Oriental	Dec 2024
Zamboanga del Norte SPP	5.6	La Libertad and Dapitan, Zamboanga del Norte	Jun 2025
Sub-Total Solar	**33.76**		
WIND			
Caraga Wind Phase 1	36	Surigao City, San Francisco, Malimono, Sison, Placer and Mainit, Surigao del Norte	Sep 2026
Mainit WPP	100	Mainit, Surigao del Norte and Lake Mainit	Dec 2029
Sub-Total Wind	**136**		
BESS			
Kibawe Energy Storge Project	50	Kibawe, Bukidnon	Oct 2024
Toril BESS*	20	Toril, Davao	Sep 2025
Nasipit Hybrid ESS Project	48	Lawis, Sta. Ana, Nasipit, Agusan del Norte	Sep 2025
Sub-Total Battery	**118**		
TOTAL INDICATIVE	1,816.46		
TOTAL INDICATIVE W/O BESS	1,698.46		

* with SIS

Appendix 5 – 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	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 6 – 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 that 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 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 for 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 a voltage which can sustain a self-reliant operation for at least 12 hours and extend power within 30 minutes.

There are four 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 that have a 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

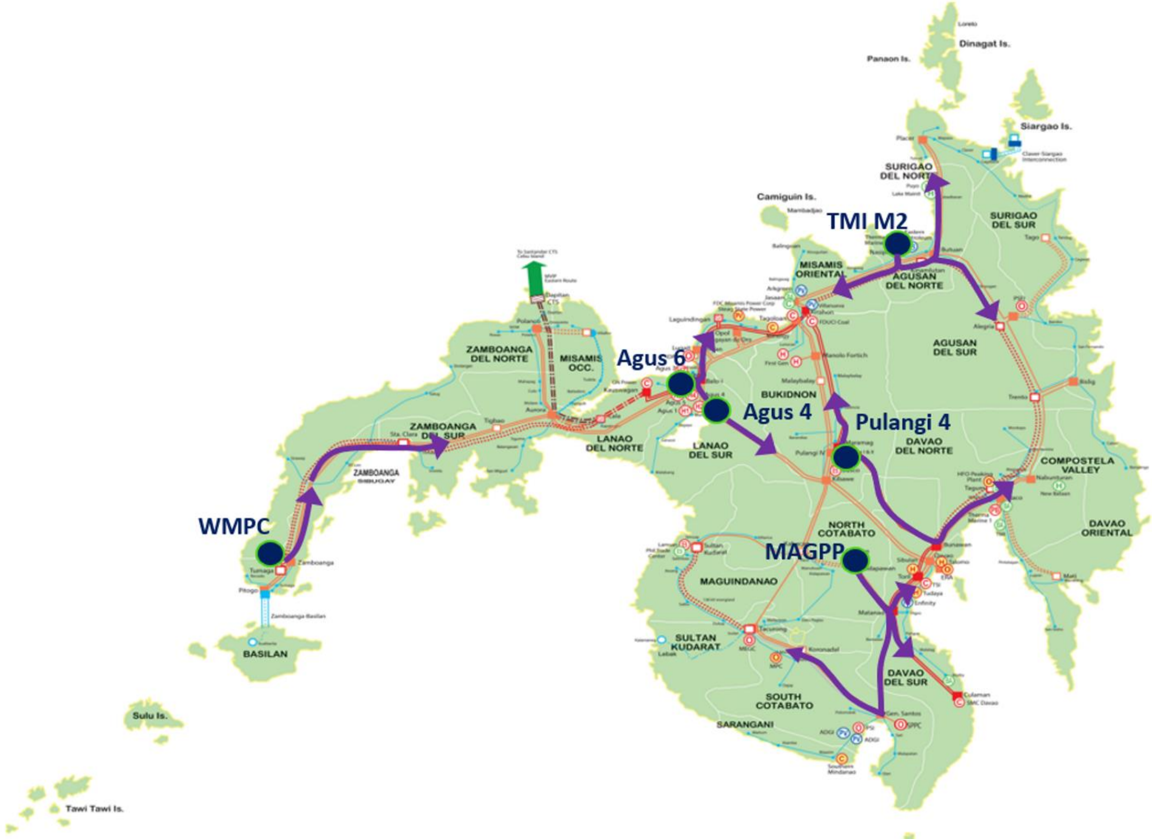

Figure 3: Mindanao Power Restoration Highway

Appendix 7 – Abbreviations and Acronyms

Development Plans	
DDP	Distribution Development Plan
ESMAP	Energy Sector Management Assistance Program
GEAP	Green Energy Auction Program
NREP	National Renewable Energy Program
PDP	Power Development Program
PEP	Philippine Energy Plan
TDP	Transmission Development Plan
Electricity Market	
IEMOP	Independent Electricity Market Operator of the Philippines
PEMC	Philippine Electricity Market Corporation
WESM	Wholesale Electricity Spot Market
Government Agencies	
ERC	Energy Regulatory Commission
DICT	Department of Information and Communications Technology
DENR	Department of Environmental and Natural Resources
DOE	Department of Energy
LLDA	Laguna Lake Development Authority
MGB	Mines and Geosciences Bureau
NEDA	National Economic & Development Authority
Government-owned and Controlled Corporation and other Government Agencies	
NPC	National Power Corporation
PSALM	Power Sector Assets & Liabilities Management
TransCo	National Transmission Corporation
SPUG	Small Power Utilities Group
Legal, Environmental and Other Requirements	
BCMS	Business Continuity Management System
