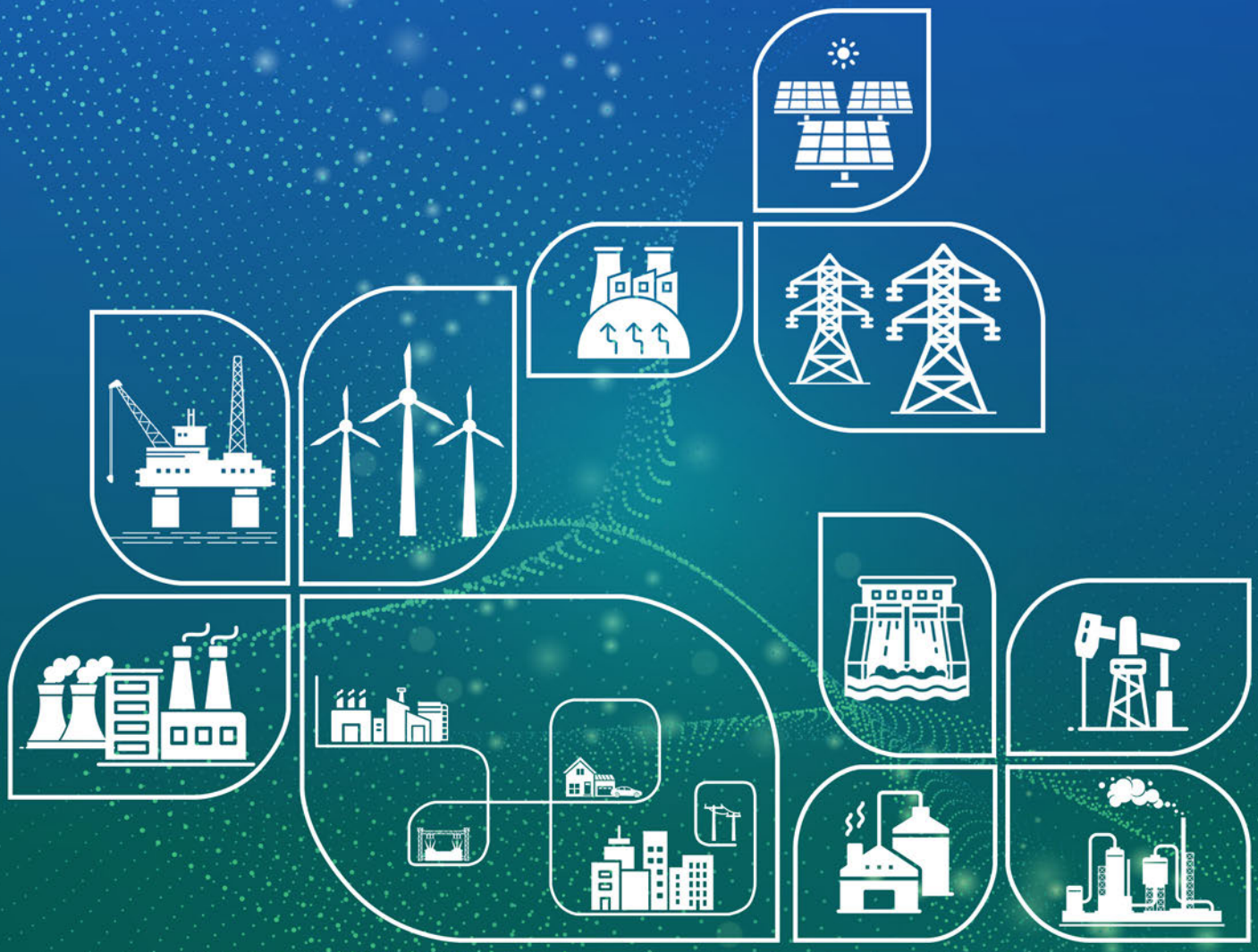
IEMOP

INDEPENDENT ELECTRICITY MARKET OPERATOR
PHILIPPINES



ANNUAL REPORT
2024

www.iemop.ph | info@iemop.ph

Behind every market participant's interface is a team of technical experts operating 24/7 to ensure an efficient and reliable WESM. At IEMOP, we know that a well-performing market fosters growth that goes beyond the power industry. That's why since our establishment in 2018, we've championed milestones that led the market to greater heights from the launch of a cloud-based databank, conduct of forums, approval of rules change proposals, to the attainment of certifications for key market systems. Our commitment to service excellence enables us to power through to more breakthroughs.

This is only the start. We will continue to work harder and deliver beyond what is expected because as the country's market operator, it is our foremost duty to provide you, our stakeholders, with **the expert service you deserve.**

The Independent Electricity Market Operator of the Philippines (IEMOP) is a private, non-stock, non-profit service company which offers market solutions in the power industry, and provides services such as trading, settlements, data and information. IEMOP's competitive advantage is rooted on IT & Power Systems expertise and experience in the Electricity Market Operations in the Philippines. | To reach us, visit us at www.iemop.ph, email us at info@iemop.ph.

IEMOP
We Run Markets

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MESSAGE FROM THE CHAIRMAN

To our stakeholders and industry partners, we are honored and grateful to present the 2024 Annual Report of the Independent Electricity Market Operator of the Philippines (IEMOP) . 2024 has been a year of significant milestones for IEMOP, as we continued to innovate, enhance our market operations, and contribute to the growth of the Philippine energy sector. As we adapted to the evolving energy landscape, we remained dedicated to our role as the trusted market operator, ensuring the stability and reliability of the electricity market while embracing the challenges and opportunities brought about by an increasingly complex energy mix.

IEMOP's central role in the industry remains strong, and our partnerships with regulators, market participants, and stakeholders have been essential to our success. Looking ahead, we remain committed to fostering innovation, maintaining operational excellence, and advocating for policies that ensure long-term sustainability in the electricity sector.

On behalf of the entire IEMOP team, I would like to extend our heartfelt thanks for the continued trust and support from our stakeholders. The collaboration we've received from regulators, market participants, and industry leaders has been vital to our achievements this year. Through these partnerships, we have been able to promote a more efficient, competitive, and dynamic electricity market that benefits all Filipinos. We are confident that, together, we will continue advancing the Philippine electricity market, ensuring a reliable and sustainable energy future for everyone.

Thank you for your continued collaboration. We look forward to achieving even greater success together in the years to come.

Sincerely,

Lt. Gen. Ralph A. Villanueva (Ret.)
Chairman of the Board, IEMOP

THE PRESIDENT'S CORNER

The Wholesale Electricity Spot Market (WESM) plays a critical role in the Philippine Electric Power Industry, acting as the primary mechanism for electricity trading among power producers, distribution utilities, and large industrial consumers. WESM was established in 2006 to enhance market efficiency, ensure reliable supply, promote competition, and support the integration of renewable energy sources. It facilitates the real-time buying and selling of electricity, with prices driven by the forces of supply and demand. As the backbone of the country's electricity market, WESM helps stabilize the grid while fostering economic and environmental sustainability.

In 2024, WESM recorded a total of 469 WESM Members - 230 of which are generation companies with a total registered capacity of 30,021 MW. These generation companies produced a total of 117.5 TWh for 2024 with renewables accounting for 22% of total power generation. Moreover, 24.93 TWh of energy was purchased from the WESM in 2024 which is equivalent to 22.1% of the customers' total consumption.

Alongside the growing demand for electricity, various market developments were operationalized in 2024. These include the integration of the Reserve Market into the WESM, the launching of Retail Competition and Open Access (RCOA) and the Green Energy Option Program (GEOP) in Mindanao, and the trading of RE certificates through the Renewable Energy Market.

Price Discovery and Market Efficiency

One of the most important functions of WESM is price discovery. WESM enables electricity prices to be set dynamically, based on the supply and demand conditions at any given time. When demand is high or generation is limited due to factors like fuel shortages, maintenance, or weather-related issues, prices rise, signaling the need for more generation capacity or load curtailment. Conversely, when supply exceeds demand, such as during periods of low demand or increased renewable generation, prices normally decrease. This pricing mechanism drives operational efficiency, as electricity producers are incentivized to optimize their generation schedules, while grid operators work to maintain a more balanced and reliable electricity system. Consumers also benefit from transparent, competitive pricing, with market forces helping to drive prices down over time.

Reliability of Supply

WESM plays a significant role in ensuring the reliability of electricity supply across the Philippines. It provides real-time signals to grid operators about potential imbalances in electricity generation and demand. For instance, if there is a shortfall in supply due to an unexpected plant shutdown or a surge in demand during peak hours, WESM helps coordinate corrective actions, such as activating reserve power plants or

shifting electricity from areas with excess supply. This dynamic adjustment process minimizes the risk of blackouts and ensures continuous service to consumers. In the event of supply disruptions, WESM's flexibility allows for rapid adjustment, improving the overall resilience of the country's energy grid. In 2024, WESM continued to support the development of new generation capacity, with several power plants coming online to meet growing demand. WESM's price signals incentivized investment in both conventional and renewable generation, contributing to long-term supply security.

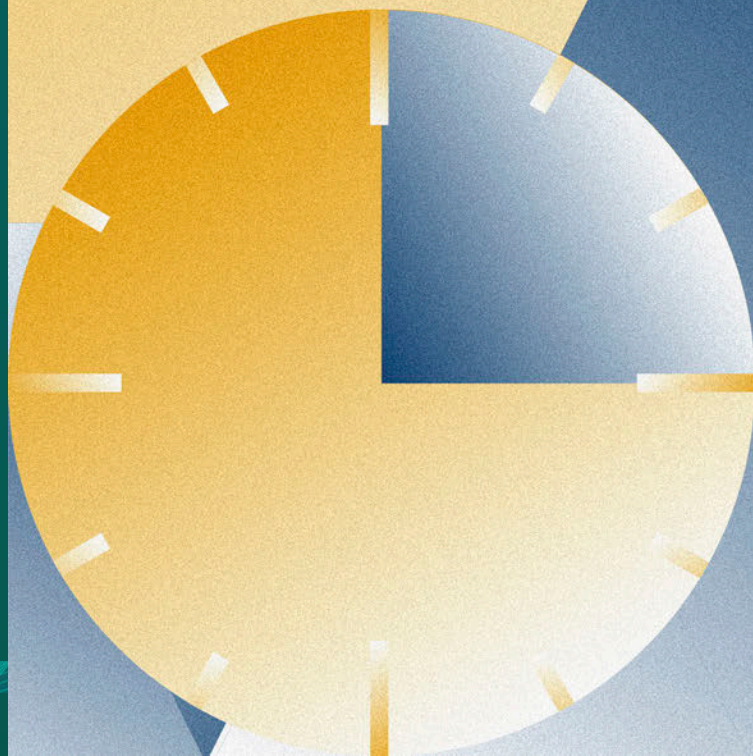
Promoting Competition

Before WESM, the electricity sector in the Philippines was dominated by state-owned entities with limited competition. WESM transformed this landscape by creating a competitive marketplace where multiple independent power producers (IPPs) could sell electricity. This encourages electricity producers to operate efficiently and strive for cost reductions to remain competitive. Competition among power producers in WESM results in lower electricity prices, benefiting consumers by driving down costs. It also provides a platform for new entrants in the generation sector, further increasing competition and diversifying the supply of electricity.

Supporting the Integration of Renewable Energy

As the Philippines aims to reduce its dependence on fossil fuels and increase the share of renewable energy in its power mix, which is targeted to be 35% by 2030 and 50% by 2040, WESM becomes an essential platform for integrating renewable energy sources, such as solar, wind, and hydroelectric power. These energy sources, while environmentally beneficial, are often intermittent and subject to variability. WESM helps manage the integration of renewable energy by providing market signals that encourage investment in grid management and energy storage technologies. It also allows renewable energy producers to participate in the market, ensuring that they have the opportunity to sell their energy at competitive prices. This promotes energy transition and supports the government's renewable energy targets.

In summary, the Wholesale Electricity Spot Market serves as a fundamental pillar of the Philippine Electric Power Industry, playing multiple critical roles. It enhances market efficiency through dynamic price discovery, ensures grid reliability by balancing supply and demand in real-time, promotes competition among electricity producers, and facilitates the integration of renewable energy sources. As the Philippines continues to evolve its energy landscape, WESM will remain a key force in fostering a more sustainable, reliable, and affordable electricity system for consumers across the country.



THE COO'S CORNER

2024 was a pivotal year for the Philippine Wholesale Electricity Spot Market (WESM), not only due to IEMOP's exceptional performance in operating the WESM for six (6) years, but also because several market developments came into fruition.

The market operations are primarily focused on the following key highlights:

Price Volatility and Demand Fluctuations

WESM notably responded to periods of high price volatility, driven by significant fluctuations in electricity demand due to extreme weather conditions, particularly during peak summer months. On 30 April 2024, the ERC issued an order for ERC Case No.2024-017MC, entitled In the Matter of Declaration of Market Suspension During Red Alerts During Summer Months of 2024, in response to the recorded all-time high energy demand across all regions, exacerbated by extreme heat. This demand surge strained available generation capacities, leading to the issuances of Yellow and Red Alerts by the National Grid Corporation of the Philippines (NGCP). The highest average WESM price in 2024 was recorded in May 2024 billing period at 8.22 PhP/kWh, while the lowest was in December 2024, with an all-time average price of 3.45 PhP/kWh. These figures are consistent with the level of average system demand, which was highest in May 2024 and lowest in December 2024.

Generation Supply

As of 26 December 2024, the registered capacity in the WESM grew to 30,021 MW from its original capacity of 27,236 MW in 2023. Regionally, the capacities for Luzon, Visayas, and Mindanao increased from 19,459 MW, 3,458 MW, and 4,320 MW in 2023 to 21,882 MW, 3,679 MW, and 4,460 MW in 2024, respectively. The year 2024 likewise marked the commencement of the reserve market which offers additional incentives for investment in new capacities for both energy and reserves. Currently, there are forty-nine (49) registered ancillary services providers for Luzon, Visayas, and Mindanao grids, translating to a total reserve capacity of 2,744 MW for Regulation, 3,558 MW for Contingency, and 4,056 MW for Dispatchable Reserves. Following the commencement of the reserve market's commercial operations on 26 January 2024, the reserve requirements set by the Grid Code were met, except in Visayas on certain trading dates due to a deficit in regulation reserves.

Renewable Energy Integration

The continued integration of renewable energy into the market was notable in 2024. WESM efficiently accommodated increased contributions from renewable sources, signaling the sector's transition towards a more sustainable energy future. Relative to 2023, it was recorded that 0.81% of RE Capacity was added to the

WESM registered capacity in 2024. This translates to a total of 25,764 GWh or 21.93% RE in the generation mix for the year 2024 which is higher than last year's 23,168 GWh or 21.67%. The Renewable Energy Market (REM), which began full commercial operations on 26 December 2024, provides an additional incentive for RE developers. One (1) MWh of Actual RE Generation generates One (1) Renewable Energy Certificate, which can currently be sold at the cap of 241.56 PhP. The REM is intended to facilitate compliance of mandated participants with their Renewable Portfolio Standards (RPS) obligations.

Transmission Development vis-à-vis Market Network Model

Transmission limitations, which lead to congestion in the grid, also affect generator availability and dispatchability, thereby affecting the WESM prices. After the completion of major transmission projects integrated into the market network model in 2024, the congestions reduced, and consequently, congestion cost in each region lowered. This demonstrated the impact of expanding the energy grid on market prices.

Power Outlook

Looking ahead, WESM remains committed to enhancing its operational efficiency and market structure. As renewable energy continues to grow, the market is evolving to better accommodate variable generation. In line with this, a segment of this annual report provides a simulation on the impact of increasing renewable energy integration in a co-optimized energy and reserve market by 2030. Related projections show that the country's renewable energy mix is expected to reach 37% upon consideration of the existing GEA 1 to 3 capacities and 44% with GEA 1 to 5 capacities. The addition of these RE capacities provides significant effects on the prices for the co-optimized energy and reserve market. The intermittency of renewable technologies entails adaptation through incentivizing flexible generation and storage providers to ensure market stability. Moreover, the integration of new technologies, such as advanced grid management and energy storage, will play a crucial role in strengthening market resilience and ensuring that the Philippines' electricity supply remains reliable and affordable.

Indeed, 2024 was a remarkable year of growth for the Wholesale Electricity Spot Market operations. WESM adapted to the challenges of a rapidly evolving energy landscape while maintaining its core mission of promoting efficiency, reliability, and sustainability in the Philippine electricity market.

IEMOP ANNOUNCES

THE FULL COMMERCIAL OPERATIONS OF THE

RESERVE MARKET

26 JANUARY 2024

IEMOP
We Run Markets

ACRONYMS

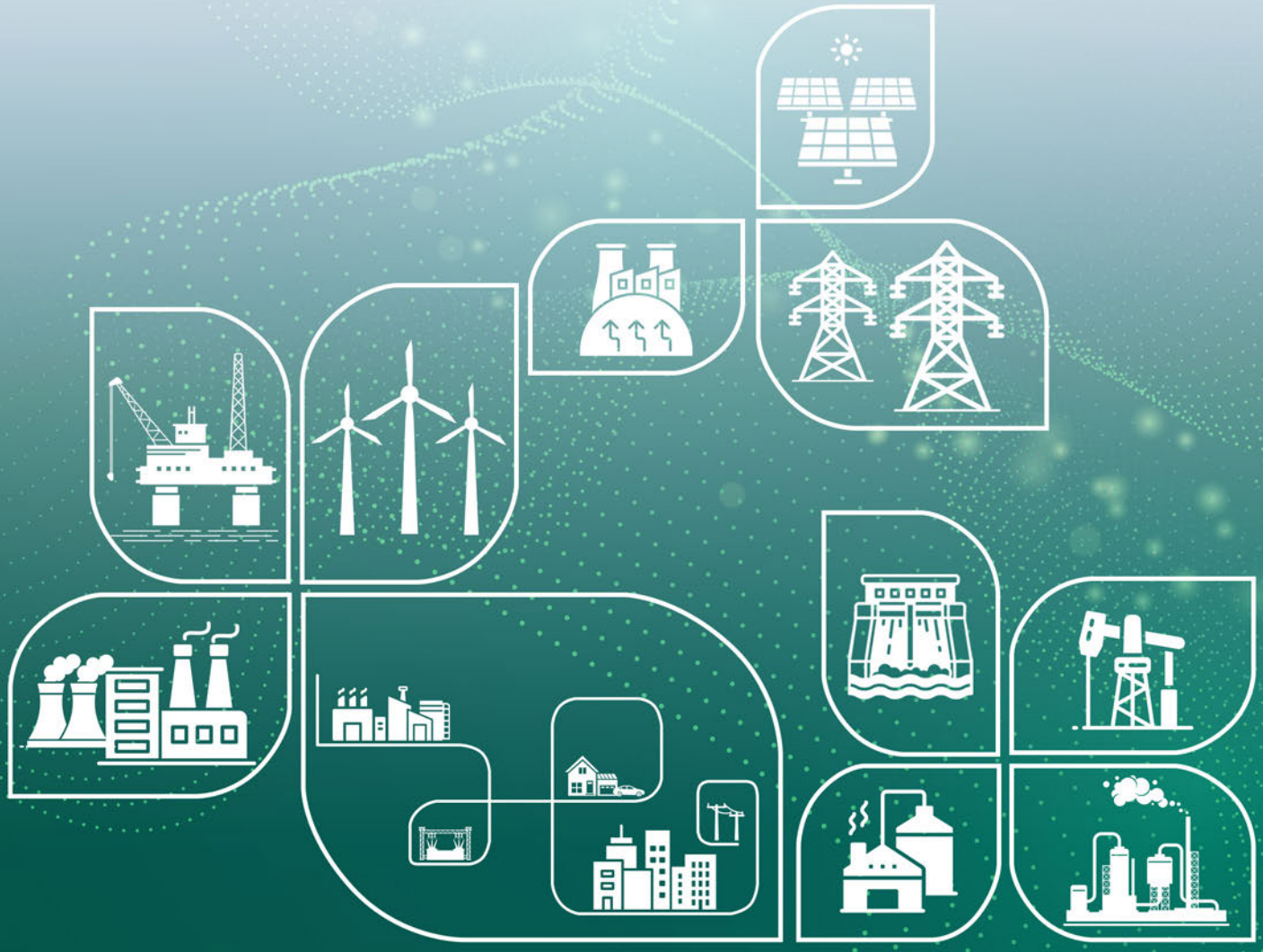
ACRONYM	DEFINITION
AS or A/S	Ancillary Service
AAGR	Average Annual Growth Rate
APEx	Association of Power Exchanges
ASEAN	Association of Southeast Asian Nations
ASPA	Ancillary Services Procurement Agreements
BESS	Battery Energy Storage Systems
BIMP-PIP	Brunei Darussalam-Indonesia-Malaysia-Philippines Power Integration Project
C02e	Carbon Dioxide Emissions
CCU	Contestable Customer
CRB	Central Registration Body
DC	Department Circular
DCC	Directly Connected Customer
DCU	Directly Connected Contestable Customer
DOE	Department of Energy
EDGE	Enhancing Development & Growth through Energy
ENR	Bureau of Energy Resources
EPIRA	Electric Power Industry Reform Act
ERC	Energy Regulatory Commission
ESS	Energy Storage Systems
ESSP	Effective Spot Settlement Price
EWDO	Enhanced WESM Design and Operations
FIT	Feed-in-Tariff
GDP	Gross Domestic Product
GEA	Green Energy Auction
GEAP	Green Energy Auction Program
GEOP	Green Energy Option Program
GHG	Greenhouse Gas
GW	Gigawatt
GWh	Gigawatt-hour
HVDC	High-voltage Direct Current
ICON	Iloilo Convention Center
I-COP	Interim Commercial Operations
IEMOP	Independent Electricity Market Operator of the Philippines
IPP	Independent Power Producer
kWh	Kilowatt-hour
LGU	Local Government Unit
LRES	Local Retail Electricity Supplier
LTMS-PIP	Laos-Thailand-Malaysia-Singapore Power Integration Project
MO	Market Operator
MPU	Market Participants Update

ACRONYM	DEFINITION
MQ	Metered Quantity
MSP	Metering Service Provider
MT	Megatonne
MW	Megawatt
MWh	Megawatt-hour
NOA	Notice of Auction
PDM	Price Determination Methodology
PDU	Public Distribution Utility
PEMC	Philippine Electricity Market Corporation
PEPIF	Philippine Electric Power Industry Forum
PREMS	Philippine Renewable Energy Market System
PSP	Power Sector Program
PV	Photovoltaic
RA	Republic Act
RCOA	Retail Competition and Open-Access
RE	Renewable Energy
REC	Renewable Energy Certificate
REM	Renewable Energy Market
RER	Renewable Energy Registrar
RES	Retail Electricity Supplier
ROR	Run-of-River
RPS	Renewable Portfolio Standards
RTD	Real-time Dispatch
SO	System Operator
SOE	State-owned Enterprise
SOLR	Supplier of Last Resort
TransCo	National Transmission Corporation
TWh	Terawatt-hour
UNDP	United Nations Development Programme
USEA	United States Energy Association
VRE	Variable Renewable Energy
WESM	Wholesale Electricity Spot Market

INTRODUCTION

This IEMOP Annual Report provides highlights on the operations of the Philippine Wholesale Electricity Spot Market (WESM) particularly the market outcomes for year 2024. This report covers the state of supply and demand including generator performance per technology as well as transmission performance – all of which are factors affecting the WESM prices.

This report also features market developments including Reserve Market and the concept of co-optimization with energy, implementation of the Retail Competition and Open Access (RCOA) and the Green Energy Option Program (GEOP) in Mindanao, and the launching of the full commercial operations of the Renewable Energy Market (REM) with IEMOP as the Renewable Energy Registrar (RER). Additionally, this report provides updates on the country's economic and technological state of energy with respect to neighboring Southeast Asian countries and the world.



1. ENERGY MARKET OUTCOMES

In 2024, several changes occurred in the operations of WESM. From relevant system and operational enhancements to new market developments, all significant data related to the effective supply, demand, reserve, margin, and prices were investigated and determined, taking into account their average values and the integration of WESM Mindanao, Retail Market developments, Renewable Energy technologies, and other pertinent progress towards obtaining optimal market conditions.

For reference, "system" or "system-wide" collectively refers to Luzon, Visayas, and Mindanao. "Billing months" refers to the period from the 26th of the previous month until the 25th of the current month. The following data covers all billing months of 2024, specifically from 26 December 2023 until 25 December 2024.

1.1 OPERATIONAL HIGHLIGHTS

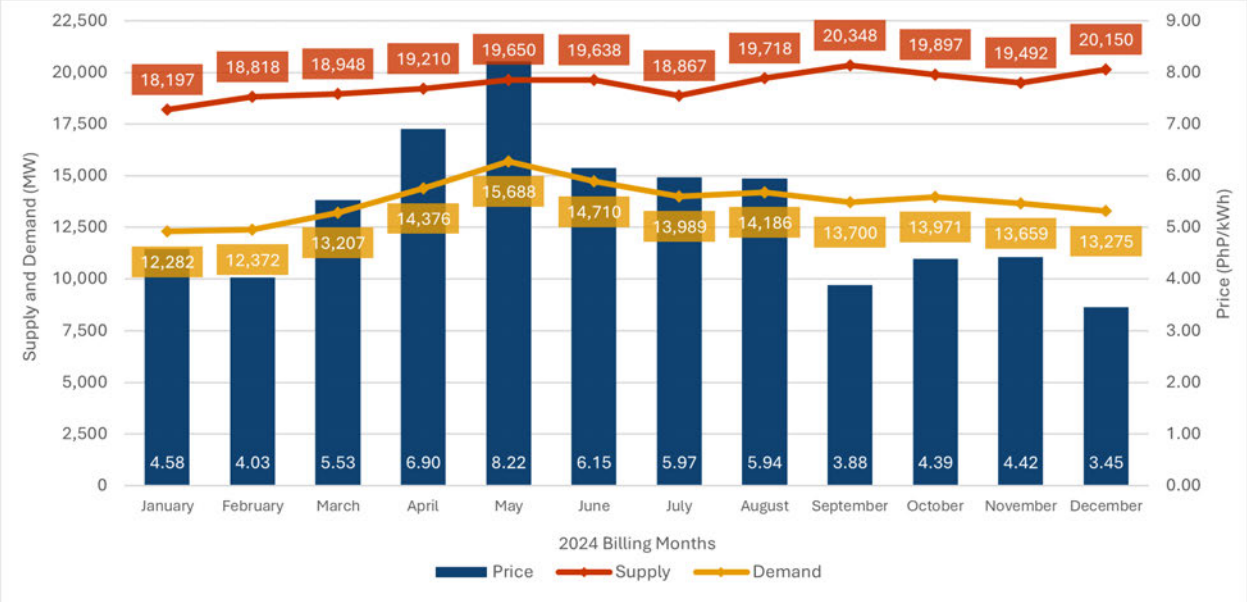


Figure 01: System Average Supply, Demand, and Price Trend (2024)

Based on the 2024 operational highlights, the May 2024 billing period recorded the highest system average WESM price, driven by the highest average demand for the system during that month, similar with the conditions of previous year, 2023. Following May 2024, prices notably decreased and continued to gradually decrease towards the end of 2024. In addition to the May 2024 billing period, relatively high WESM prices were also observed in the March 2024, April 2024, and June 2024 billing months.

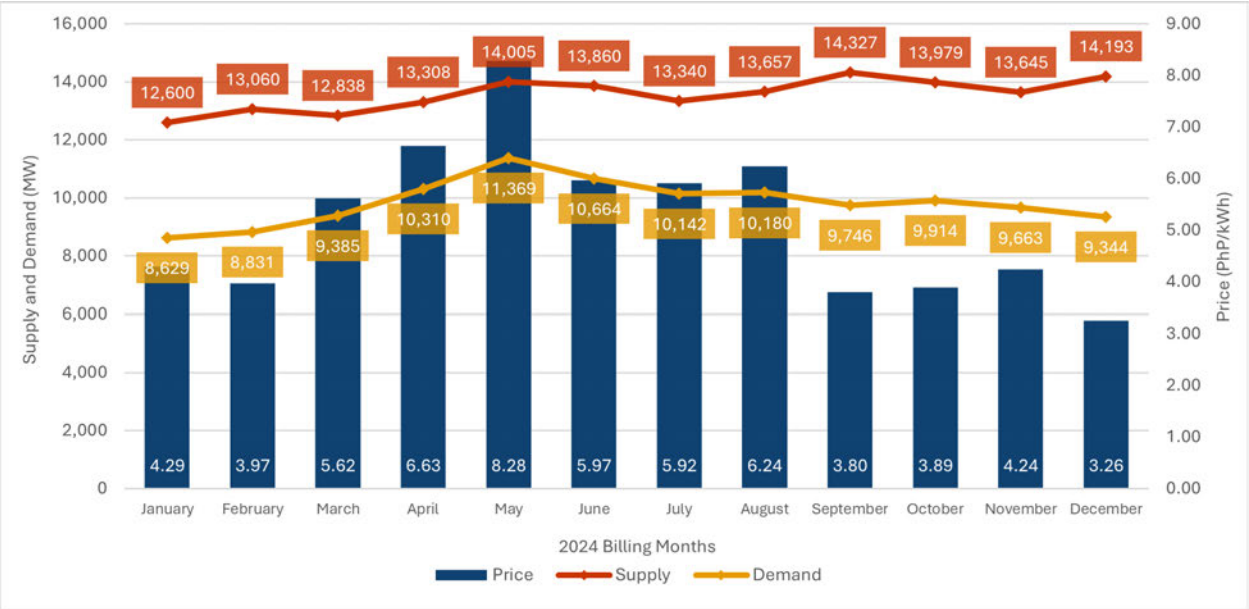


Figure 02: Luzon Average Supply, Demand, and Price Trend (2024)

Among the regions, Luzon exhibits the most robust supply and demand trends, contributing significantly to the overall system results. Similarly, Luzon recorded the highest demand and WESM price for the billing month of May 2024, a trend also observed in the previous year. The region's supply ranged from approximately 12,000 MW to 14,000 MW, while its demand ranged from around 8,000 MW to 11,000 MW.

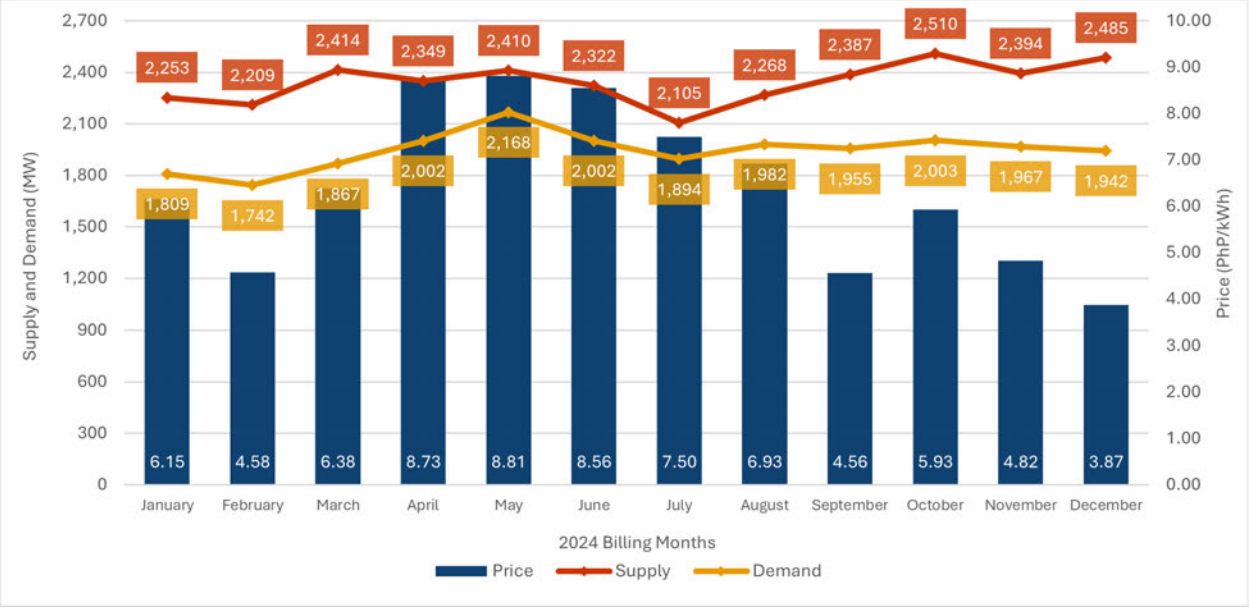


Figure 03: Visayas Average Supply, Demand, and Price Trend (2024)

In Visayas, the highest demand was recorded between the billing months of April 2024 and June 2024, while the highest price was recorded during the May 2024 billing. The region's supply was approximately 2,000 MW, while its demand ranged from 1,000 MW to 2,000 MW.

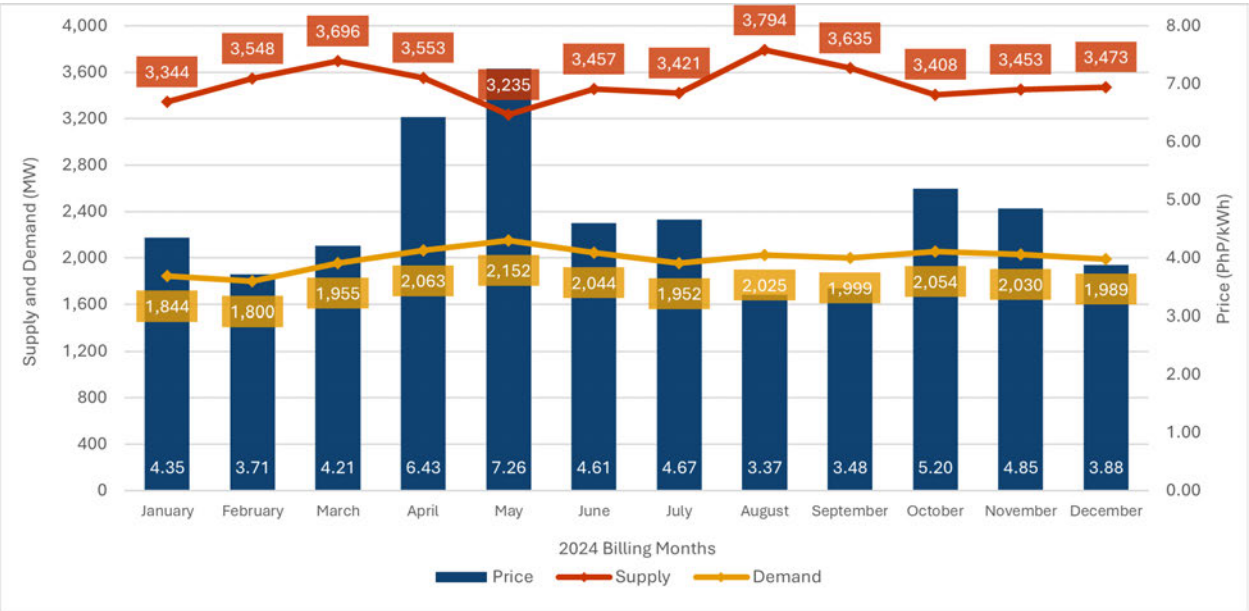


Figure 04: Mindanao Average Supply, Demand, and Price Trend (2024)

Similar to the previous graphs, Mindanao identifies its highest demand and prices during the April 2024 and May 2024 billing periods. Its supply ranged from 1,000 MW to 2,000 MW, while its demand remained around 3,000 MW. Overall, the region's demand trend stands relatively stable throughout the year.

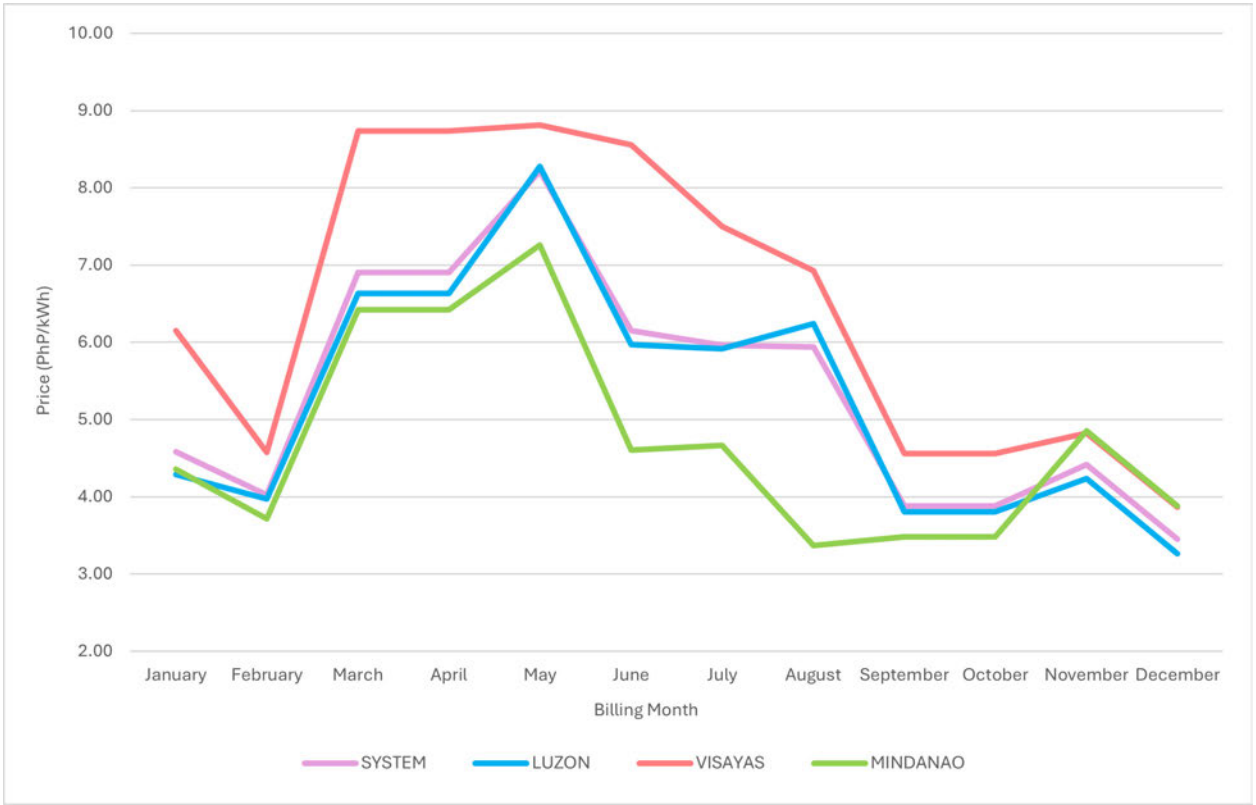


Figure 05: Monthly Average Market Prices – System, Luzon, Visayas, and Mindanao (2024)

The monthly average Market Prices for Luzon, Visayas, Mindanao, and the system-wide average for 2024 can be observed in Figure 5. The market prices in Visayas were consistently higher throughout most of the year, as compared to the two other regions. Conversely, the market prices in Mindanao remained consistently low throughout the year, except for the last quarter, when its prices aligned with those of Visayas. For Luzon, the prices stayed between the two regions' levels, except for the last quarter of the year, when their prices were the cheapest. The system-wide market prices were consistently low from January 2024 to February 2024 and again in the last quarter of the year, reaching its lowest record in December 2024. On the other hand, the market prices gradually increased starting in March.

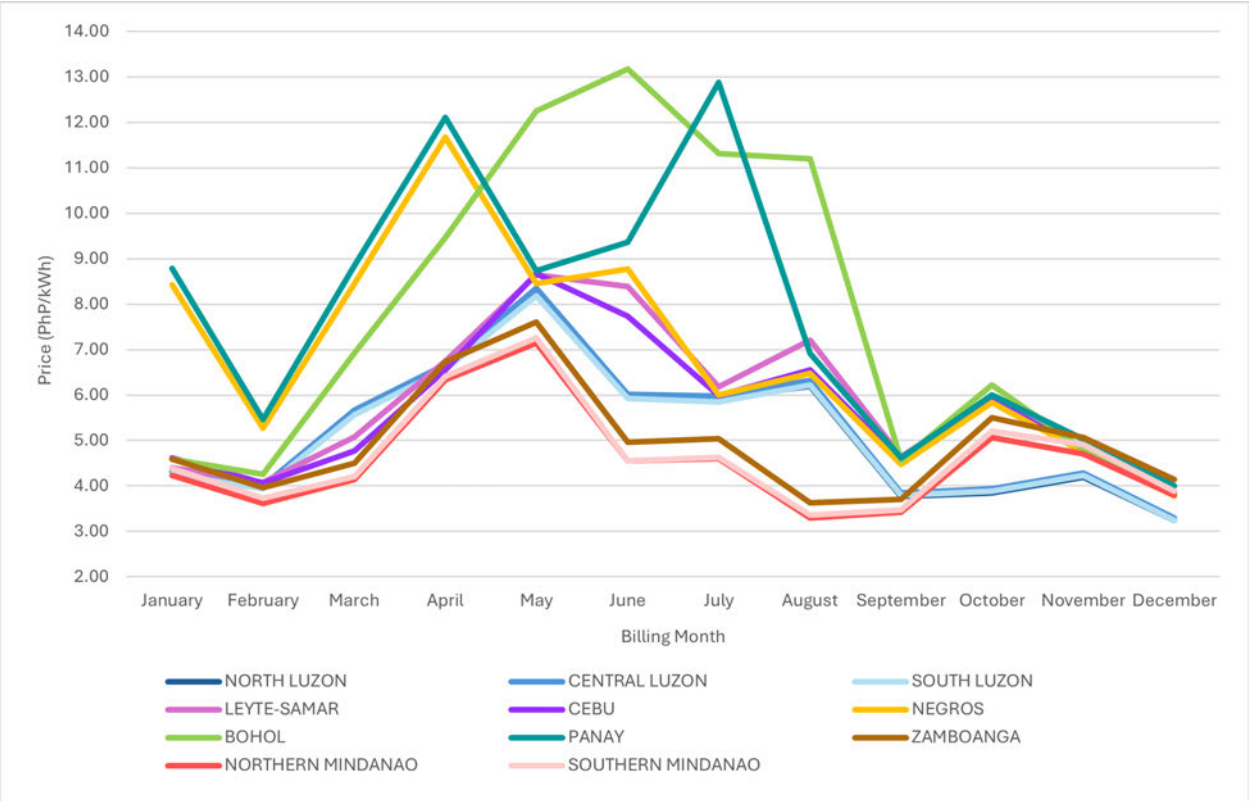


Figure 06: Monthly Average Market Prices – Sub-Regions (2024)

The 2024 monthly average market prices, further broken down into sub-regions, are shown in Figure 6. The market prices in the northern, southern, and central part of Luzon follow a similar trend, exhibiting minimal price differences. The same trend can be observed for northern and southern Mindanao. For Visayas, the market prices vary greatly depending on the location, which happens for most of the year. Particularly, Bohol experienced consistently high prices from May 2024 through August 2024. Meanwhile, Negros and Panay had similar prices at the start of the year. However, Panay saw a spike in prices towards the middle of the year, peaking in the month of July 2024. Although the prices in Visayas varied across different locations, they converged towards closer values by September 2024 and continued until the end of the year.

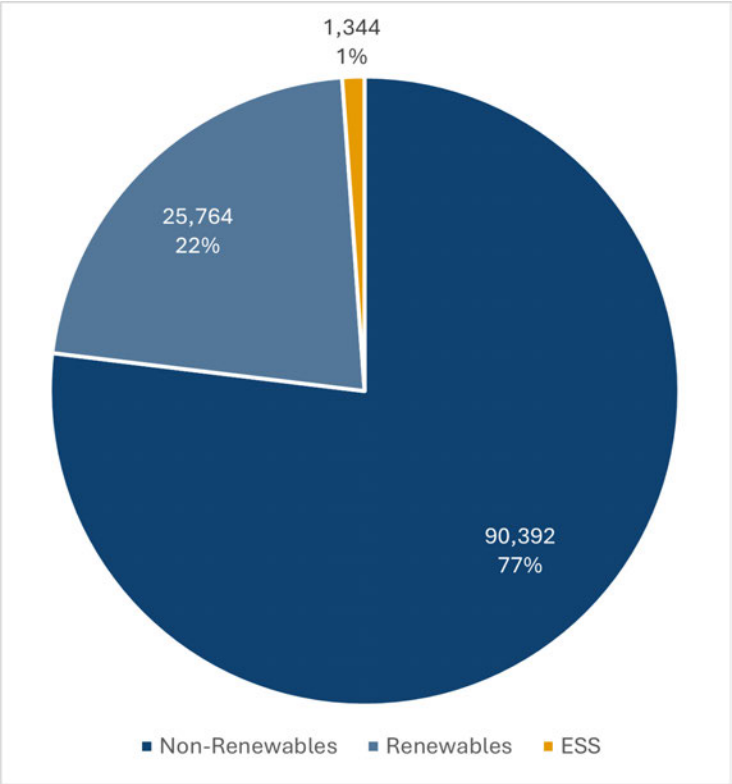


Figure 07: System Generation Mix - Clustered (2024)

Clustering the technologies together, non-renewables, renewables, and energy storage systems (ESS), non-renewable energies dominate the system generation mix by approximately 76.93% as shown in Figure 7. Renewable energies and ESS contribute to the mix by 21.93% and 1.14%, respectively. To specify its categorization, non-renewables include coal, natural gas, and oil-based technologies, renewables encompass geothermal, hydro, solar, wind, and biomass technologies, while ESS includes battery energy storage systems (BESS) and pump storage systems.