EMS	Environmental Management System
EPIRA	Electric Power Industry Reform Act
IMS	Integrated Management System
ISMS	Information Security and Management System
ISO	International Organization for Standardization
IRR	Implementing Rules and Regulation
OHSMS	Occupational Health and Safety Management System
PGC	Philippine Grid Code
PQMS	Power Quality Management System
QMS	Quality Management System
RE Law	Renewable Energy Law
Other Companies	
BEI	Bohol Enterprises, Inc.
BSTC	Bukidnon Sub transmission Corporation
IFC	International Finance Corporation
NREL	National Renewable Energy Laboratory
USAID	United States Agency for International Development
Power Generating Companies	
CEDC	Cebu Energy Development Corporation
EERI	Excellent Energy Resources Inc.
EWC	Energy World Corporation
FGHPC	First Gen Hydro Power Corporation
GN Power	General Nakar Power
KEILCO	KEPCO Ilijan 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
SCPC	Sta. Clara Power Corporation
SEC	Sarangani Energy Corporation
SBPL	San Buenaventura Power Ltd. Company
SBSSEC	Sapang Balen Solar Sustainable Energy Corporation
SMCPC	San Miguel Consolidated Power Corporation
TAREC	Trans-Asia Renewable Energy Corporation
Power Plants	
BESS	Battery Energy Storage System
CCPP	Combined Cycle Power Plant
CFPP	Coal-Fired Power Plant
BPP	Biomass 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
SPP	Solar Power Plant
WPP	Wind Power Plant
Solar PV	Solar Photovoltaic
VRE	Variable Renewable Energy
Private Distribution Utilities	
AEC	Angeles Electric Corporation
BEZ	Balamban Enerzone Corporation
BLCI	Bohol Light Company, Inc.
CEPALCO	Cagayan Electric Power & Light Company
CLARK ELECTRIC	Clark Electric Distribution Corporation
DLPC	Davao Light and Power Company
MECO	Mactan Electric Company, Inc.
MERALCO	Manila Electric Company
MEZ	Mactan Enerzone Corporation
MORE	MORE Electric and Power Corporation
TEI	Tarlac Electric Inc.
VECO	Visayan Electric Company, Inc.
Regions/Areas/Grid	
CALABARZON	Cavite, Laguna, Batangas, Rizal, and Quezon
CBD	Central Business District
CLACC	Central Luzon sub-grid
LA	Lanao Area
NCC	New Clark City
NCR	National Capital Region
NCMA	North Central Mindanao Area
NLACC	Northern Luzon sub-grid
NEMA	North Eastern Mindanao Area
NWMA	North Western Mindanao Area
SEMA	South Eastern Mindanao Area
SOCCSKSARGEN	South Cotabato, Cotabato, Sultan Kudarat, Sarangani & Gen Santos
SRP	South Road Properties
SWMA	South Western Mindanao Area
STACC	Southern Tagalog sub-grid
Regulatory	