1.2 MARKET TRANSACTIONS

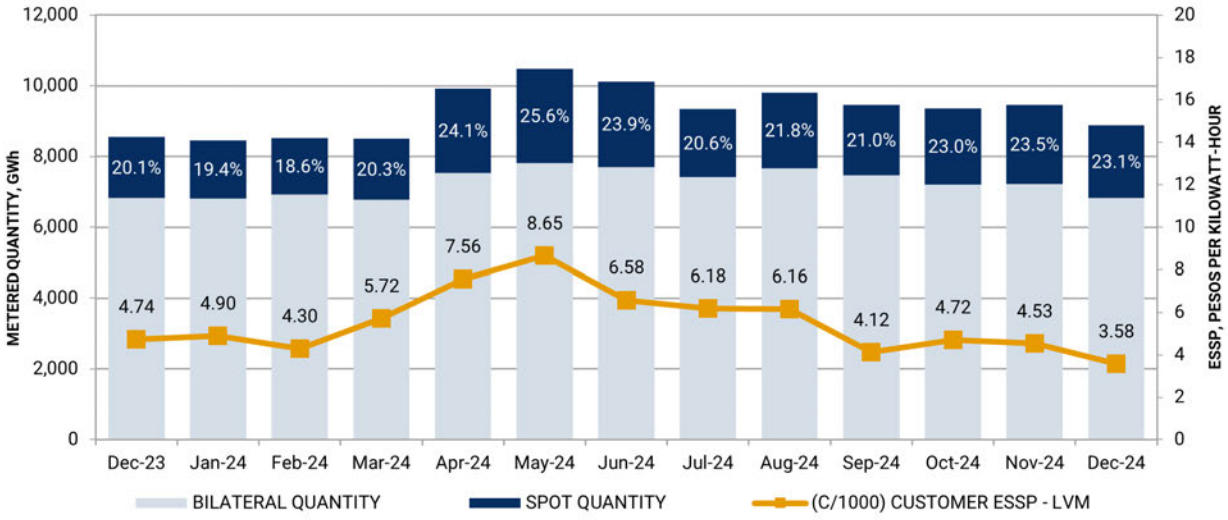


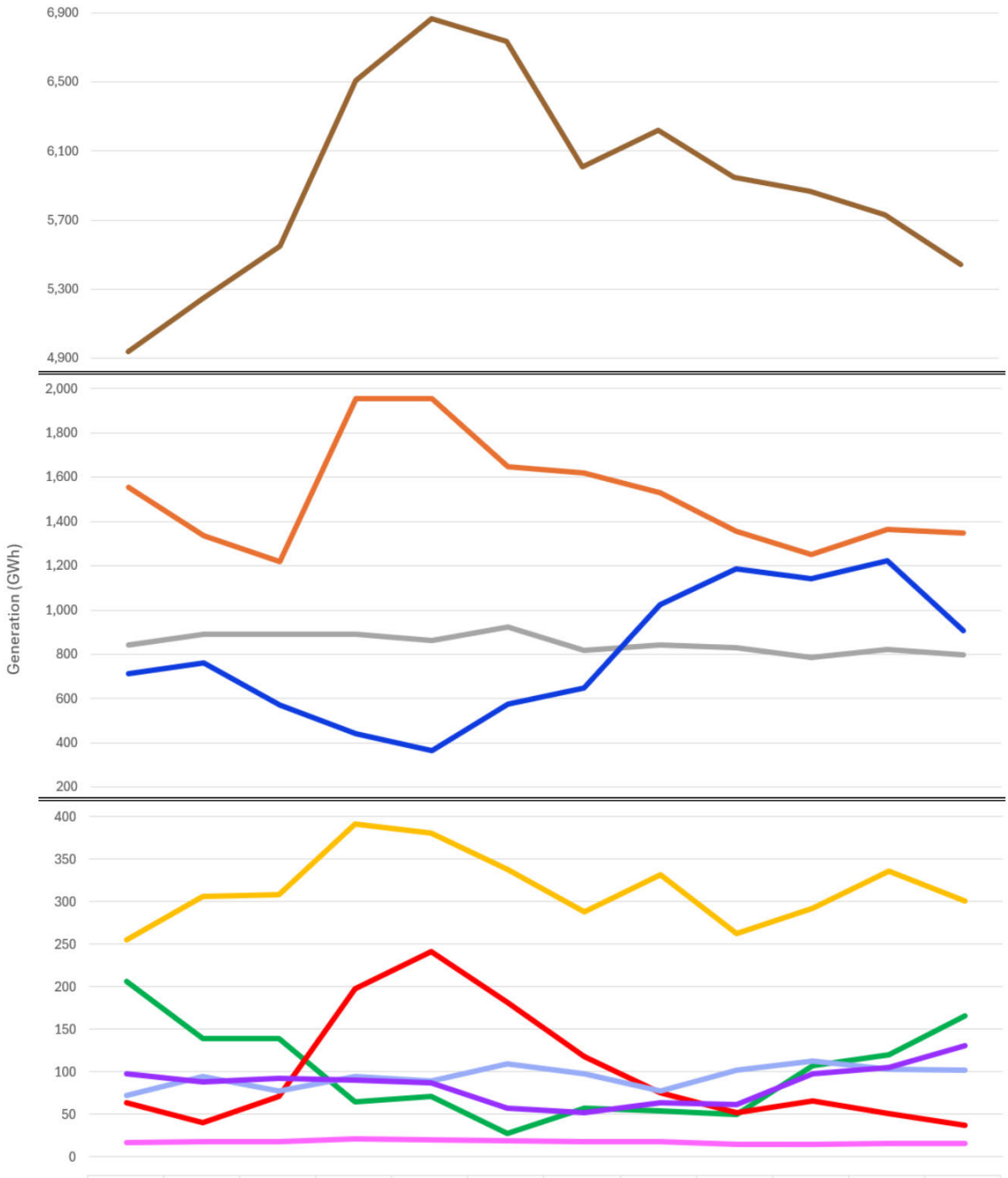
Figure 08: System Market Transactions Trend (2024)

Coinciding with the month identified with the highest demand and price, May 2024 recorded the highest Effective Spot Settlement Price (ESSP), which refers to the average price paid by wholesale customers in the spot market. The highest ESSP in May approximately reached 8.65 PhP/kWh, while a downward trend in prices was observed as the months progressed towards the colder months of the year.

BILLING PERIOD	2023 DEC	2024 JAN	2024 FEB	2024 MAR	2024 APR	2024 MAY	2024 JUN	2024 JUL	2024 AUG	2024 SEP	2024 OCT	2024 NOV	2024 DEC
METERED QUANTITY (GWh)	8,546	8,449	8,514	8,498	9,925	10,489	10,125	9,337	9,808	9,451	9,363	9,451	8,878
BILATERAL QUANTITY (GWh)	6,824	6,814	6,930	6,773	7,530	7,807	7,701	7,410	7,668	7,471	7,205	7,227	6,824
SPOT QUANTITY (GWh)	1,721	1,636	1,584	1,726	2,396	2,682	2,424	1,926	2,140	1,980	2,157	2,224	2,054
DAILY AVERAGE MQ (GWh)	285	273	284	293	320	350	327	311	327	305	312	305	296
CUSTOMER ESSP - LVM (PhP/kWh)	4.74	4.90	4.30	5.72	7.56	8.65	6.58	6.18	6.16	4.12	4.72	4.53	3.58
TRADING AMOUNT (in Billion, PhP)	15.07	14.44	12.41	17.03	28.05	34.71	25.88	20.21	21.69	12.92	16.15	16.19	12.79

Table 01: System Market Transactions (2024)

Moreover, the highest trading amount was recorded during the May 2024 billing month, which also reflected the highest metered quantity (MQ) and daily average MQ. The daily average MQ is calculated by dividing the total MQ by the total number of days included. Meanwhile, the billing months identified with the highest spot quantities were May 2024, followed by June 2024 and April 2024, in that order.



	January	February	March	April	May	June	July	August	September	October	November	December
COAL	4,938	5,252	5,548	6,511	6,866	6,734	6,010	6,221	5,946	5,868	5,728	5,442
NAT. GAS	1,557	1,334	1,219	1,955	1,955	1,647	1,619	1,530	1,356	1,250	1,363	1,346
GEO	841	890	889	889	862	923	816	842	831	788	820	799
HYDRO	713	762	570	440	364	574	649	1,026	1,184	1,143	1,225	905
SOLAR	256	306	309	391	381	338	288	332	262	292	336	301
WIND	206	139	140	65	71	27	58	54	50	107	120	166
OIL-BASED	64	40	71	198	242	182	118	76	52	65	50	37
PUMP	72	95	78	95	89	110	98	77	102	113	104	102
BIOMASS	97	89	92	90	87	57	52	63	62	98	106	130
BATTERY	16	18	18	22	20	19	18	18	15	15	16	16

COAL NAT. GAS GEO HYDRO SOLAR WIND OIL-BASED PUMP BIOMASS BATTERY

Figure 09: System Market Transactions (2024)

Figure 9 shows an overview of the 2024 system generation mix which significantly underscores the predominance of coal with around 71,066 GWh of generated energy. With coal's extensive availability, cost-effectiveness, and baseload nature, it evidently becomes the most utilized technology among others in the country. Following through, natural gas, geothermal and hydro technologies also maintain substantial contributions to the generation mix. The overall increase of generation aligns with that of the increase in demand in the previous graphs, specifically distinguishing the May billing period among the other months and coincides at the advent of warmer months in the Philippines.

1.3 REGISTRATION DEMOGRAPHICS

The next few tables comprehensively break down the registration demographics of WESM, the Retail Competition and Open Access (RCOA), and the Green Energy Option Program (GEOP), highlighting the increased participation in these markets across the three regions. Categorically, based on tables 2-5, "Direct" refers to "Direct WESM Members" who either partake in market transactions or trading directly through WESM, while "Indirect" refers to "Indirect WESM Members" who are still registered in WESM but whose transactions are done through an existing direct WESM member. "Service Providers" are those who are either WESM-registered owners, controllers, or operators of transmission or distribution systems. Significantly, the regions "LUZ, VIS, and MIN" refer to the direct location of their registered facilities while "LVM" refers to registrants whose owned facilities may exist in more than simply one region. This explanation applies to the proximate demographic tables.

REGION	COAL	NATURAL GAS	OIL BASED	HYDRO	GEO-THERMAL	BIOMASS	SOLAR	WIND	BATTERY	TOTAL MW
LUZON	8,937	4,612	1,766	1,866	800	156	2,157	466	1,123	21,882
	40.84%	21.08%	8.07%	8.53%	3.65%	0.71%	9.86%	2.13%	5.13%	
VISAYAS	1,330	0	433	66	857	212	568	104	110	3,679
	36.14%	0.00%	11.76%	1.80%	23.29%	5.76%	15.43%	2.82%	2.99%	
MINDANAO	2,273	0	652	1,162	155	51	67	0	100	4,460
	50.95%	0.00%	14.62%	26.06%	3.48%	1.15%	1.51%	0.00%	2.24%	
TOTAL	12,539	4,612	2,850	3,095	1,812	419	2,792	570	1,333	30,021
	41.77%	15.36%	9.49%	10.31%	6.03%	1.39%	9.30%	1.90%	4.44%	

Table 02: WESM Registered Capacities (MW & %, as of 26 December 2024)

In terms of registration, coal dominates the WESM registered capacity. In the spectrum of renewable energies, hydro takes dominance among others, followed by solar and geothermal technologies. Luzon distinctively leads in the energy mix for coal, natural gas, oil-based, hydro, solar, wind, and battery technologies, while Visayas provides the most geothermal and biomass capacities. Collectively, the registered capacity from all WESM-registered power plants aggregates to 30,021 MW by the end of 2024.

CATEGORY	TOTAL	DIRECT				INDIRECT				SERVICE PROVIDERS			
		LUZ	VIS	MIN	LVM*	LUZ	VIS	MIN	LVM*	LUZ	VIS	MIN	LVM*
GENERATION COMPANIES	**230**	**127**	**53**	**45**	**4**	**1**	**0**	**0**	**0**	**-**	**-**	**-**	**-**
CUSTOMERS	172	57	37	34	1	30	5	8	0	-	-	-	-
PRIVATE DISTRIBUTION UTILITIES AND LOCAL GOVERNMENT UTILITIES	26	12	6	4	0	4	0	0	0	-	-	-	-
ELECTRIC COOPERATIVES	99	38	28	26	0	5	0	2	0	-	-	-	-
DIRECTLY CONNECTED CUSTOMERS	47	7	3	4	1	21	5	6	0	-	-	-	-
ANCILLARY SERVICE PROVIDERS	**46**	**18**	**16**	**10**	**2**	**0**	**0**	**0**	**0**	**-**	**-**	**-**	**-**
ANCILLARY SERVICE BUYER	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**-**	**-**	**-**	**-**
METERING SERVICE PROVIDERS	**20**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**7**	**0**	**12**	**1**
TOTAL PARTICIPANTS	**469**	**202**	**106**	**89**	**8**	**31**	**5**	**8**	**0**	**7**	**0**	**12**	**1**

Table 03: WESM Registered Capacities (MW & %, as of 26 December 2024)
** LVM refers to registrants whose facilities may be located in more than one region.*

The WESM registration demographics show that there are a total of 469 participants currently registered as of December 2024. Out of these participants, 230 are Generation Companies, 172 are Customers, 46 are Ancillary Service Providers, 1 is an Ancillary Service Buyer, and 20 are Metering Service Providers (MSPs). Among the customers, 26 are composed of PDUs and LGUs, 99 are Electric Cooperatives, and 47 are Directly Connected Customers (DCCs). Direct WESM members comprise most of the participants- where 202 of which are situated in Luzon. Likewise, the majority of indirect WESM members in Luzon consist of 31 total participants. Meanwhile, 12 out of 20 MSPs are in Mindanao.

CATEGORY	TOTAL	DIRECT					INDIRECT			CRB ONLY			SERVICE PROVIDERS		
		LUZ	VIS	MIN	LUZ/ VIZ	NATIONWIDE	LUZ	VIS	MIN	LUZ	VIS	MIN	LUZ	VIS	MIN
RETAIL METERING SERVICES PROVIDERS	**89**	0	0	0	0	0	0	0	0	-	-	-	44	28	17
LOCAL RETAIL ELECTRICITY SUPPLIERS	**15**	10	5	0	0	0	0	0	0	-	-	-	-	-	-
RETAIL ELECTRICITY SUPPLIERS	**50**	0	0	0	0	50	0	0	0	-	-	-	-	-	-
SUPPLIERS OF LAST RESORT	**28**	17	11	0	0	0	0	0	0	-	-	-	-	-	-
CONTESTABLE CUSTOMERS	**2113**	1	0	0	0	0	1464	176	0	370	76	26	-	-	-
DIRECTLY CONNECTED CONTESTABLE CUSTOMER	**43**	1	2	0	0	0	31	8	1	0	0	0	-	-	-
TOTAL PARTICIPANTS	**2338**	**29**	**18**	**0**	**0**	**50**	**1495**	**184**	**1**	**370**	**76**	**26**	**44**	**28**	**17**

Table 04: RCOA Registration Demographics as of 26 December 2024

The RCOA, which started on 26 June 2013, provides an opportunity for qualified electricity end-users, with an average demand set by the Energy Regulatory Commission (ERC), to choose their Retail Electricity Supplier (RES) for their own electricity requirements, and generally allows WESM participants to use transmission, distribution systems, and/or other associated facilities. The "Indirect" and "CRB only" categories technically do not differ in terms of their interface with the Central Registration Body; however, "Indirect" refers to those that opted to register as WESM members.

With regard to RCOA's registration demographics, there are a total of 2,338 registered participants as of December 2024. Out of these participants, 89 are Retail Metering Services Providers, 15 are Local Retail Electricity Suppliers (LRES), 50 are Retail Electricity Suppliers (RES), 28 are Suppliers of Last Resort (SOLR), 2,113 are Contestable Customers (CCUs), and 43 are Directly Connected Contestable Customers (DCUs). Contestable Customers (CCUs and DCUs) constitute 90% of the RCOA participants, most of which are indirect WESM members. The bulk of the participants are situated in Luzon, which comprises around 83% of the total participants, while the RES serves nationwide coverage.

CATEGORY	TOTAL	DIRECT				CRB ONLY			SERVICE PROVIDERS		
		LUZ	VIS	MIN	NATIONWIDE	LUZ	VIS	MIN	LUZ	VIS	MIN
DU-CONNECTED END-USER	515	0	0	0	0	425	90	0	-	-	-
DIRECTLY CONNECTED END-USER	0	0	0	0	0	0	0	0	-	-	-
GEOP METERING SERVICES PROVIDER	49	-	-	-	-	-	-	-	25	17	7
RENEWABLE ENERGY (RE) SUPPLIER	18	0	0	0	18	0	0	0	-	-	-
LOCAL RETAIL ELECTRICITY SUPPLIER	1	1	0	0	0	-	-	-	-	-	-
SUPPLIER OF LAST RESORT - GEOP	16	9	7	0	0	-	-	-	-	-	-
TOTAL PARTICIPANTS	599	10	7	0	18	425	90	0	25	17	7

Table 05: GEOP Registration Demographics as of 26 December 2024

GEOP, which commenced on 3 December 2021, is a mechanism that empowers electricity end-users to choose solely from renewable energy resources in accordance with their electricity requirements. To be eligible under this program, the average peak demand for the past 12 months of operations should be 100kW.

As of December 2024, the total 599 GEOP participants are composed of 515 DU-Connected End Users, 49 GEOP Metering Services Providers, 18 RE Suppliers, 1 Local Retail Electricity Supplier, and 16 Suppliers of Last Resort, with no registered Directly Connected End-User. All End-Users are currently registered through the CRB and are only situated in Luzon and Visayas. Most of the registered participants are situated in Luzon, with RE suppliers serving nationwide.

2. INDUSTRY PERFORMANCE DATA

The Wholesale Electricity Spot Market or WESM essentially involves a complex interplay of supply and demand which determines the main drivers to consider upon the determination of WESM prices. With primary consideration of the Price Determination Methodology (PDM), a series of factors are ordinarily considered in the determination of the main drivers that shape the market's spot prices. From the state of the country's supply, demand, and energy dynamics to generation and transmission performances, this section aims to analyze the governing factors in WESM Prices and provide a general perspective as to where we are now with our country's spot rates.

The year 2024 carried out several market developments that have since gone underway, highlighting the Reserve Market, its co-optimization with energy, the Renewable Energy Market, and several other market-related and systems-based enhancements. Considering these developments, the market dynamics of supply and demand are observed accordingly below.

2.1 SUPPLY, DEMAND, AND PRICE

The Wholesale Electricity Spot Market or WESM essentially involves a complex interplay of supply and demand, which are the main drivers considered in determining WESM prices. With primary consideration of the Price Determination Methodology (PDM), several factors are typically considered in determining the main drivers that shape WESM's spot prices. From the state of the country's supply, demand, and energy dynamics to generation and transmission performances, this section aims to analyze the factors governing WESM Prices and provide a general perspective on the current state of the country's spot rates.

The year 2024 saw several market development, including the Reserve Market, its co-optimization with energy, the Renewable Energy Market, and several other market-related and systems-based enhancements. In light of these developments, the market dynamics of supply and demand are observed and outlined below.

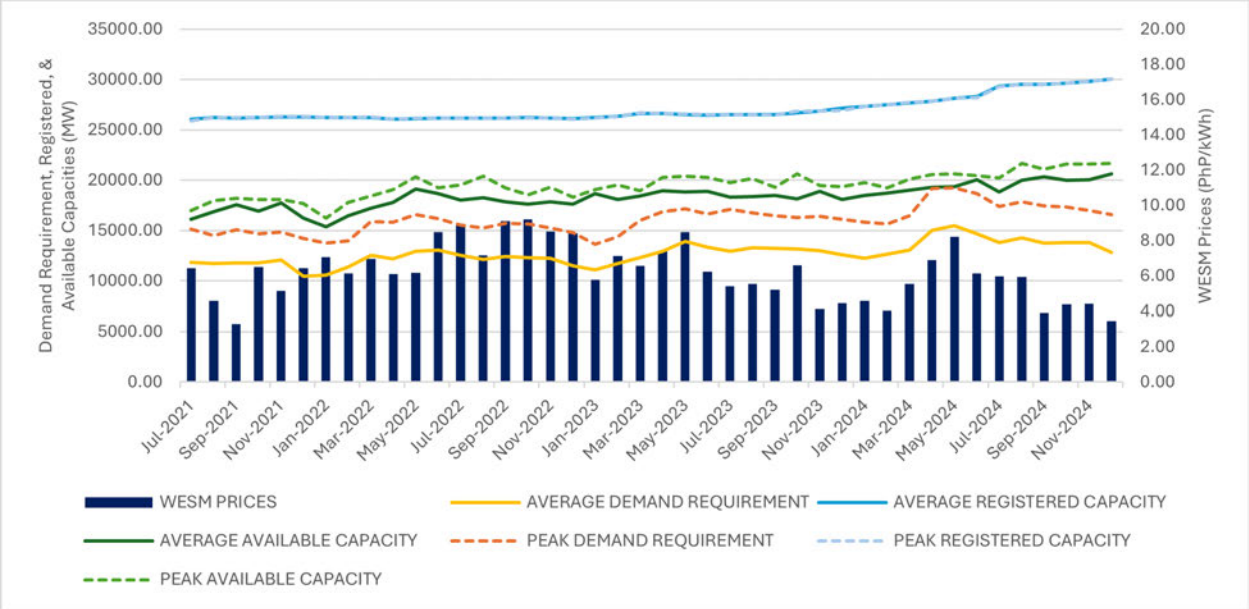


Figure 10: System Demand, Registered & Available Capacities, and WESM Prices Trend (2021-2024)

Per Month	Average Demand Requirement	Average Registered Capacity	Average Available Capacity	Peak Demand Requirement	Peak Registered Capacity	Peak Available Capacity	WESM Prices
JUL 2021	11834.98	26041.57	16113.64	15136.01	25868.60	17001.88	**6.45**
AUG 2021	11717.02	26230.23	16869.83	14492.17	26214.60	17965.17	**4.58**
SEP 2021	11795.39	26200.22	17566.75	15058.26	26232.20	18230.58	**3.30**
OCT 2021	11805.59	26260.86	16947.14	14672.04	26232.90	18090.91	**6.50**
NOV 2021	12101.22	26309.05	17736.44	14835.77	26340.20	18087.10	**5.16**
DEC 2021	10473.94	26289.24	16236.75	14209.97	26340.20	17670.16	**6.43**
JAN 2022	10543.27	26224.70	15356.05	13758.98	26224.80	16211.32	**7.06**
FEB 2022	11382.07	26224.80	16450.43	13991.38	26224.80	17804.22	**6.15**
MAR 2022	12538.13	26215.73	17197.44	15877.23	26300.30	18431.46	**6.96**
APR 2022	12191.85	26068.48	17781.13	15848.07	26055.60	19085.83	**6.09**
MAY 2022	12944.55	26126.82	19155.15	16589.25	26155.60	20363.20	**6.17**
JUN 2022	13035.01	26174.79	18641.38	16178.99	26167.60	19268.22	**8.50**
JUL 2022	12535.40	26196.12	18038.57	15516.75	26197.80	19525.67	**8.89**
AUG 2022	12143.98	26204.09	18252.52	15237.66	26197.80	20415.99	**7.17**
SEP 2022	12396.69	26197.17	17864.59	15744.27	26208.40	19250.32	**9.11**
OCT 2022	12306.97	26239.01	17642.48	15658.77	26184.00	18522.74	**9.22**
NOV 2022	12259.17	26168.24	17867.00	15258.70	26207.00	19304.37	**8.53**
DEC 2022	11490.65	26117.37	17640.02	14772.41	26080.40	18297.40	**8.42**
JAN 2023	11098.58	26225.07	18673.07	13614.07	26199.10	19063.22	**5.76**
FEB 2023	11715.07	26360.49	18074.17	14390.95	26355.70	19542.10	**7.14**
MAR 2023	12297.47	26619.88	18413.97	15995.96	26691.63	18966.72	**6.59**
APR 2023	12949.29	26660.43	18927.02	16875.55	26658.43	20311.48	**7.40**
MAY 2023	13951.36	26551.39	18833.31	17182.24	26594.53	20380.96	**8.50**
JUN 2023	13361.16	26495.21	18889.39	16667.70	26513.03	20265.69	**6.23**
JUL 2023	12964.25	26518.65	18296.39	17120.35	26512.83	19747.59	**5.42**
AUG 2023	13276.99	26554.87	18365.30	16774.83	26538.83	20184.17	**5.55**
SEP 2023	13251.18	26528.95	18498.86	16480.53	26496.43	19300.81	**5.22**
OCT 2023	13180.21	26709.16	18149.08	16287.56	26876.98	20640.91	**6.60**
NOV 2023	12982.43	26885.80	18897.56	16433.99	26876.98	19459.31	**4.12**
DEC 2023	12578.57	27169.41	18111.15	16094.90	26920.87	19378.15	**4.45**
JAN 2024	12263.20	27338.43	18470.59	15836.32	27336.35	19759.82	**4.58**
FEB 2024	12636.32	27502.58	18739.72	15640.86	27506.08	19269.75	**4.03**
MAR 2024	13078.06	27701.40	19022.07	16478.17	27733.58	20085.08	**5.53**
APR 2024	15016.89	27872.03	19285.35	19178.36	27843.68	20586.06	**6.90**
MAY2024	15478.55	28149.53	19377.90	19246.17	28123.68	20641.87	**8.22**
JUN 2024	14649.93	28304.82	20052.72	18677.80	28187.18	20455.15	**6.15**
JUL 2024	13831.11	29345.66	18823.51	17402.10	29277.18	20209.60	**5.97**
AUG 2024	14280.43	29516.49	20010.41	17832.77	29524.68	21665.74	**5.94**
SEP 2024	13724.03	29527.72	20365.63	17448.43	29550.38	21115.87	**3.88**
OCT 2024	13792.59	29651.02	20013.95	17315.87	29657.02	21616.47	**4.39**
NOV 2024	13791.93	29808.50	20032.14	16983.80	29840.08	21596.22	**4.42**
DEC 2024	12826.72	30078.51	20646.57	16594.21	30035.78	21666.57	**3.45**

Table 06: System Demand, Registered & Available Capacities, and WESM Prices Data (2021-2024)

For the System average and peak supply, demand, and WESM prices trend, the available capacity has consistently remained above the respective demand requirement each month since the commencement of the 5-minute market. While the historical prices show monthly fluctuations, typically spiking during summer periods or warmer months, spot prices began to obtain lower rates starting 2023, following the integration of WESM Mindanao to the grid, which provided additional capacities for Visayas, and in extension, to the country. Table 6 shows the specific values of Figure 10.

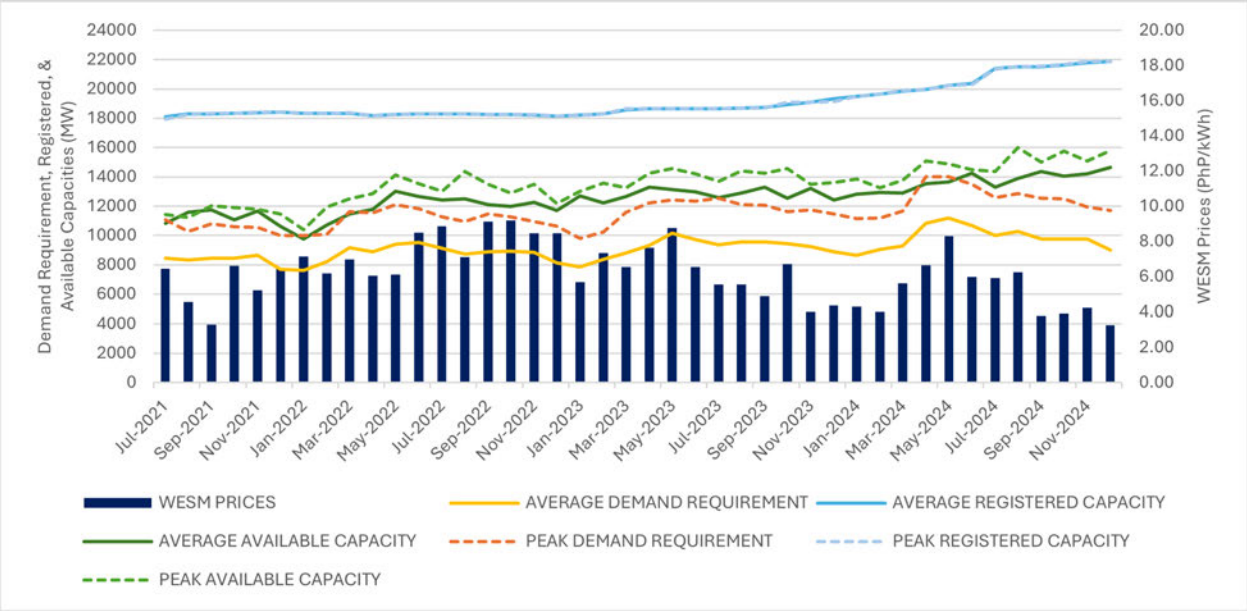


Figure 11: Luzon Demand, Registered & Available Capacities, and WESM Prices Trend (2021-2024)

Per Month	Average Demand Requirement	Average Registered Capacity	Average Available Capacity	Peak Demand Requirement	Peak Registered Capacity	Peak Available Capacity	WESM Prices
JUL 2021	8445.05	18108.41	10833.48	11049.05	17933.70	11406.48	**6.45**
AUG 2021	8339.13	18281.72	11583.16	10264.94	18266.80	11212.00	**4.56**
SEP 2021	8455.02	18307.48	11747.22	10803.40	18325.70	12028.98	**3.29**
OCT 2021	8441.19	18334.82	11070.19	10596.85	18325.70	11911.21	**6.59**
NOV 2021	8653.72	18394.71	11676.60	10549.53	18427.50	11766.10	**5.21**
DEC 2021	7703.81	18395.12	10618.17	9999.00	18427.50	11481.80	**6.48**
JAN 2022	7593.08	18342.00	9742.05	9976.99	18342.10	10399.52	**7.15**
FEB 2022	8202.32	18342.10	10704.60	10056.25	18342.10	11925.62	**6.16**
MAR 2022	9156.51	18318.90	11452.53	11617.30	18393.10	12496.69	**6.97**
APR 2022	8871.86	18180.53	11792.89	11560.71	18172.10	12841.03	**6.06**
MAY 2022	9406.15	18241.28	13019.66	12103.21	18272.10	14142.70	**6.11**
JUN 2022	9509.65	18277.02	12668.53	11837.75	18285.40	13520.09	**8.51**
JUL 2022	9117.66	18281.60	12418.53	11278.46	18280.90	12995.56	**8.86**
AUG 2022	8702.53	18281.35	12504.97	10938.99	18280.90	14371.78	**7.10**
SEP 2022	8870.30	18267.59	12090.28	11458.77	18267.50	13477.52	**9.12**
OCT 2022	8902.13	18268.30	11982.89	11252.54	18268.30	12890.74	**9.18**
NOV 2022	8827.82	18229.83	12237.94	10958.20	18268.30	13495.77	**8.46**
DEC 2022	8122.79	18150.57	11710.73	10625.23	18142.70	12173.50	**8.45**

JAN 2023	7859.72	18230.81	12674.08	9778.95	18220.90	13018.83	**5.68**
FEB 2023	8374.05	18307.23	12217.47	10219.52	18309.80	13552.30	**7.34**
MAR 2023	8801.66	18574.00	12659.26	11579.86	18645.73	13268.19	**6.54**
APR 2023	9333.96	18640.73	13272.94	12221.82	18637.53	14242.88	**7.64**
MAY 2023	10158.96	18636.29	13137.26	12416.64	18637.53	14574.46	**8.77**
JUN 2023	9720.01	18646.04	12957.72	12344.28	18666.93	14211.98	**6.55**
JUL 2023	9353.96	18669.15	12583.12	12521.76	18666.93	13687.11	**5.55**
AUG 2023	9574.42	18704.74	12891.03	12093.15	18693.13	14418.27	**5.53**
SEP 2023	9543.24	18719.09	13293.16	12052.53	18711.33	14250.01	**4.87**
OCT 2023	9417.86	18928.74	12521.62	11634.59	19088.68	14560.51	**6.70**
NOV 2023	9230.22	19097.16	13212.12	11721.02	19088.68	13474.71	**4.00**
DEC 2023	8877.73	19344.95	12426.07	11451.00	19116.57	13616.23	**4.36**
JAN 2024	8655.05	19501.42	12812.54	11154.98	19500.45	13854.82	**4.29**
FEB 2024	9029.90	19656.57	12929.05	11176.18	19652.48	13246.55	**3.97**
MAR 2024	9280.32	19832.74	12897.30	11659.74	19876.58	13749.48	**5.62**
APR 2024	10829.55	19966.57	13515.57	14010.69	19945.68	15092.66	**6.63**
MAY2024	11166.30	20250.69	13656.93	13999.75	20225.68	14862.07	**8.28**
JUN 2024	10675.60	20365.78	14223.37	13477.72	20275.68	14497.25	**5.97**
JUL 2024	9974.01	21393.35	13300.59	12576.13	21346.88	14367.50	**5.92**
AUG 2024	10264.39	21530.78	13881.63	12853.90	21530.78	15994.95	**6.24**
SEP 2024	9758.26	21532.72	14378.76	12551.39	21556.48	15016.67	**3.80**
OCT 2024	9763.07	21646.72	14063.09	12478.31	21652.72	15733.18	**3.89**
NOV 2024	9765.74	21772.54	14192.84	11944.58	21870.78	15095.72	**4.24**
DEC 2024	8984.35	21879.90	14631.83	11704.58	21870.78	15792.62	**3.26**

Table 07: Luzon Demand, Registered & Available Capacities, and WESM Prices Data (2021-2024)

Considering the large contribution of Luzon to the system values for supply, demand, and price, Figure 11 shows similar trends with the system's trend lines in all parameters. Specific values for Figure 11 are shown in Table 7.

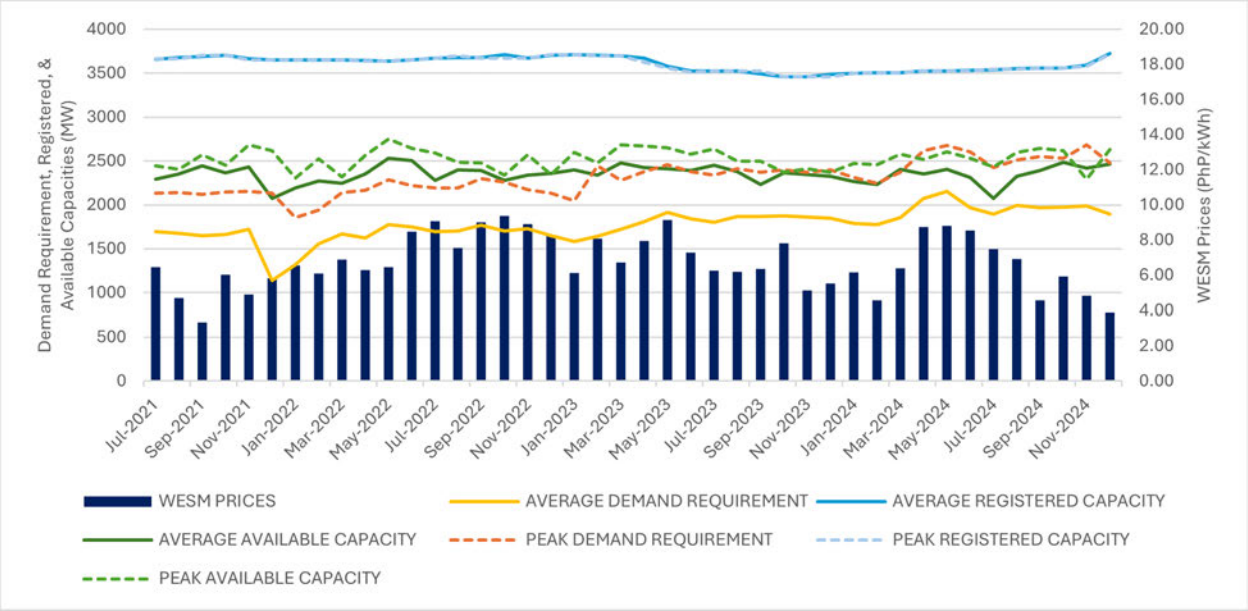


Figure 12: Visayas Demand, Registered & Available Capacities, and WESM Prices Trend (2021-2024)

Per Month	Average Demand Requirement	Average Registered Capacity	Average Available Capacity	Peak Demand Requirement	Peak Registered Capacity	Peak Available Capacity	WESM Prices
JUL 2021	1694.46	3658.26	2293.82	2131.20	3665.60	2444.50	**6.46**
AUG 2021	1676.07	3676.45	2353.86	2139.73	3665.60	2406.45	**4.68**
SEP 2021	1652.09	3690.12	2442.05	2121.15	3703.30	2570.80	**3.35**
OCT 2021	1664.39	3704.00	2366.27	2144.54	3704.00	2454.50	**6.01**
NOV 2021	1723.08	3666.60	2434.31	2153.87	3652.50	2682.40	**4.89**
DEC 2021	1141.16	3651.56	2076.24	2134.51	3652.50	2615.60	**5.81**
JAN 2022	1317.34	3651.50	2193.18	1858.19	3651.50	2304.30	**6.55**
FEB 2022	1554.14	3651.50	2269.95	1944.40	3651.50	2521.90	**6.11**
MAR 2022	1672.55	3649.60	2245.97	2142.68	3651.50	2320.60	**6.90**
APR 2022	1622.58	3647.99	2348.94	2164.14	3636.20	2563.20	**6.30**
MAY 2022	1775.27	3638.25	2533.02	2285.29	3636.20	2749.80	**6.44**
JUN 2022	1749.31	3651.26	2506.82	2222.21	3652.60	2644.20	**8.46**
JUL 2022	1694.73	3668.56	2276.84	2190.88	3671.50	2591.70	**9.06**
AUG 2022	1704.67	3677.33	2395.94	2191.96	3695.50	2486.60	**7.55**
SEP 2022	1771.51	3678.18	2390.86	3262.01	3695.50	2632.10	**9.01**
OCT 2022	1701.71	3711.34	2276.57	2261.15	3670.40	2338.20	**9.38**
NOV 2022	1730.39	3673.40	2341.80	2176.20	3673.40	2572.60	**8.90**
DEC 2022	1650.19	3702.26	2361.01	2133.53	3713.40	2343.40	**8.27**
JAN 2023	1584.20	3713.40	2397.34	2049.40	3713.40	2600.70	**6.13**
FEB 2023	1641.77	3704.78	2335.78	2444.14	3697.40	2480.20	**8.08**
MAR 2023	1724.27	3697.40	2477.98	2280.03	3697.40	2685.80	**6.72**
APR 2023	1805.82	3674.19	2422.07	2380.86	3624.90	2669.30	**7.94**
MAY 2023	1912.26	3580.01	2413.58	2455.92	3561.90	2651.80	**9.16**
JUN 2023	1838.58	3527.21	2390.42	2381.70	3513.90	2574.40	**7.28**
JUL 2023	1799.04	3525.90	2448.48	2339.90	3525.90	2638.20	**6.25**
AUG 2023	1871.42	3525.90	2376.96	2408.50	3525.90	2499.80	**6.19**
SEP 2023	1866.99	3491.28	2235.30	2373.74	3525.90	2501.20	**6.36**
OCT 2023	1873.04	3457.70	2368.69	2399.00	3457.70	2374.40	**7.83**
NOV 2023	1858.60	3457.16	2342.76	2373.55	3456.90	2409.70	**5.14**
DEC 2023	1846.52	3485.27	2323.39	2399.00	3457.70	2374.40	**5.53**
JAN 2024	1785.54	3501.71	2266.24	2315.42	3500.60	2474.60	**6.15**
FEB 2024	1774.59	3503.48	2230.99	2247.27	3503.80	2454.90	**4.58**
MAR 2024	1853.57	3506.96	2405.39	2369.96	3507.50	2579.00	**6.38**
APR 2024	2072.28	3525.79	2351.20	2619.92	3527.50	2518.00	**8.73**
MAY2024	2155.31	3527.76	2406.64	2678.58	3527.20	2602.40	**8.81**
JUN 2024	1970.15	3529.51	2310.28	2601.92	3527.20	2528.10	**8.56**
JUL 2024	1895.33	3540.26	2076.59	2426.48	3544.50	2431.10	**7.50**
AUG 2024	1992.13	3549.51	2327.34	2513.39	3543.50	2594.10	**6.93**
SEP 2024	1964.65	3557.70	2393.78	2548.75	3557.70	2642.80	**4.56**
OCT 2024	1975.27	3557.70	2482.99	2533.70	3557.70	2620.10	**5.93**
NOV 2024	1990.54	3589.40	2415.16	2683.24	3578.60	2290.26	**4.82**
DEC 2024	1894.26	3723.03	2467.89	2475.41	3718.40	2632.90	**3.87**

Table 08: Luzon Demand, Registered & Available Capacities, and WESM Prices Data (2021-2024)

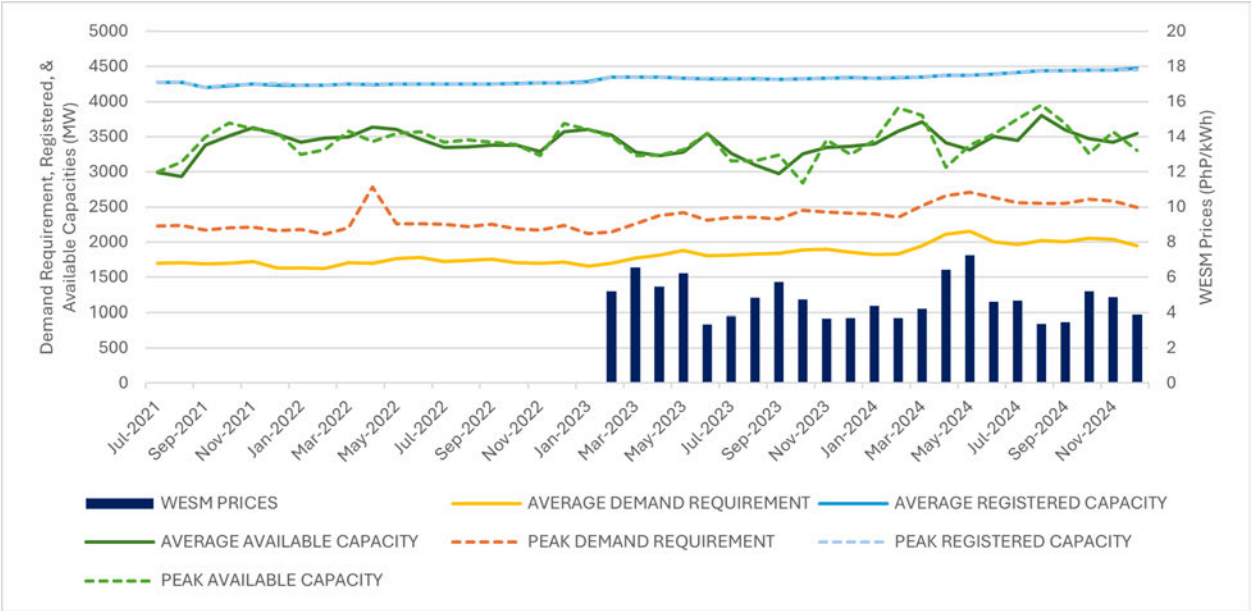


Figure 13: Mindanao Demand, Registered & Available Capacities, and WESM Prices Trend (2021-2024)

Per Month	Average Demand Requirement	Average Registered Capacity	Average Available Capacity	Peak Demand Requirement	Peak Registered Capacity	Peak Available Capacity	WESM Prices
JUL 2021	1695.36	4274.94	2986.36	2227.86	4272.90	4272.90	-
AUG 2021	1701.82	4272.05	2933.05	2236.26	4275.90	4275.90	-
SEP 2021	1688.32	4202.64	3377.41	2171.63	4203.20	4203.20	-
OCT 2021	1699.85	4222.05	3510.75	2202.77	4240.20	4240.20	-
NOV 2021	1725.54	4247.74	3625.33	2210.47	4240.20	4240.20	-
DEC 2021	1628.52	4236.65	3538.69	2164.07	4260.20	4260.20	-
JAN 2022	1633.08	4231.20	3420.86	2178.90	4231.20	4231.20	-
FEB 2022	1625.66	4231.20	3475.95	2108.47	4231.20	4231.20	-
MAR 2022	1709.29	4247.21	3499.00	2203.70	4245.30	4245.30	-
APR 2022	1697.35	4239.96	3639.37	2779.26	4247.30	4247.30	-
MAY 2022	1763.15	4247.30	3602.40	2262.61	4247.30	4247.30	-
JUN 2022	1775.98	4246.51	3466.13	2262.35	4247.30	4247.30	-
JUL 2022	1722.89	4245.96	3343.25	2254.76	4246.20	4246.20	-
AUG 2022	1736.89	4245.40	3351.46	2223.02	4245.40	4245.40	-
SEP 2022	1755.09	4245.33	3379.24	2248.76	4245.30	4245.30	-
OCT 2022	1702.84	4256.42	3380.92	2189.39	4245.30	4245.30	-
NOV 2022	1701.13	4264.99	3287.36	2172.63	4265.30	4265.30	-
DEC 2022	1717.48	4264.55	3568.52	2232.31	4264.80	4264.80	-
JAN 2023	1654.72	4280.88	3601.57	2120.64	4264.80	4264.80	**0.00**
FEB 2023	1699.31	4348.50	3520.92	2142.51	4348.50	4348.50	**5.20**
MAR 2023	1771.77	4348.50	3276.69	2256.82	4348.50	4348.50	**6.56**
APR 2023	1809.46	4345.49	3232.07	2374.16	4348.10	4348.10	**5.47**
MAY 2023	1880.09	4332.11	3280.40	2415.86	4332.10	4332.10	**6.21**

JUN 2023	1802.51	4321.95	3541.25	2311.93	4332.20	4332.20	**3.34**
JUL 2023	1811.11	4323.61	3264.79	2351.89	4335.50	4335.50	**3.79**
AUG 2023	1831.38	4321.25	3095.28	2352.94	4319.80	4319.80	**4.83**
SEP 2023	1841.05	4318.57	2970.29	2326.12	4314.50	4314.50	**5.71**
OCT 2023	1889.14	4322.76	3258.89	2453.65	4320.50	4320.50	**4.73**
NOV 2023	1893.75	4331.48	3342.63	2426.18	4331.90	4331.90	**3.67**
DEC 2023	1854.13	4339.23	3361.66	2411.93	4331.90	4331.90	**3.72**
JAN 2024	1822.62	4335.30	3391.92	2403.07	4335.30	4335.30	**4.35**
FEB 2024	1831.98	4342.56	3579.55	2352.83	4349.80	4349.80	**3.71**
MAR 2024	1944.85	4352.40	3713.12	2514.19	4349.70	4349.70	**4.21**
APR 2024	2115.40	4370.03	3411.89	2658.11	4370.50	4370.50	**6.43**
MAY2024	2156.95	4371.09	3314.26	2711.17	4370.50	4370.50	**7.26**
JUN 2024	2006.00	4389.88	3505.17	2636.94	4384.30	4384.30	**4.61**
JUL 2024	1961.83	4412.17	3446.30	2557.75	4420.80	4420.80	**4.67**
AUG 2024	2023.93	4436.20	3801.54	2549.72	4436.20	4436.20	**3.37**
SEP 2024	2001.03	4437.32	3593.18	2549.55	4436.20	4436.20	**3.48**
OCT 2024	2054.16	4446.60	3467.76	2609.05	4446.60	4446.60	**5.20**
NOV 2024	2035.60	4446.60	3424.28	2583.02	4446.60	4446.60	**4.85**
DEC 2024	1948.21	4475.59	3546.91	2493.61	4446.60	4446.60	**3.88**

Table 09: Mindanao Demand, Registered & Available Capacities, and WESM Prices Data (2021-2024)

Certain peaks along the graph's trend lines were found to be significant in the historical supply and demand vis-a-vis the WESM prices. Certain events such as transmission congestion, plant outages, electricity generation availability, the variance between the supply and demand, and even the weather, could affect the spot prices. Some of the notable and contributory events which form these trend lines may have been deduced from the following:

- In December 2021, the country experienced the Super Typhoon Rai (locally known as Odette) which caused violent winds, torrential rains, landslides, and storm surges. This caused a dip in the month's demand requirement.