ASAI	Ancillary Services Availability Indicator
ASAPP	Ancillary Service Agreement Procurement Plan
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 Regulation
PIS	Performance Incentive Scheme
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
CR	Contingency Reserve
DR	Dispatchable Reserve
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
LoLp	Loss of Load Probability
SPD	System Peak Demand
Transmission Network Provider	
NGCP	National Grid Corporation of the Philippines
Unit of Measure	
ckt-km	Circuit-kilometer
km	kilometer
kV	kilo-Volt
MVA	Mega-Volt Ampere
MVAR	Mega-Volt Ampere Reactivef
MW	Mega-Watt
UTS	Ultimate Tensile Strength
Electric Cooperatives	
ABRECO	Abra Electric Cooperative
AKELCO	Aklan Electric Cooperative, Inc.
ALECO	Albay Electric Cooperative, Inc.
ANTECO	Antique Electric Cooperative, Inc.
BANELCO	Bantayan Island Electric Cooperative, Inc.
BATELEC II	Batangas II Electric Cooperative, Inc.
BENECO	Benguet Electric Cooperative, Inc.
BILECO	Biliran Electric Cooperative, Inc.
BOHECO I	Bohol I Electric Cooperative, Inc.
BOHECO II	Bohol II Electric Cooperative, Inc.
CAGELCO I	Cagayan 1 Electric Cooperative, Inc.
CAPELCO	Capiz Electric Cooperative, Inc.
CASURECO IV	Camarines Sur IV Electric Cooperative, Inc.
CEBECO I	Cebu I Electric Cooperative, Inc.
CEBECO II	Cebu II Electric Cooperative, Inc.
CEBECO III	Cebu III Electric Cooperative, Inc.
CELCO	Camotes Electric Cooperative, Inc.
CENECO	Central Negros Electric Cooperative, Inc.
CENPELCO	Central Pangasinan Electric Cooperative, Inc.
DORELCO	Don Orestes Romuladez Elect Cooperative, Inc.
ESAMELCO	Eastern Samar Electric Cooperative, Inc.
FICELCO	First Catanduanes Electric Cooperative, Inc.
GUIMELCO	Guimaras Electric Cooperative
ILECO II	Iloilo II Electric Cooperative, Inc.
ILECO III	Iloilo III Electric Cooperative, Inc.
INEC	Ilocos Norte Electric Cooperative, Inc.
ISECO	Ilocos Sur Electric Cooperative, Inc.
KAELCO	Kalinga-Apayao Electric Cooperative, Inc.
LEYECO II	Leyte II Electric Cooperative, Inc.
LEYECO III	Leyte III Electric Cooperative, Inc.
LEYECO IV	Leyte IV Electric Cooperative, Inc.
LEYECO V	Leyte V Electric Cooperative, Inc.
LUELCO	La Union Electric Cooperative, Inc.
MORESCO I	Misamis Oriental I Electric Cooperative
MOELCI I	Misamis Occidental I Electric Cooperative, Inc.
MORESCO I	Misamis Oriental I Electric Cooperative, Inc.
NEECO II A2	Nueva Ecija II Electric Cooperative, Inc. – Area 2
NONECO	Northern Negros Electric Cooperative, Inc.
NORECO I	Negros Oriental I Electric Cooperative, Inc.
NORECO II	Negros Oriental II Electric Cooperative, Inc.
NORDECO	Northern Davao Electric Cooperative
NORSAMELCO	Northern Samar Electric Cooperative, Inc.
OMECO	Occidental Mindoro Electric Cooperative, Inc.
ORMECO	Oriental Mindoro Electric Cooperative, Inc.
PANELCO I	Pangasinan I Electric Cooperative
PANELCO III	Pangasinan III Electric Cooperative, Inc.
PELCO I	Pampanga I Electric Cooperative, Inc.
PELCO II	Pampanga II Electric Cooperative, Inc.
PRESCO	Pampanga Rural Electric Service Cooperative, Inc.
PROSIELCO	Province of Siquijor Electric Cooperative, Inc.
SAJELCO	San Jose City Electric Cooperative, Inc.
SAMELCO I	Samar I Electric Cooperative, Inc.
SAMELCO II	Samar II Electric Cooperative, Inc.
SIARELCO	Siargao Electric Cooperative, Inc.
SOCOTECO I	South Cotabato I Electric Cooperative, Inc.
SOLECO	Southern Leyte Electric Cooperative, Inc.
TARELCO I	Tarlac I Electric Cooperative, Inc.
TARELCO II	Tarlac II Electric Cooperative, Inc.
ZAMECO I	Zambales I Electric Cooperative
ZAMSURECO I	Zamboanga del Sur Electric Cooperative
ZAMCELCO	Zamboanga City Electric Cooperative, Inc.
Transmission System/Projects	
AACGR	Average Annual Compounded Growth Rate
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
ASPP	Ancillary Services Procurement Plan
ASAPP	Ancillary Service Agreement Procurement Plan
AVC	Automatic Voltage Control
BMS	Battery Monitoring System
BRCC	Backup Regional Control Center
CAES	Compressed Air Energy Storage
CBM	Condition-Based Maintenance
CCMS	Central Control and Monitoring System
COMS	Centralized Online Monitoring System
CREZ	Competitive Renewable Energy Zone
CSP	Competitive Selection Process