- In 2022, oil prices significantly increased primarily due to the Russia-Ukraine war and severely impacted energy markets across the globe. This geopolitical tension brought about global disruption of oil supply as Russia, being a major oil exporter, reduced oil availability which caused price spikes.

- The integration of the Reserve Market beginning January 2023 allowed optimization of MO and SO interfaces, central scheduling and dispatch of contracted AS using enhanced MO and SO systems, and automated real-time dispatch of committed AS. This market provided a venue for generators to have reserve offers which are co-optimized with energy offers, determining the best mix of energy and reserve supply and resulted in the most competitive electricity prices.

- In April 2024, all regions of the country experienced red and yellow alerts, where these areas of extremely high demand had localized power interruptions. Energy conservation measures and energy usage optimization were campaigned throughout the inclusive periods.

- And overall, fluctuations in the country's heat indices significantly impacted the market prices all throughout the inclusive years. This can be observed during the warmer and colder months of each year.

Retrospectively, despite its dynamic nature, a market typically associates expanding supply margins with the decrease in prices while, conversely, tightening supply margins entail a certain price increase. This concept is evident upon the examination of the above market dynamics of all regions.

2.2 ANNUAL TREND OF SUPPLY SUPPORTING ENERGY DEMAND

The following figures and datasets direct their focus from the implementation of the 5-minute market, which was integrated into WESM starting July 2021, up until the present. These capacity-supply-demand data are segregated into the three regions and historically highlight the registered MW capacity, average demand requirement, average available MW capacity, and the average supply margin trends.

The demand requirement data represents both the average and peak demand requirements for each respective billing month, where the peak pertains to the highest recorded 5-minute interval data from the grid for each billing month. The available and registered capacity data also encompasses its average and peak values, where the registered data considers the plant capacities that have been registered in the inclusive month and the available capacity considers the total available MW value that may be dispatched at a given time which coincides with the recorded demand. Lastly, the average and peak supply margin is taken as the difference between the available capacity and the demand requirements.

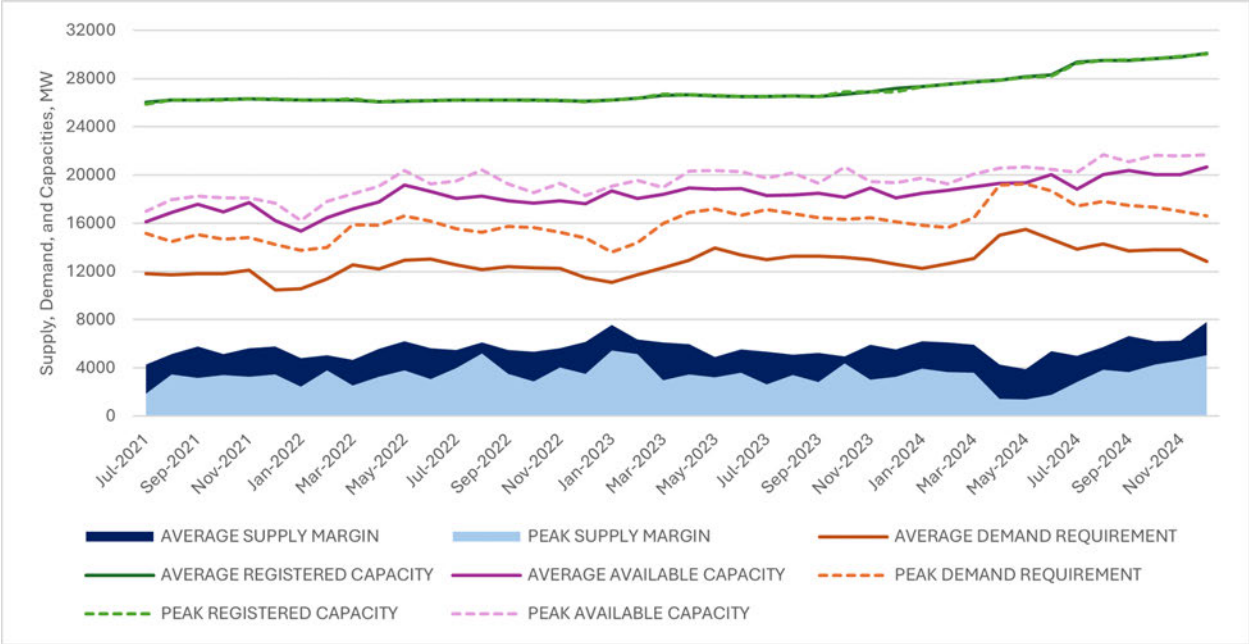


Figure 14: System Average & Peak Capacity, Available Supply, and Demand Trend (2021-2024)

All figures in this segment have registered capacities which consistently exceed the supply by a wide margin. On the other hand, the margin between the supply and demand varies per month but can be observed with narrower margins during summer months compared to colder months.

Per Month	Average Demand Requirement	Average Supply Margin	Average Registered Capacity	Average Available Capacity	Peak Demand Requirement	Peak Supply Margin	Peak Registered Capacity	Peak Available Capacity
JUL 2021	11834.98	4278.65	26041.57	16113.64	15136.01	1865.87	25868.60	17001.88
AUG 2021	11717.02	5152.81	26230.23	16869.83	14492.17	3473.00	26214.60	17965.17
SEP 2021	11795.39	5771.36	26200.22	17566.75	15058.26	3172.32	26232.20	18230.58
OCT 2021	11805.59	5141.55	26260.86	16947.14	14672.04	3418.87	26232.90	18090.91
NOV 2021	12101.22	5635.22	26309.05	17736.44	14835.77	3251.33	26340.20	18087.10
DEC 2021	10473.94	5762.82	26289.24	16236.75	14209.97	3460.19	26340.20	17670.16
JAN 2022	10543.27	4812.78	26224.70	15356.05	13758.98	2452.34	26224.80	16211.32
FEB 2022	11382.07	5068.36	26224.80	16450.43	13991.38	3812.84	26224.80	17804.22
MAR 2022	12538.13	4659.32	26215.73	17197.44	15877.23	2554.23	26300.30	18431.46
APR 2022	12191.85	5589.28	26068.48	17781.13	15848.07	3237.76	26055.60	19085.83
MAY 2022	12944.55	6210.60	26126.82	19155.15	16589.25	3773.95	26155.60	20363.20
JUN 2022	13035.01	5606.37	26174.79	18641.38	16178.99	3089.23	26167.60	19268.22
JUL 2022	12535.40	5503.17	26196.12	18038.57	15516.75	4008.92	26197.80	19525.67
AUG 2022	12143.98	6108.54	26204.09	18252.52	15237.66	5178.33	26197.80	20415.99
SEP 2022	12396.69	5467.90	26197.17	17864.59	15744.27	3506.05	26208.40	19250.32
OCT 2022	12306.97	5335.52	26239.01	17642.48	15658.77	2863.97	26184.00	18522.74
NOV 2022	12259.17	5607.83	26168.24	17867.00	15258.70	4045.67	26207.00	19304.37
DEC 2022	11490.65	6149.38	26117.37	17640.02	14772.41	3524.99	26080.40	18297.40
JAN 2023	11098.58	7574.49	26225.07	18673.07	13614.07	5449.15	26199.10	19063.22
FEB 2023	11715.07	6359.10	26360.49	18074.17	14390.95	5151.15	26355.70	19542.10
MAR 2023	12297.47	6116.50	26619.88	18413.97	15995.96	2970.76	26691.63	18966.72
APR 2023	12949.29	5977.73	26660.43	18927.02	16875.55	3435.93	26658.43	20311.48
MAY 2023	13951.36	4881.95	26551.39	18833.31	17182.24	3198.72	26594.53	20380.96
JUN 2023	13361.16	5528.23	26495.21	18889.39	16667.70	3597.99	26513.03	20265.69
JUL 2023	12964.25	5332.14	26518.65	18296.39	17120.35	2627.24	26512.83	19747.59
AUG 2023	13276.99	5088.31	26554.87	18365.30	16774.83	3409.34	26538.83	20184.17
SEP 2023	13251.18	5247.68	26528.95	18498.86	16480.53	2820.28	26496.43	19300.81
OCT 2023	13180.21	4968.87	26709.16	18149.08	16287.56	4353.35	26876.98	20640.91
NOV 2023	12982.43	5915.13	26885.80	18897.56	16433.99	3025.32	26876.98	19459.31
DEC 2023	12578.57	5532.58	27169.41	18111.15	16094.90	3283.25	26920.87	19378.15
JAN 2024	12263.20	6207.39	27338.43	18470.59	15836.32	3923.50	27336.35	19759.82
FEB 2024	12636.32	6103.41	27502.58	18739.72	15640.86	3628.89	27506.08	19269.75
MAR 2024	13078.06	5944.01	27701.40	19022.07	16478.17	3606.91	27733.58	20085.08
APR 2024	15016.89	4268.46	27872.03	19285.35	19178.36	1407.70	27843.68	20586.06
MAY2024	15478.55	3899.35	28149.53	19377.90	19246.17	1395.70	28123.68	20641.87
JUN 2024	14649.93	5402.79	28304.82	20052.72	18677.80	1777.35	28187.18	20455.15
JUL 2024	13831.11	4992.40	29345.66	18823.51	17402.10	2807.50	29277.18	20209.60
AUG 2024	14280.43	5729.98	29516.49	20010.41	17832.77	3832.97	29524.68	21665.74
SEP 2024	13724.03	6641.61	29527.72	20365.63	17448.43	3667.44	29550.38	21115.87
OCT 2024	13792.59	6221.37	29651.02	20013.95	17315.87	4300.60	29657.02	21616.47
NOV 2024	13791.93	6240.21	29808.50	20032.14	16983.80	4612.42	29840.08	21596.22
DEC 2024	12826.72	7819.85	30078.51	20646.57	16594.21	5072.36	30035.78	21666.57

Table 10: System Average & Peak Capacity, Available Supply, and Demand Data (2021-2024)

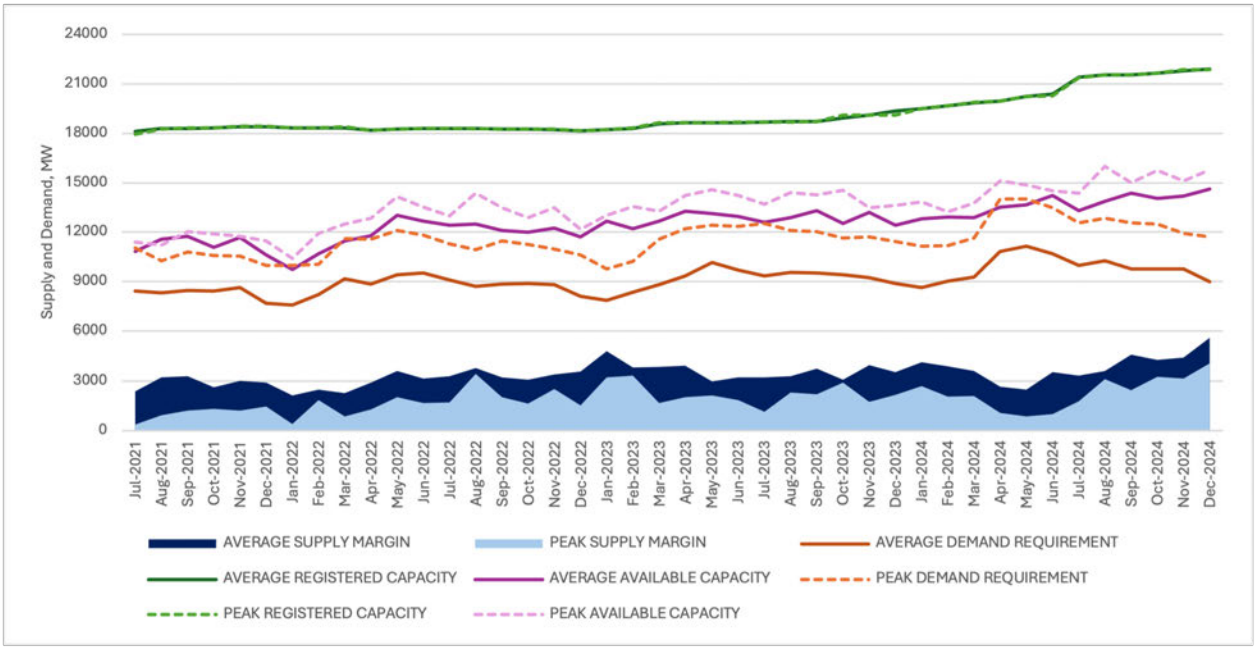


Figure 15: Luzon Average & Peak Capacity, Available Supply, and Demand Trend (2021-2024)

Per Month	Average Demand Requirement	Average Supply Margin	Average Registered Capacity	Average Available Capacity	Peak Demand Requirement	Peak Supply Margin	Peak Registered Capacity	Peak Available Capacity
JUL 2021	8445.05	2388.43	18108.41	10833.48	11049.05	357.43	17933.70	11406.48
AUG 2021	8339.13	3244.03	18281.72	11583.16	10264.94	947.06	18266.80	11212.00
SEP 2021	8455.02	3292.20	18307.48	11747.22	10803.40	1225.58	18325.70	12028.98
OCT 2021	8441.19	2629.00	18334.82	11070.19	10596.85	1314.36	18325.70	11911.21
NOV 2021	8653.72	3022.88	18394.71	11676.60	10549.53	1216.57	18427.50	11766.10
DEC 2021	7703.81	2914.36	18395.12	10618.17	9999.00	1482.80	18427.50	11481.80
JAN 2022	7593.08	2148.96	18342.00	9742.05	9976.99	422.53	18342.10	10399.52
FEB 2022	8202.32	2502.29	18342.10	10704.60	10056.25	1869.37	18342.10	11925.62
MAR 2022	9156.51	2296.02	18318.90	11452.53	11617.30	879.39	18393.10	12496.69
APR 2022	8871.86	2921.03	18180.53	11792.89	11560.71	1280.32	18172.10	12841.03
MAY 2022	9406.15	3613.51	18241.28	13019.66	12103.21	2039.49	18272.10	14142.70
JUN 2022	9509.65	3158.88	18277.02	12668.53	11837.75	1682.34	18285.40	13520.09
JUL 2022	9117.66	3300.87	18281.60	12418.53	11278.46	1717.10	18280.90	12995.56
AUG 2022	8702.53	3802.44	18281.35	12504.97	10938.99	3432.79	18280.90	14371.78
SEP 2022	8870.30	3219.98	18267.59	12090.28	11458.77	2018.75	18267.50	13477.52
OCT 2022	8902.13	3080.76	18268.30	11982.89	11252.54	1638.20	18268.30	12890.74
NOV 2022	8827.82	3410.12	18229.83	12237.94	10958.20	2537.57	18268.30	13495.77
DEC 2022	8122.79	3587.93	18150.57	11710.73	10625.23	1548.27	18142.70	12173.50
JAN 2023	7859.72	4814.35	18230.81	12674.08	9778.95	3239.88	18220.90	13018.83
FEB 2023	8374.05	3843.42	18307.23	12217.47	10219.52	3332.78	18309.80	13552.30
MAR 2023	8801.66	3857.61	18574.00	12659.26	11579.86	1688.33	18645.73	13268.19
APR 2023	9333.96	3938.98	18640.73	13272.94	12221.82	2021.06	18637.53	14242.88

MAY 2023	10158.96	2978.30	18636.29	13137.26	12416.64	2157.82	18637.53	14574.46
JUN 2023	9720.01	3237.71	18646.04	12957.72	12344.28	1867.70	18666.93	14211.98
JUL 2023	9353.96	3229.16	18669.15	12583.12	12521.76	1165.35	18666.93	13687.11
AUG 2023	9574.42	3316.61	18704.74	12891.03	12093.15	2325.12	18693.13	14418.27
SEP 2023	9543.24	3749.91	18719.09	13293.16	12052.53	2197.48	18711.33	14250.01
OCT 2023	9417.86	3103.76	18928.74	12521.62	11634.59	2925.92	19088.68	14560.51
NOV 2023	9230.22	3981.89	19097.16	13212.12	11721.02	1753.69	19088.68	13474.71
DEC 2023	8877.73	3548.35	19344.95	12426.07	11451.00	2165.23	19116.57	13616.23
JAN 2024	8655.05	4157.50	19501.42	12812.54	11154.98	2699.84	19500.45	13854.82
FEB 2024	9029.90	3899.15	19656.57	12929.05	11176.18	2070.37	19652.48	13246.55
MAR 2024	9280.32	3616.97	19832.74	12897.30	11659.74	2089.74	19876.58	13749.48
APR 2024	10829.55	2686.02	19966.57	13515.57	14010.69	1081.97	19945.68	15092.66
MAY2024	11166.30	2490.63	20250.69	13656.93	13999.75	862.32	20225.68	14862.07
JUN 2024	10675.60	3547.77	20365.78	14223.37	13477.72	1019.53	20275.68	14497.25
JUL 2024	9974.01	3326.58	21393.35	13300.59	12576.13	1791.37	21346.88	14367.50
AUG 2024	10264.39	3617.24	21530.78	13881.63	12853.90	3141.05	21530.78	15994.95
SEP 2024	9758.26	4620.50	21532.72	14378.76	12551.39	2465.28	21556.48	15016.67
OCT 2024	9763.07	4300.02	21646.72	14063.09	12478.31	3254.87	21652.72	15733.18
NOV 2024	9765.74	4427.10	21772.54	14192.84	11944.58	3151.14	21870.78	15095.72
DEC 2024	8984.35	5647.47	21879.90	14631.83	11704.58	4088.04	21870.78	15792.62

Table 11: System Average & Peak Capacity, Available Supply, and Demand Data (2021-2024)

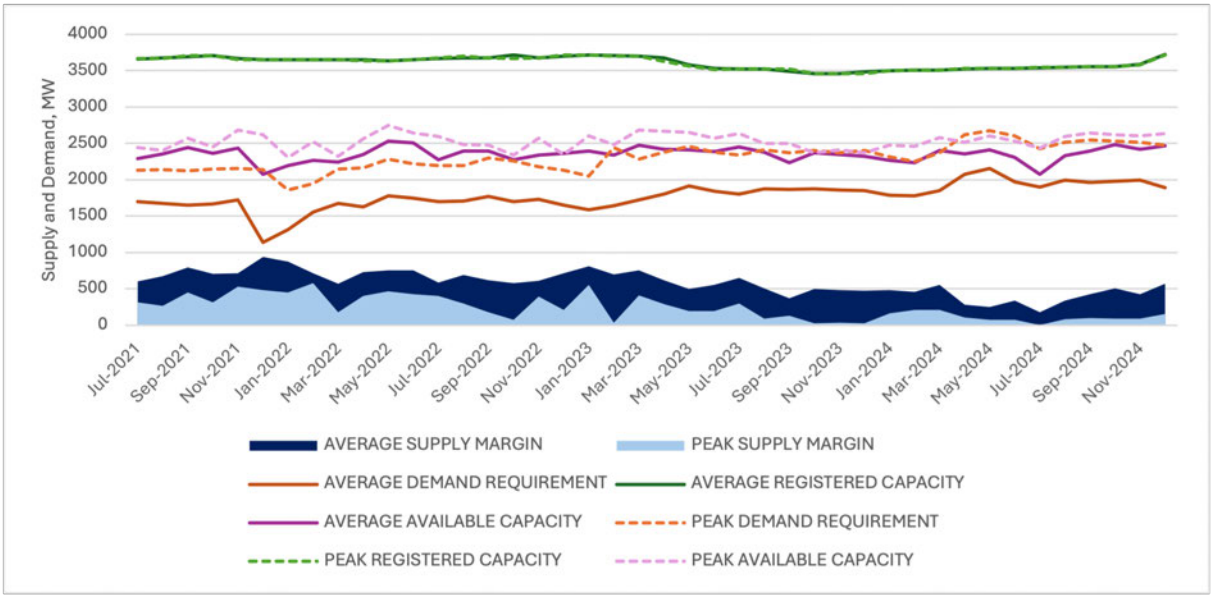


Figure 16: Visayas Average & Peak Capacity, Available Supply, and Demand Trend (2021-2024)

Per Month	Average Demand Requirement	Average Supply Margin	Average Registered Capacity	Average Available Capacity	Peak Demand Requirement	Peak Supply Margin	Peak Registered Capacity	Peak Available Capacity
JUL 2021	1694.46	599.36	3658.26	2293.82	2131.20	313.30	3665.60	2444.50
AUG 2021	1676.07	677.79	3676.45	2353.86	2139.73	266.72	3665.60	2406.45
SEP 2021	1652.09	789.96	3690.12	2442.05	2121.15	449.65	3703.30	2570.80
OCT 2021	1664.39	701.89	3704.00	2366.27	2144.54	309.96	3704.00	2454.50
NOV 2021	1723.08	711.23	3666.60	2434.31	2153.87	528.53	3652.50	2682.40
DEC 2021	1141.16	935.08	3651.56	2076.24	2134.51	481.09	3652.50	2615.60
JAN 2022	1317.34	875.84	3651.50	2193.18	1858.19	446.11	3651.50	2304.30
FEB 2022	1554.14	715.82	3651.50	2269.95	1944.40	577.50	3651.50	2521.90
MAR 2022	1672.55	573.42	3649.60	2245.97	2142.68	177.92	3651.50	2320.60
APR 2022	1622.58	726.36	3647.99	2348.94	2164.14	399.06	3636.20	2563.20
MAY 2022	1775.27	757.75	3638.25	2533.02	2285.29	464.51	3636.20	2749.80
JUN 2022	1749.31	757.51	3651.26	2506.82	2222.21	421.99	3652.60	2644.20
JUL 2022	1694.73	582.10	3668.56	2276.84	2190.88	400.82	3671.50	2591.70
AUG 2022	1704.67	691.27	3677.33	2395.94	2191.96	294.64	3695.50	2486.60
SEP 2022	1771.51	619.35	3678.18	2390.86	3262.01	629.91	3695.50	2632.10
OCT 2022	1701.71	574.86	3711.34	2276.57	2261.15	77.05	3670.40	2338.20
NOV 2022	1730.39	611.41	3673.40	2341.80	2176.20	396.40	3673.40	2572.60
DEC 2022	1650.19	710.82	3702.26	2361.01	2133.53	209.87	3713.40	2343.40
JAN 2023	1584.20	813.14	3713.40	2397.34	2049.40	551.30	3713.40	2600.70
FEB 2023	1641.77	694.01	3704.78	2335.78	2444.14	36.06	3697.40	2480.20
MAR 2023	1724.27	753.71	3697.40	2477.98	2280.03	405.77	3697.40	2685.80
APR 2023	1805.82	616.25	3674.19	2422.07	2380.86	288.44	3624.90	2669.30
MAY 2023	1912.26	501.31	3580.01	2413.58	2455.92	195.88	3561.90	2651.80
JUN 2023	1838.58	551.85	3527.21	2390.42	2381.70	192.70	3513.90	2574.40
JUL 2023	1799.04	649.43	3525.90	2448.48	2339.90	298.30	3525.90	2638.20
AUG 2023	1871.42	505.55	3525.90	2376.96	2408.50	91.30	3525.90	2499.80
SEP 2023	1866.99	368.31	3491.28	2235.30	2373.74	127.46	3525.90	2501.20
OCT 2023	1873.04	495.65	3457.70	2368.69	2399.00	24.60	3457.70	2374.40
NOV 2023	1858.60	484.17	3457.16	2342.76	2373.55	36.15	3456.90	2409.70
DEC 2023	1846.52	476.88	3485.27	2323.39	2399.00	24.60	3457.70	2374.40
JAN 2024	1785.54	480.70	3501.71	2266.24	2315.42	159.18	3500.60	2474.60
FEB 2024	1774.59	456.40	3503.48	2230.99	2247.27	207.63	3503.80	2454.90
MAR 2024	1853.57	551.82	3506.96	2405.39	2369.96	209.04	3507.50	2579.00
APR 2024	2072.28	278.93	3525.79	2351.20	2619.92	101.92	3527.50	2518.00
MAY2024	2155.31	251.33	3527.76	2406.64	2678.58	76.18	3527.20	2602.40
JUN 2024	1970.15	340.13	3529.51	2310.28	2601.92	73.82	3527.20	2528.10
JUL 2024	1895.33	181.27	3540.26	2076.59	2426.48	4.62	3544.50	2431.10
AUG 2024	1992.13	335.21	3549.51	2327.34	2513.39	80.71	3543.50	2594.10
SEP 2024	1964.65	429.13	3557.70	2393.78	2548.75	94.05	3557.70	2642.80
OCT 2024	1975.27	507.72	3557.70	2482.99	2533.70	86.40	3557.70	2620.10
NOV 2024	1990.54	424.61	3589.40	2415.16	2683.24	392.98	3578.60	2290.26
DEC 2024	1894.26	573.63	3723.03	2467.89	2475.41	157.49	3718.40	2632.90

Table 12: Visayas Average & Peak Capacity, Available Supply, and Demand Data (2021-2024)

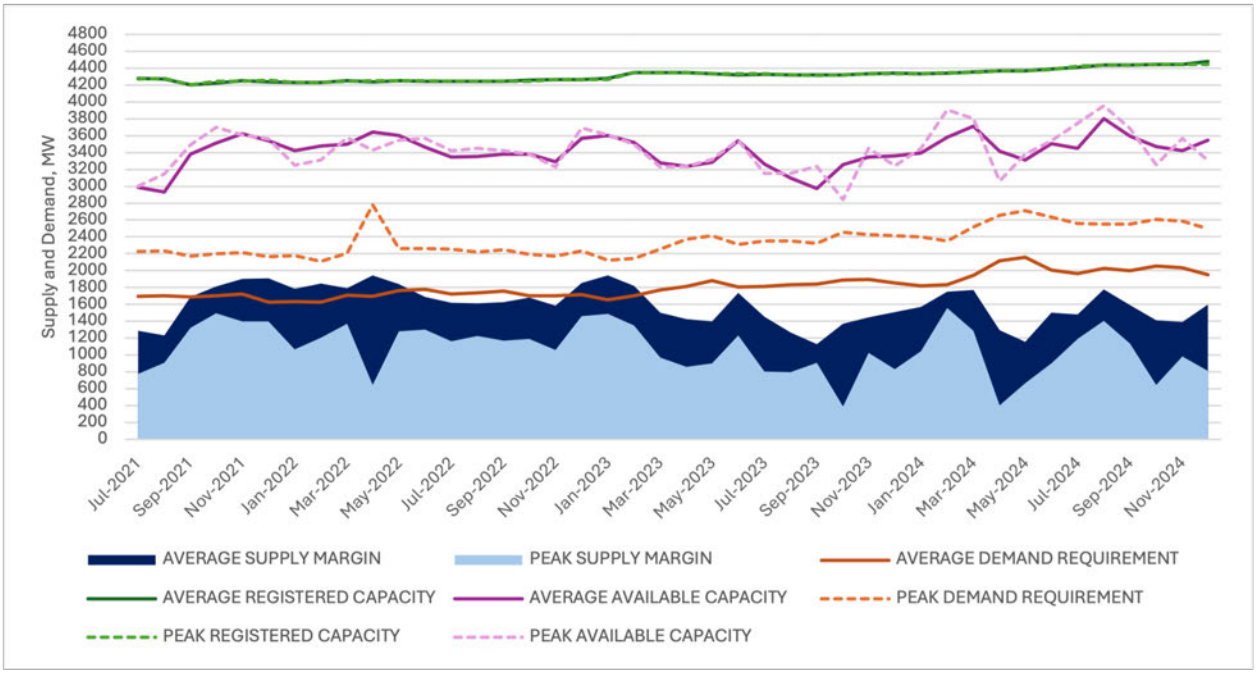


Figure 17: Mindanao Average & Peak Capacity, Available Supply, and Demand Trend (2021-2024)

Per Month	Average Demand Requirement	Average Supply Margin	Average Registered Capacity	Average Available Capacity	Peak Demand Requirement	Peak Supply Margin	Peak Registered Capacity	Peak Available Capacity
JUL 2021	1695.36	1291.00	4274.94	2986.36	2227.86	774.34	4272.90	3002.20
AUG 2021	1701.82	1231.24	4272.05	2933.05	2236.26	906.34	4275.90	3142.60
SEP 2021	1688.32	1689.09	4202.64	3377.41	2171.63	1321.67	4203.20	3493.30
OCT 2021	1699.85	1810.90	4222.05	3510.75	2202.77	1494.13	4240.20	3696.90
NOV 2021	1725.54	1899.79	4247.74	3625.33	2210.47	1399.63	4240.20	3610.10
DEC 2021	1628.52	1910.18	4236.65	3538.69	2164.07	1397.63	4260.20	3561.70
JAN 2022	1633.08	1787.78	4231.20	3420.86	2178.90	1067.60	4231.20	3246.50
FEB 2022	1625.66	1850.29	4231.20	3475.95	2108.47	1202.43	4231.20	3310.90
MAR 2022	1709.29	1789.71	4247.21	3499.00	2203.70	1370.70	4245.30	3574.40
APR 2022	1697.35	1942.02	4239.96	3639.37	2779.26	646.14	4247.30	3425.40
MAY 2022	1763.15	1839.25	4247.30	3602.40	2262.61	1282.59	4247.30	3545.20
JUN 2022	1775.98	1690.15	4246.51	3466.13	2262.35	1304.05	4247.30	3566.40
JUL 2022	1722.89	1620.36	4245.96	3343.25	2254.76	1164.24	4246.20	3419.00
AUG 2022	1736.89	1614.58	4245.40	3351.46	2223.02	1228.68	4245.40	3451.70
SEP 2022	1755.09	1624.16	4245.33	3379.24	2248.76	1172.04	4245.30	3420.80
OCT 2022	1702.84	1678.07	4256.42	3380.92	2189.39	1194.31	4245.30	3383.70
NOV 2022	1701.13	1586.23	4264.99	3287.36	2172.63	1058.27	4265.30	3230.90
DEC 2022	1717.48	1851.04	4264.55	3568.52	2232.31	1457.59	4264.80	3689.90
JAN 2023	1654.72	1946.85	4280.88	3601.57	2120.64	1486.36	4264.80	3607.00
FEB 2023	1699.31	1821.60	4348.50	3520.92	2142.51	1352.79	4348.50	3495.30
MAR 2023	1771.77	1504.92	4348.50	3276.69	2256.82	970.38	4348.50	3227.20
APR 2023	1809.46	1422.61	4345.49	3232.07	2374.16	862.07	4348.10	3236.23
MAY 2023	1880.09	1400.31	4332.11	3280.40	2415.86	899.94	4332.10	3315.80
JUN 2023	1802.51	1738.74	4321.95	3541.25	2311.93	1234.37	4332.20	3546.30

JUL 2023	1811.11	1453.67	4323.61	3264.79	2351.89	803.08	4335.50	3154.97
AUG 2023	1831.38	1263.90	4321.25	3095.28	2352.94	800.66	4319.80	3153.60
SEP 2023	1841.05	1129.24	4318.57	2970.29	2326.12	910.08	4314.50	3236.20
OCT 2023	1889.14	1369.75	4322.76	3258.89	2453.65	386.65	4320.50	2840.30
NOV 2023	1893.75	1448.88	4331.48	3342.63	2426.18	1026.32	4331.90	3452.50
DEC 2023	1854.13	1507.53	4339.23	3361.66	2411.93	830.77	4331.90	3242.70
JAN 2024	1822.62	1569.31	4335.30	3391.92	2403.07	1043.83	4335.30	3446.90
FEB 2024	1831.98	1747.57	4342.56	3579.55	2352.83	1553.87	4349.80	3906.70
MAR 2024	1944.85	1768.27	4352.40	3713.12	2514.19	1290.71	4349.70	3804.90
APR 2024	2115.40	1296.49	4370.03	3411.89	2658.11	403.39	4370.50	3061.50
MAY2024	2156.95	1157.31	4371.09	3314.26	2711.17	667.33	4370.50	3378.50
JUN 2024	2006.00	1499.16	4389.88	3505.17	2636.94	903.06	4384.30	3540.00
JUL 2024	1961.83	1484.46	4412.17	3446.30	2557.75	1190.35	4420.80	3748.10
AUG 2024	2023.93	1777.62	4436.20	3801.54	2549.72	1405.03	4436.20	3954.75
SEP 2024	2001.03	1592.15	4437.32	3593.18	2549.55	1135.25	4436.20	3684.80
OCT 2024	2054.16	1413.59	4446.60	3467.76	2609.05	644.85	4446.60	3253.90
NOV 2024	2035.60	1388.67	4446.60	3424.28	2583.02	986.38	4446.60	3569.40
DEC 2024	1948.21	1598.70	4475.59	3546.91	2493.61	808.99	4446.60	3302.60

Table 13: Mindanao Average & Peak Capacity, Available Supply, and Demand Data (2021-2024)

The registered and available average MW capacities and peak demand per region in the WESM as of 25 December 2024 are tabulated and compared as follows:

	LUZON		**VISAYAS**		**MINDANAO**	
FUEL TECHNOLOGY	Registered MW Capacity	Available MW Capacity	Registered MW Capacity	Available MW Capacity	Registered MW Capacity	Available MW Capacity
BATTERY	394.50	262.00	110.00	99.60	100.00	76.40
BIOMASS	155.58	85.96	211.90	112.30	63.50	26.30
COAL	8,936.60	7,140.00	1,329.70	1,171.60	2,272.50	1,813.60
GEOTHERMAL	799.50	491.50	857.00	588.30	155.00	85.50
HYDRO	2,408.20	2,134.75	10.00	4.80	942.30	623.50
NATURAL GAS	4,612.40	3,181.10	-	-	-	-
OIL-BASED	1,765.60	1,126.90	432.70	398.70	652.00	560.30
ROR-HYDRO	186.59	81.60	66.30	21.20	219.90	116.10
SOLAR	2,157.16	1,112.69	567.90	218.60	67.20	0.90
WIND	465.80	189.70	103.90	17.80	-	-
TOTAL	**21,881.93**	**15,806.20**	**3,679.40**	**2,632.90**	**4,472.40**	**3,302.60**
PEAK DEMAND	**-**	**11,704.58**	**-**	**2,475.41**	**-**	**2,493.61**

Table 14: Registered & Available Average Capacities & Regional Peak Demand (December 2024)

2.3 GENERATOR SUPPLY PERFORMANCE

Reconciling the values of available, registered, and dispatched capacities, the historical generator performances were obtained beginning from the implementation of the Enhanced WESM Design and Operations (EWDO) or the 5-minute market and duly measured by fuel type. In the identification of generator technology efficiency for baseload, mid-merit, and peaking plants, the plants' performances are measured using availability and capacity factor per technology and are computed as follows:

$$Availability\ Factor = \frac{Available\ Capacity}{Registered\ Capacity}$$

The availability factor measures how much generator capacity is available with respect to its registered capacity and as shown in monthly breakdowns in the inclusive graphs below. The availability factor of a generation plant is inversely proportional to the deration and directly proportional to the generator's efficiency. To visualize, a high availability factor suggests less deration and a higher generator efficiency.

$$Capacity\ Factor = \frac{MW\ Output\ Dispatch}{Registered\ Capacity}$$

On the other hand, the capacity factor measures the ratio of the generator's MW value dispatched vis a vis its registered capacity. In simpler terms, this factor is a measure of how often a plant operates with respect to its maximum power output. This factor is affected by the generator's offers and schedules, the Merit Order Table for the dispatch interval, and actual grid conditions, among others.

The following figures illustrate the performance of various generator technologies from July 2021 to December 2024 billing months based on the metrics discussed above.

2.3.1 CONVENTIONAL THERMAL PLANTS

COAL-FIRED PLANTS

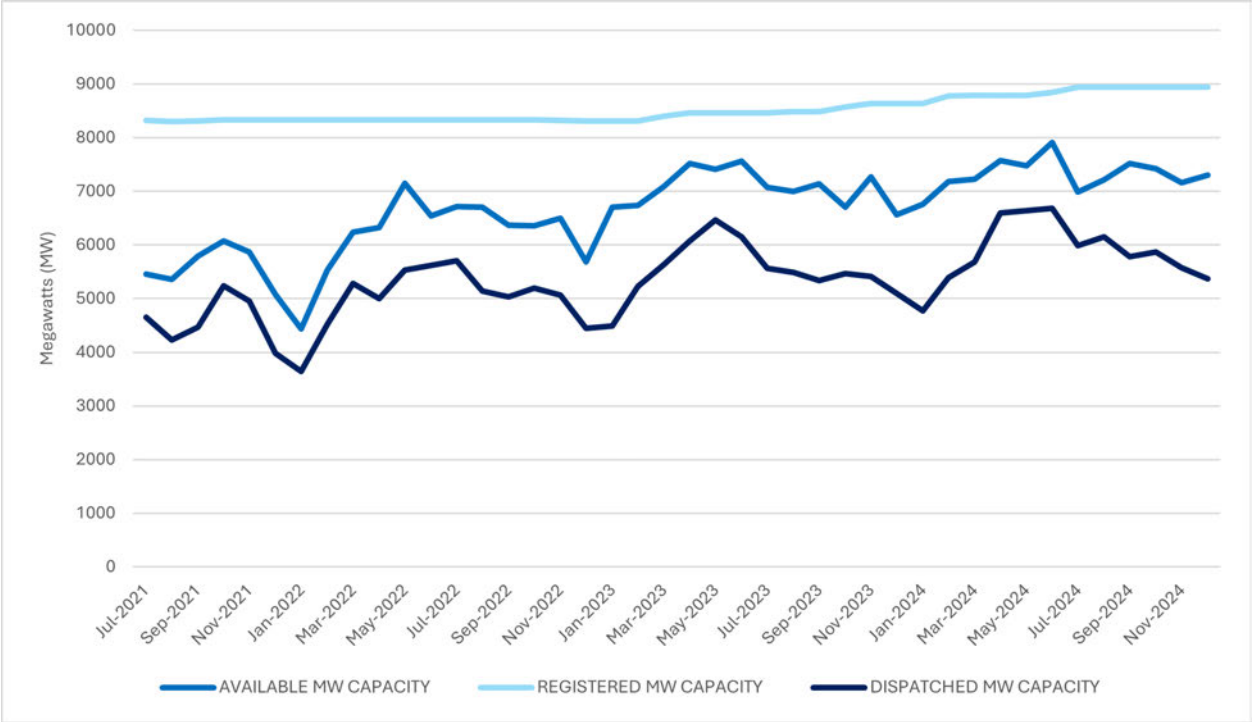


Figure 18: Performance of Coal-Fired Plants (Luzon)

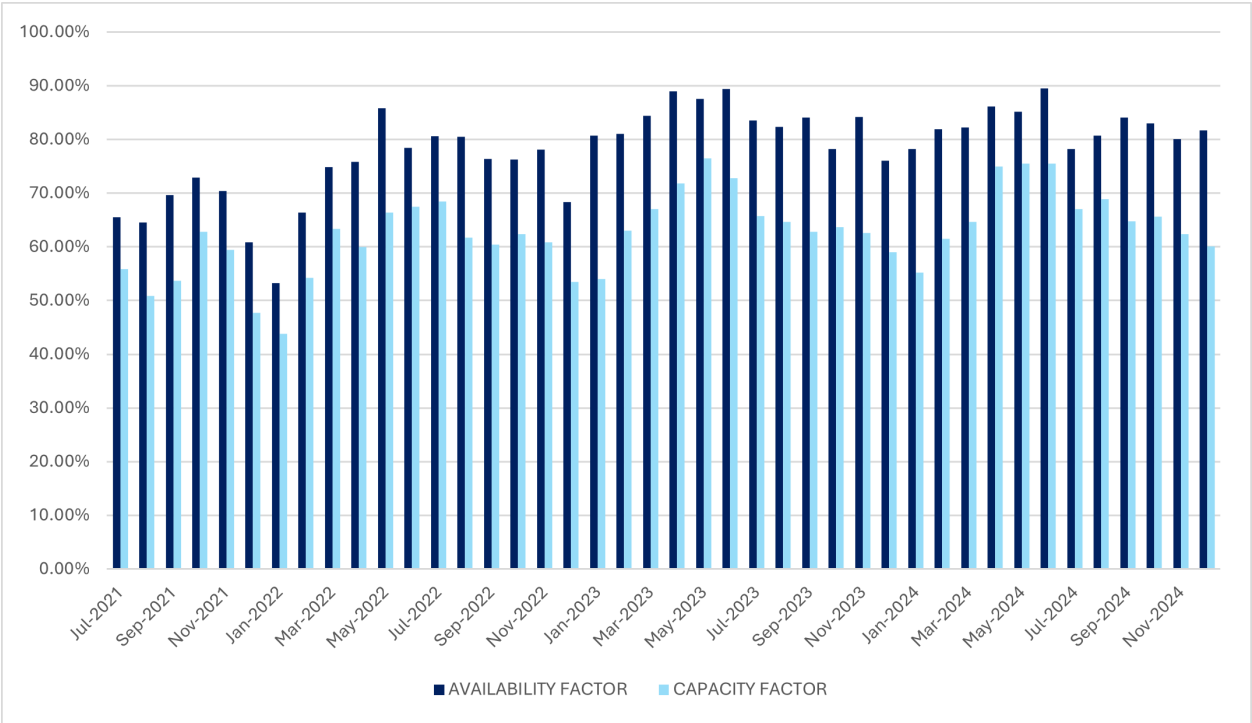


Figure 19: Availability and Capacity Factor of Coal-Fired Plants (Luzon)

Throughout the years of 2021 to 2024, coal plants in Luzon have exhibited a steady rise in their availability and capacity factors. In 2024, coal plants had an average availability factor of 82% and an average capacity factor of 66%. This is a big increase when compared to the average availability and capacity factors of 72% and 59% respectively for the years 2021 and 2022. Such high availability and capacity factors are expected for base load plants since they can reliably generate power all year round with downtimes usually only attributed to maintenance and repairs.

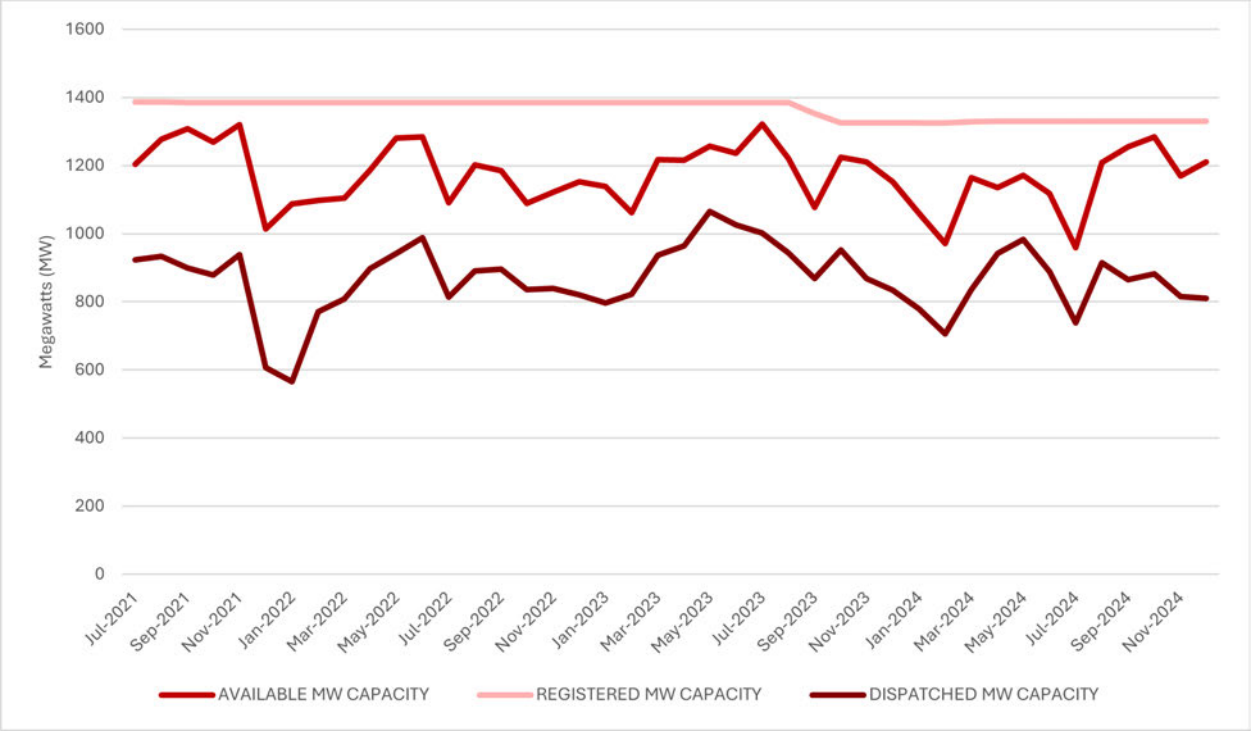


Figure 20: Performance of Coal-Fired Plants (Visayas)

Figure 21: Availability and Capacity Factor of Coal-Fired Plants (Visayas)

In Visayas, the coal plants consistently have high availability and capacity factors throughout 2021 to 2024. For 2024 alone, the coal plants had an average availability factor of 86%, which is 4% higher than Luzon. However, the average capacity factor sits at 64%, which is slightly lower. Although the total registered capacity of coal plants in Visayas is around 1300 MW as compared to Luzon which exhibits a much larger capacity of around 8900 MW. A common point between Luzon and Visayas coal plants is the noticeable dip in both the availability and capacity factors in early 2022.