CTS	Cable Terminal Station
CS	Converter Station
DC	Double Circuit
DC1	Double Circuit Transmission Line First Stringing
DC2	Double Circuit Transmission Line Second Stringing
DER	Distribution Energy Resources
DS/ES	Disconnecting/Earthing Switches
DU	Distribution Utility
EAM	Enterprise Asset Management
EHV	Extra High Voltage
EMS	Energy Management System
ERS	Emergency Restoration System
ES	Electrode Station
ESS	Energy Storage System
ETC	Expected Target Completion
ICT	Information and Communications Technology
FACTS	Flexible AC Transmission System
FESS	Flywheel Energy Storage System
FMS	Facilities Management System
GEOP	Green Energy Option
GIS	Gas Insulated Switchgear
HVE	High Voltage Equipment
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
ICT	Information and Communications Technology
IP	Internet Protocol
IPP	Independent Power Producer
LES	Load-End Substations
MBSC	Microprocessor-Based Substation Control
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
PSIPP	Private Section Initiated Power Projects

PAN	Planned Activity Notice
PCB	Power Circuit Breaker
PLC	Powerline Carrier
PMU	Phasor Measurement Unit
PQA	Power Quality Analyzer
PSH	Pumped-Storage Hydropower
PST	Philippine Standard Time
RPA	Remotely Piloted Aircraft
RCC	Regional Control Center
RCOA	Retail Competition and Open Access
RFMS	Remote Fiber Monitoring System
ROW	Right-of-Way
RPS	Renewable Portfolio Standards
RTD	Real-time Dispatch
RTU	Remote Terminal Unit
TNP	Transmission Network Provider
STATCOM	Static Synchronous Compensator
SACS	Substation Automation Control System
SCADA	Supervisory Control and Data Acquisition
SCADA-EMS	Data Acquisition-Energy Management System
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
SS	Substation
ST-SC	Steel Tower Single Circuit
ST-DC	Steel Tower Double Circuit
SWS	Switching Station
TL	Transmission Line
UAV	Unmanned Aerial Vehicle
WSD	Wind Speed Design
ZWG	Zone Working Group
WBG	World Bank Group
WMSP	WESM Metering Service Provider

Appendix 8 – Contact Details

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

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