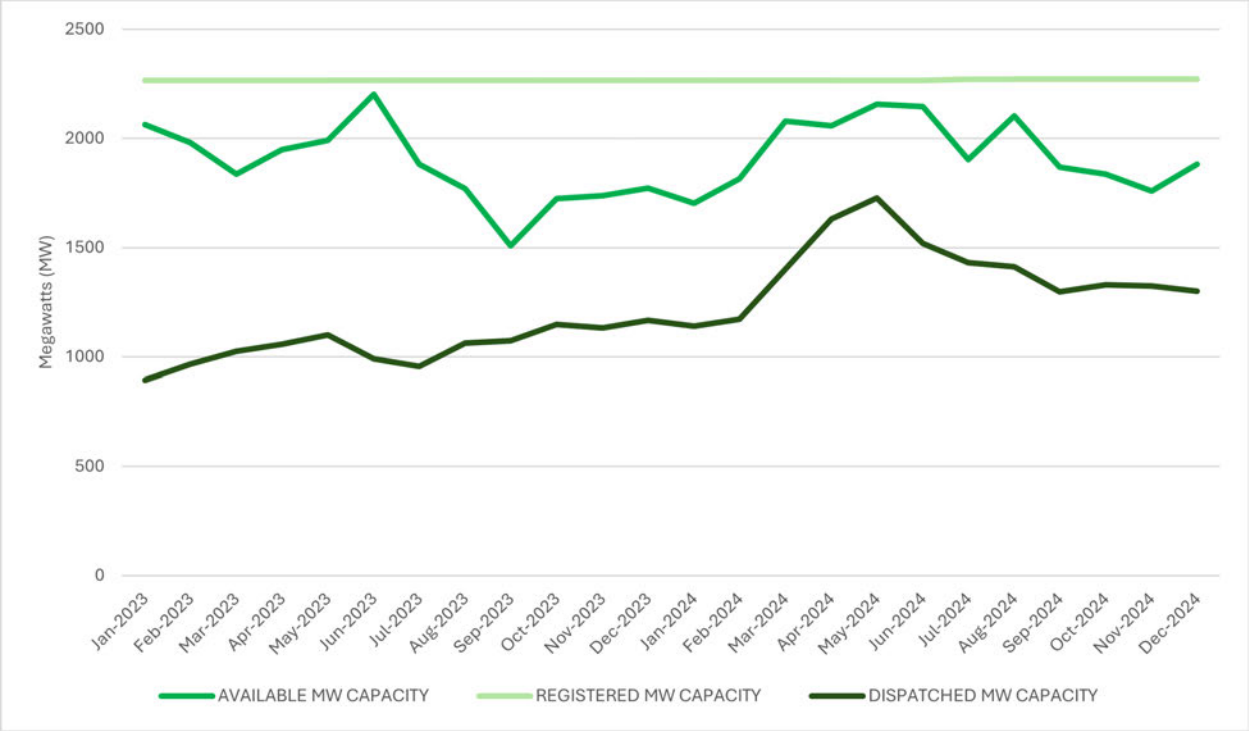


Figure 22: Performance of Coal-Fired Plants (Mindanao)

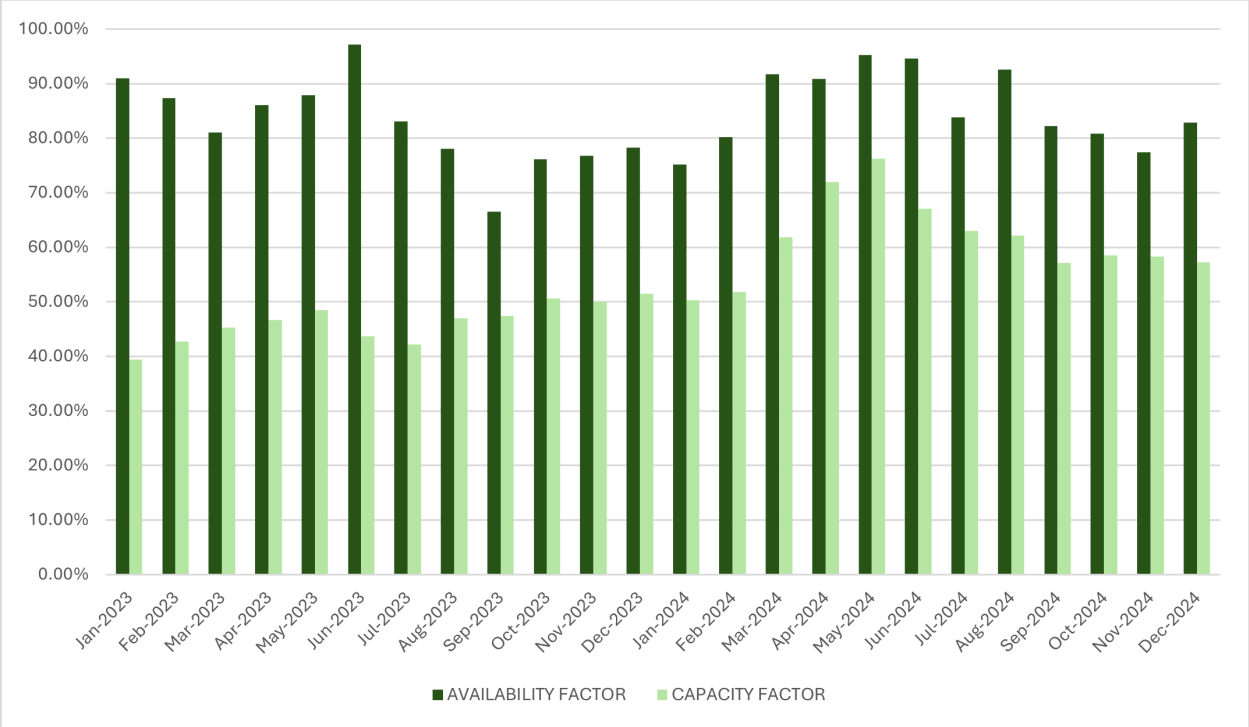


Figure 23: Availability and Capacity Factor of Coal-Fired Plants (Mindanao)

Meanwhile in Mindanao, coal plants exhibit a larger coal registered capacity of around 2300 MW as of 2024 as compared to Visayas. Its average availability and capacity factors for 2024 are near the other two regions which sit at 85% and 61% respectively. While the availability factors of the coal plants in Mindanao are consistently high throughout 2023 and 2024, the capacity factors started low at the start of 2023 and steadily increased in 2024. A common trend that can be observed for the coal power plants is the increase of both the availability and capacity factors during summer which can be attributed to increased demand during the period.

NATURAL GAS PLANTS

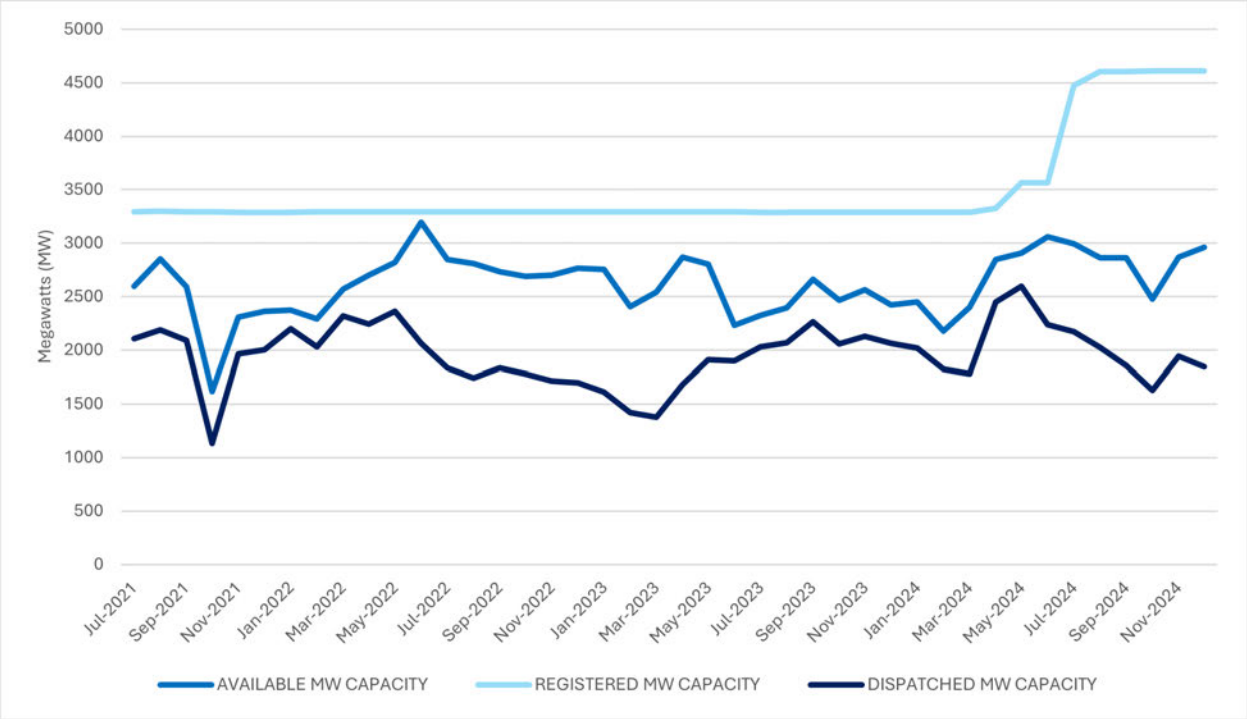


Figure 24: Performance of Natural Gas Plants (Luzon)

Natural gas plants in Luzon exhibited a surge towards the latter half of 2024 where its registered capacity greatly increased by around 1200 MW as compared to 2023. Despite this, the availability and capacity factors continue a downward trend with an average of 70% and 52%, respectively, for 2024. This is around a 7% decrease in the availability factor and 5% decrease in the capacity factor when compared to 2023. This continued decrease may be due to the restrictions imposed on natural gas.

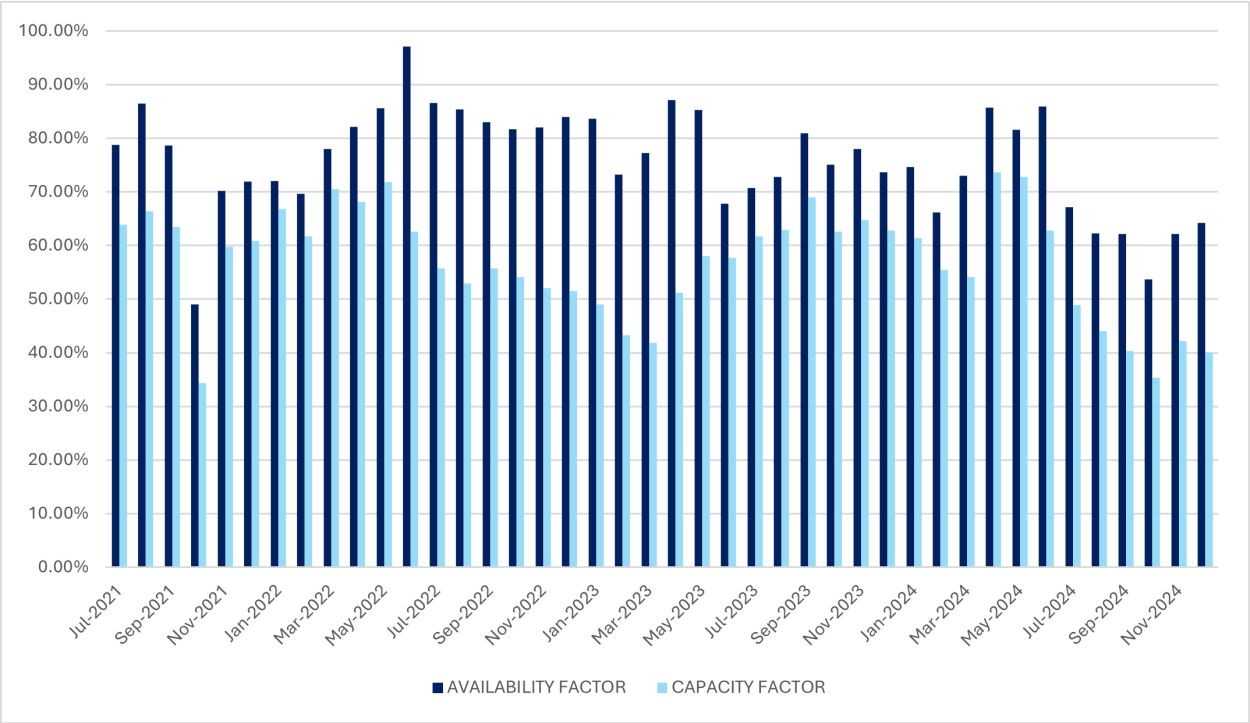


Figure 25: Availability and Capacity Factor of Natural Gas Plants (Luzon)

OIL-BASED PLANTS

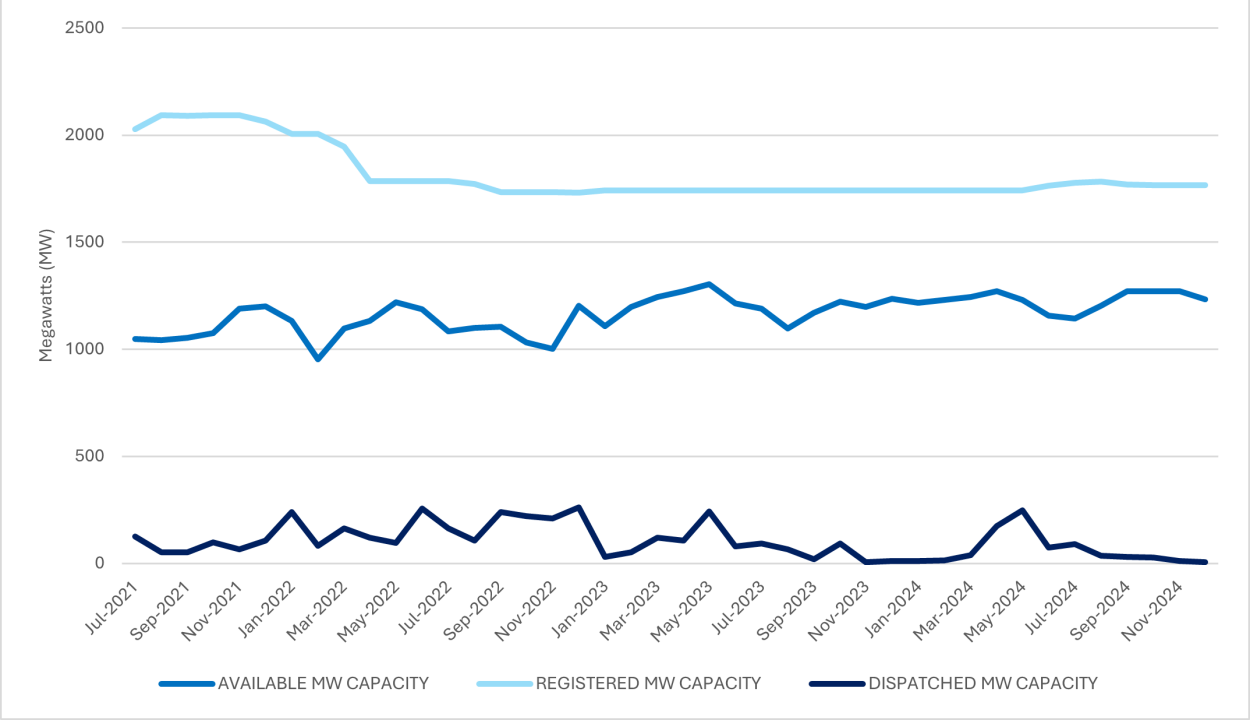


Figure 26: Performance of Oil-Based Plants (Luzon)

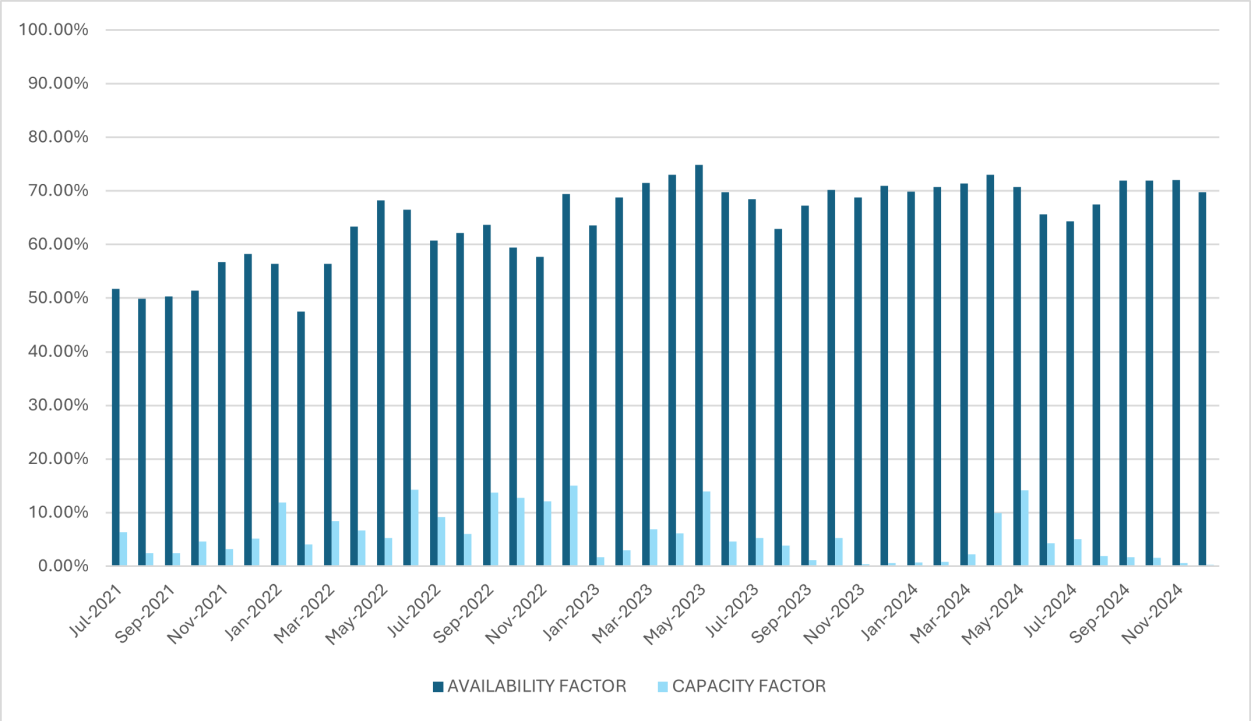


Figure 27: Availability and Capacity Factor of Oil-Based Plants (Luzon)

Similar to the coal plants, the oil-based plants in Luzon exhibited a steady increase in their availability factor throughout 2021 to 2024. Oil-based plants had an average availability factor of 70% for 2024, which is noticeably lower than coal plants. Meanwhile, the average capacity factor is 4%, which is generally observed for peaking plants. Unlike base load plants, peaking plants exhibit fast start up capabilities and are utilized during periods of high demand. Considering that an oil-based plant has expensive fuel costs but a fast start up capability, it is generally utilized as a peaking plant. This can be observed in the spikes in the capacity factors which mainly happen during the middle of the year when demand is highest.

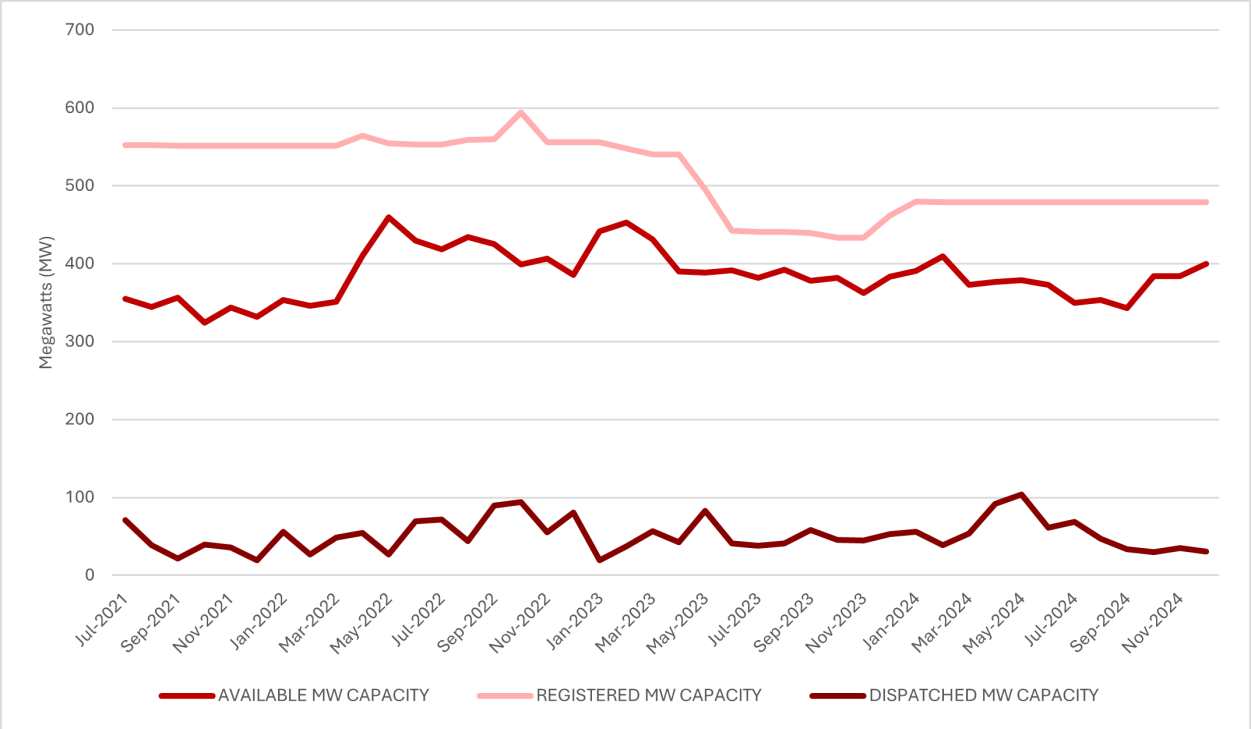


Figure 28: Performance of Oil-Based Plants (Visayas)

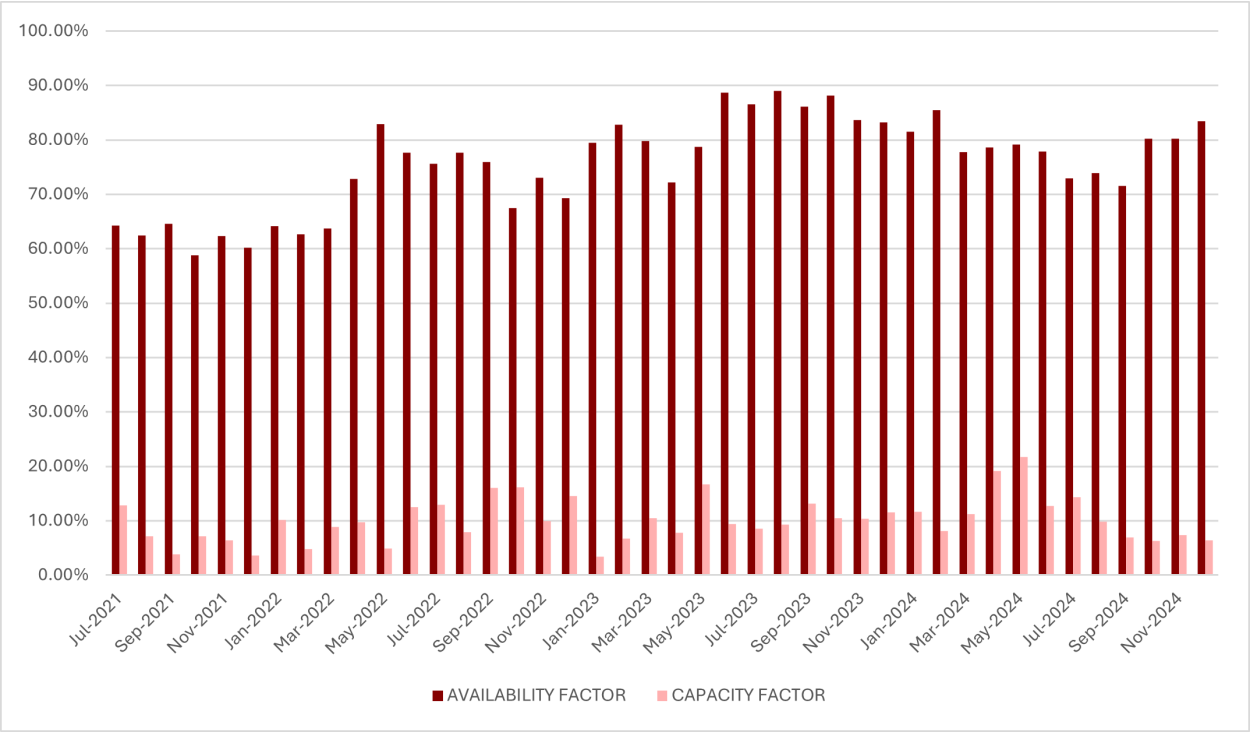


Figure 29: Availability and Capacity Factor of Oil-Based Plants (Visayas)

In Visayas, the oil-based plants exhibited a higher availability and capacity factor as compared to Luzon. In 2024, the average availability and capacity factors were 78% and 11%, respectively, which can be attributed to the higher utilization of the oil-based plants in Visayas as compared to Luzon.

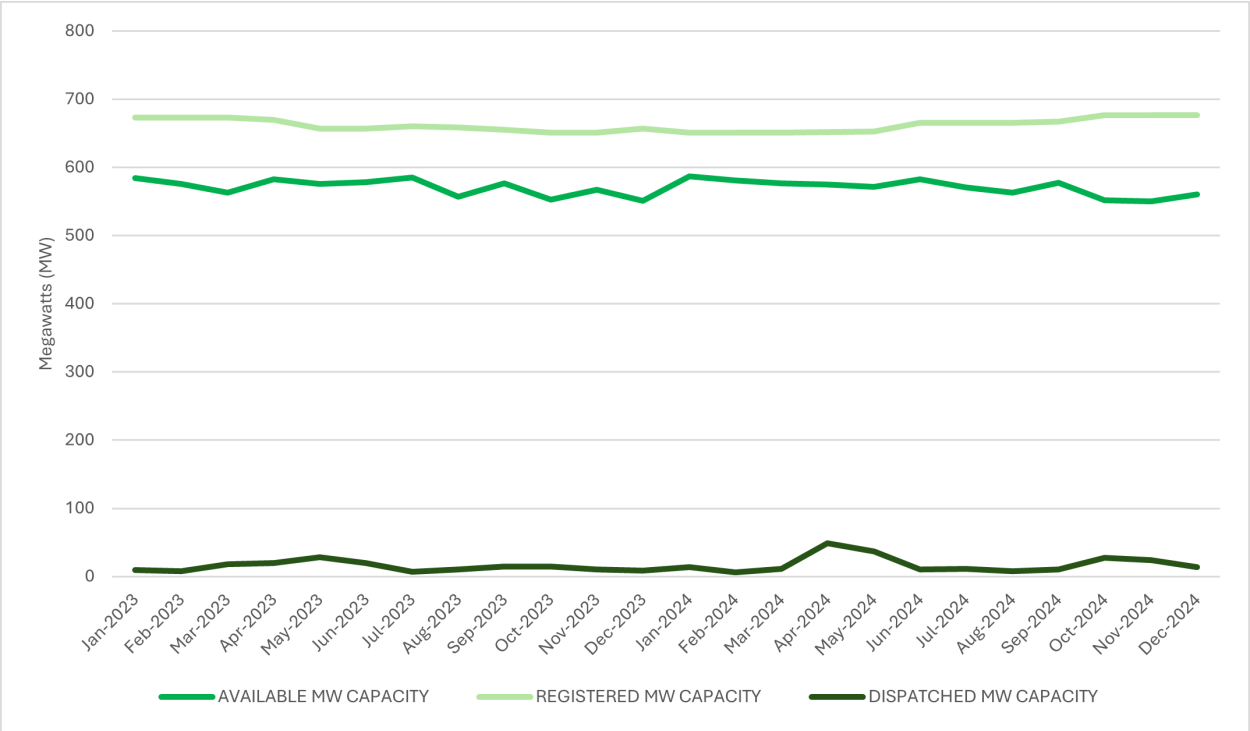


Figure 30: Performance of Oil-Based Plants (Mindanao)

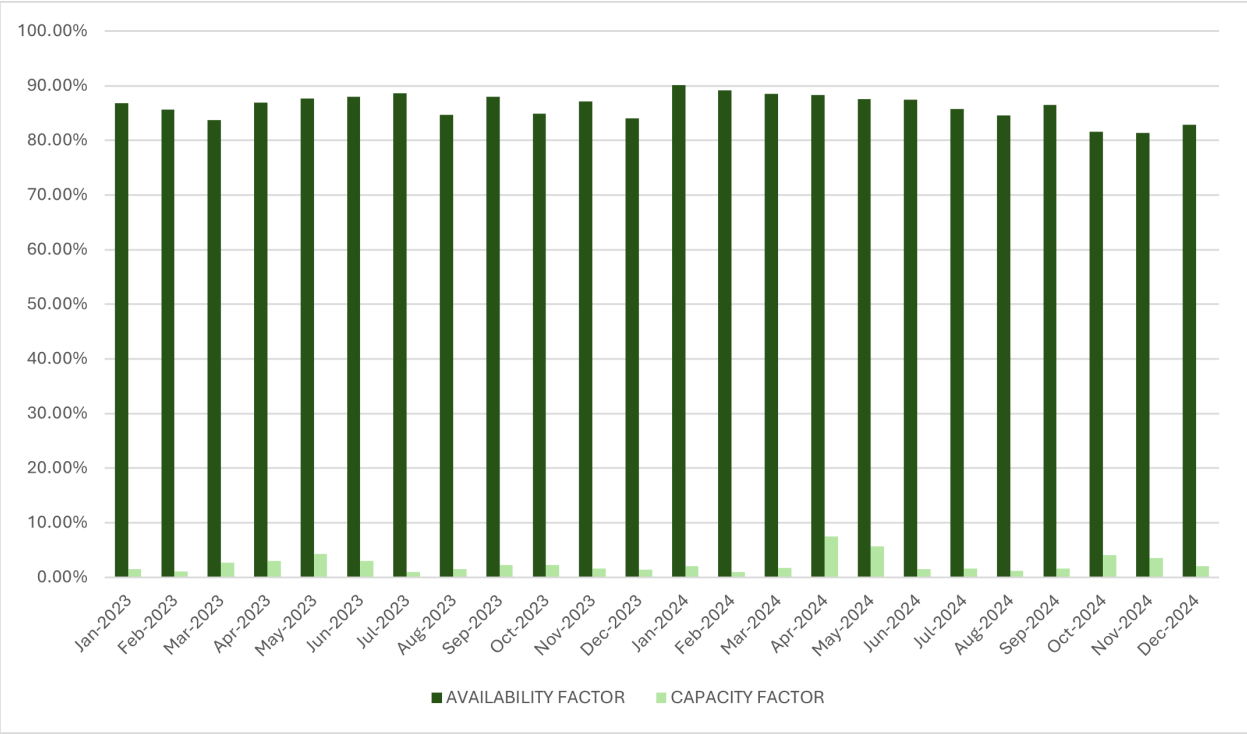


Figure 31: Availability and Capacity Factor of Oil-Based Plants (Mindanao)

Oil-based plants in Mindanao exhibited the highest availability factor among the three regions, with an average value of 86% in 2024. On the other hand, the capacity factor was the lowest among the three regions, with an average value of 3%. The oil-based plants in Mindanao behave similarly to those in Luzon, with their utilization peaking during periods of high demand. However, they are not utilized as much as the plants in Luzon, since the capacity factor does not exceed 10%, even in those periods.

2.3.2 RENEWABLE ENERGY PLANTS

GEOTHERMAL PLANTS

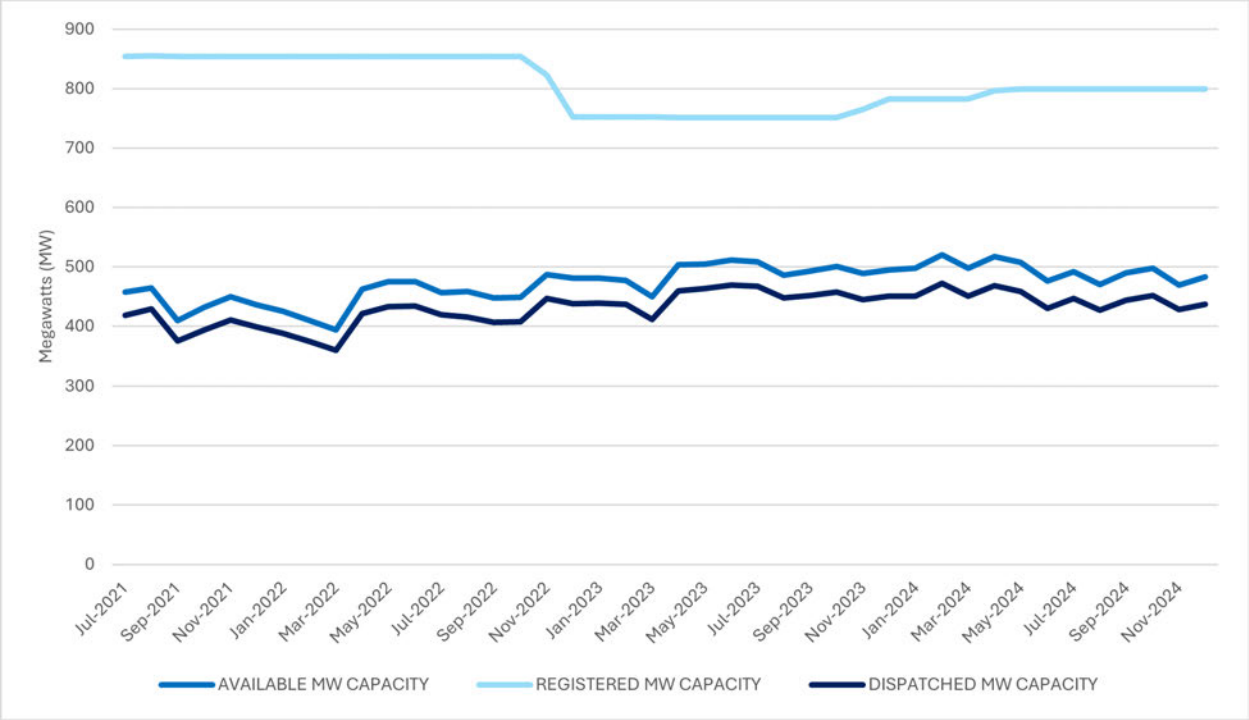


Figure 32: Performance of Geothermal Plants (Luzon)

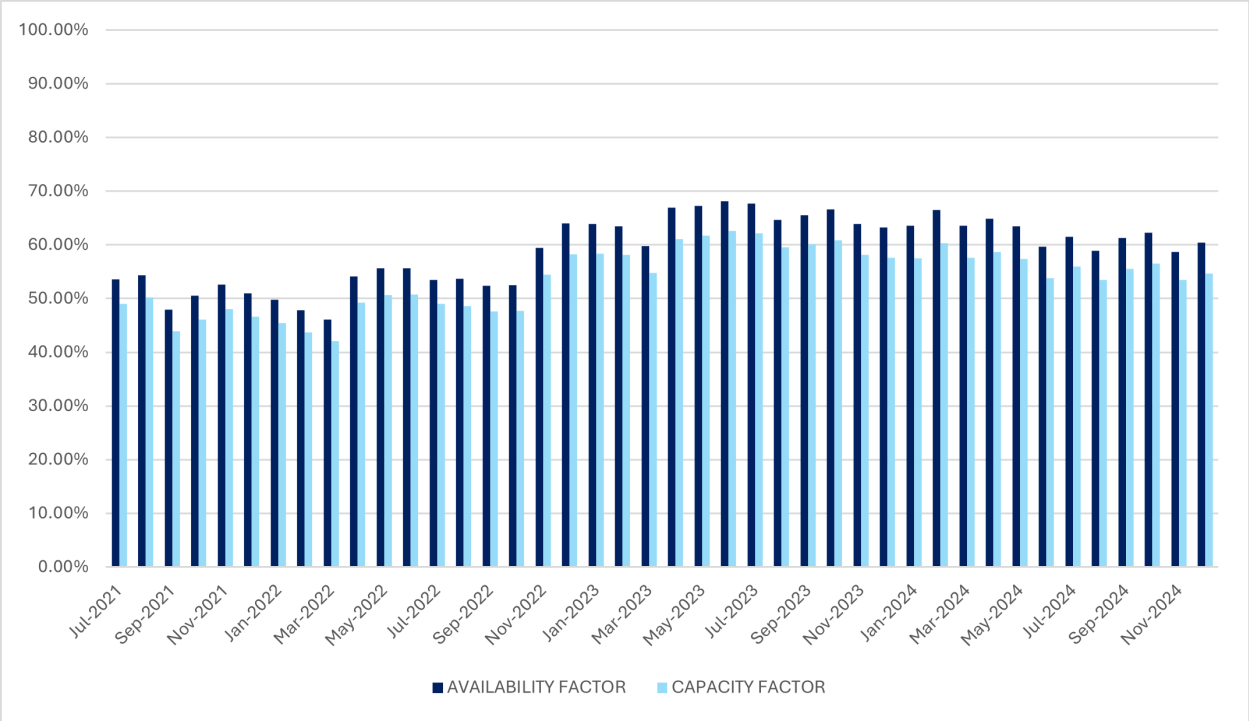


Figure 33: Availability and Capacity Factor of Geothermal Plants (Luzon)

Geothermal plants in Luzon exhibited the same steady increase in both the availability and capacity factors throughout 2021 to 2024. In 2024, the average availability and capacity factors were 62% and 56%, respectively. The low availability factor can be attributed to limited steam supply. However, unlike coal plants, the capacity factor of geothermal plants was near their availability factor due to the nature of geothermal plants where they dispatch power as soon as supply is available.

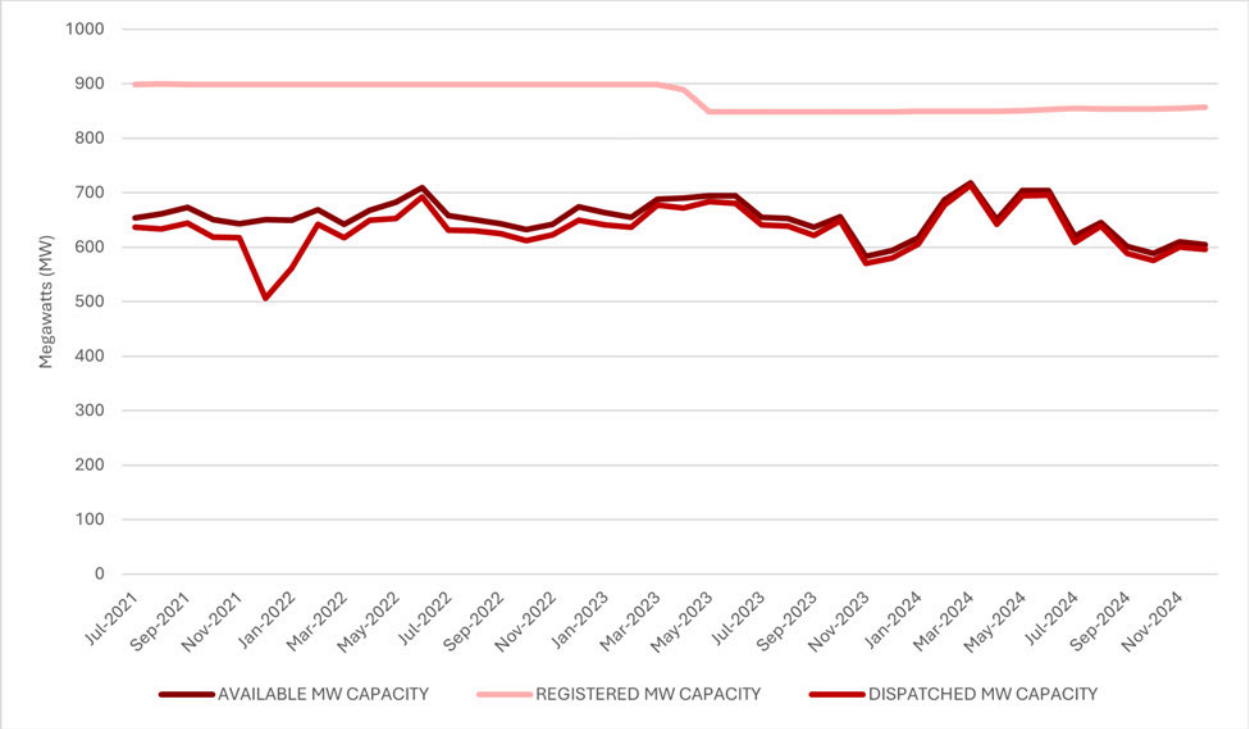


Figure 34: Performance of Geothermal Plants (Visayas)

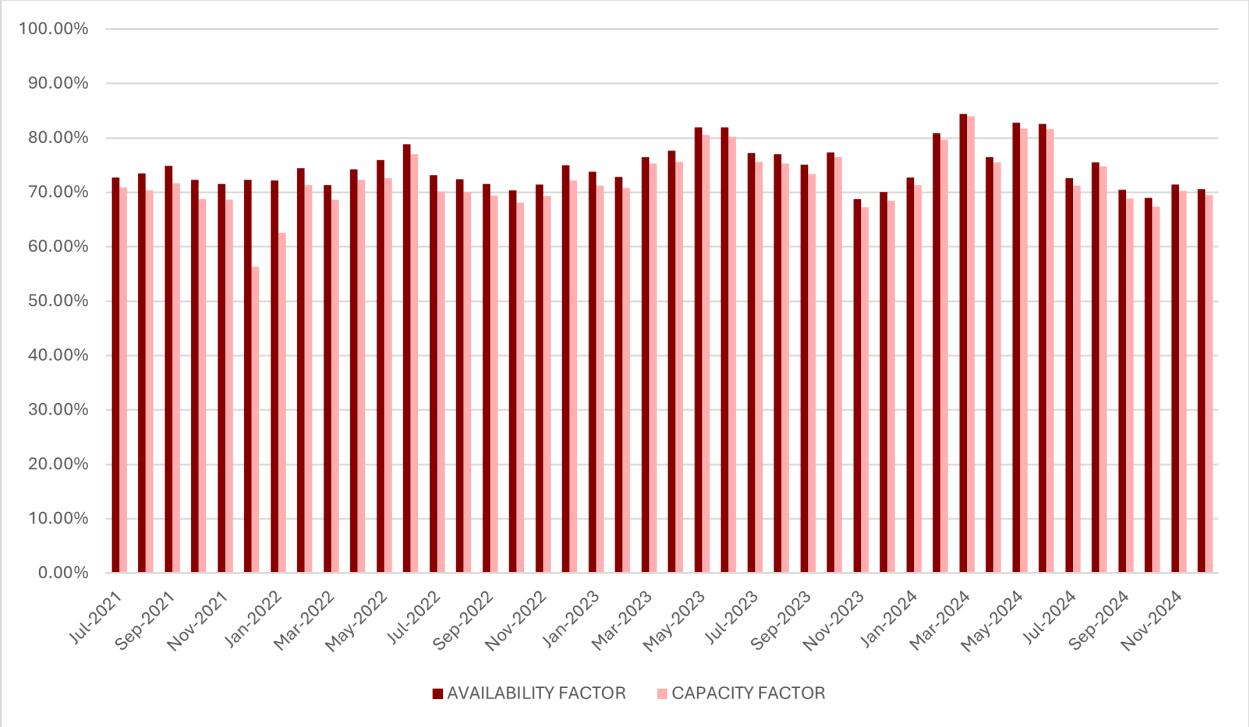


Figure 35: Availability and Capacity Factor of Geothermal Plants (Visayas)

Geothermal plants in Visayas show both a higher availability and capacity factor than Luzon, with an average of 76% and 75%, respectively. This suggests that the geothermal plants in Visayas can readily acquire supply easier than in Luzon. This is supported by the higher available capacities with an average difference of 150 MW between Luzon and Visayas for 2024.

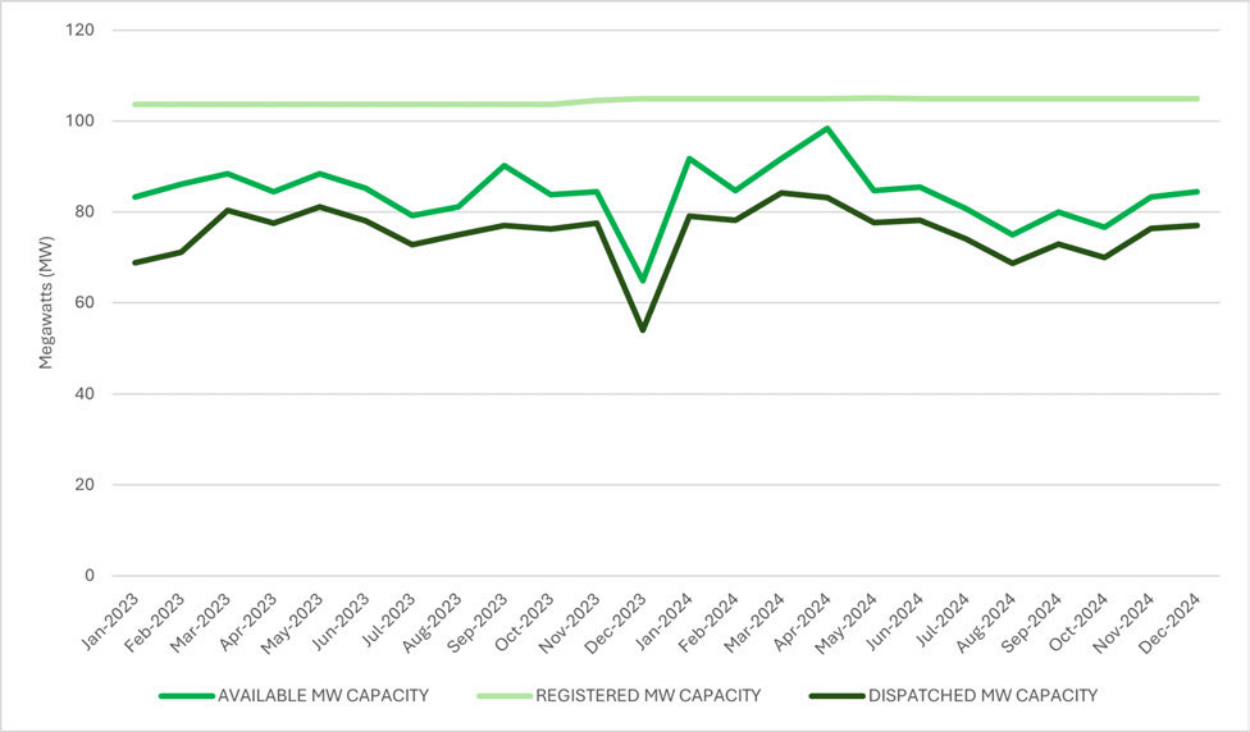


Figure 36: Performance of Geothermal Plants (Mindanao)

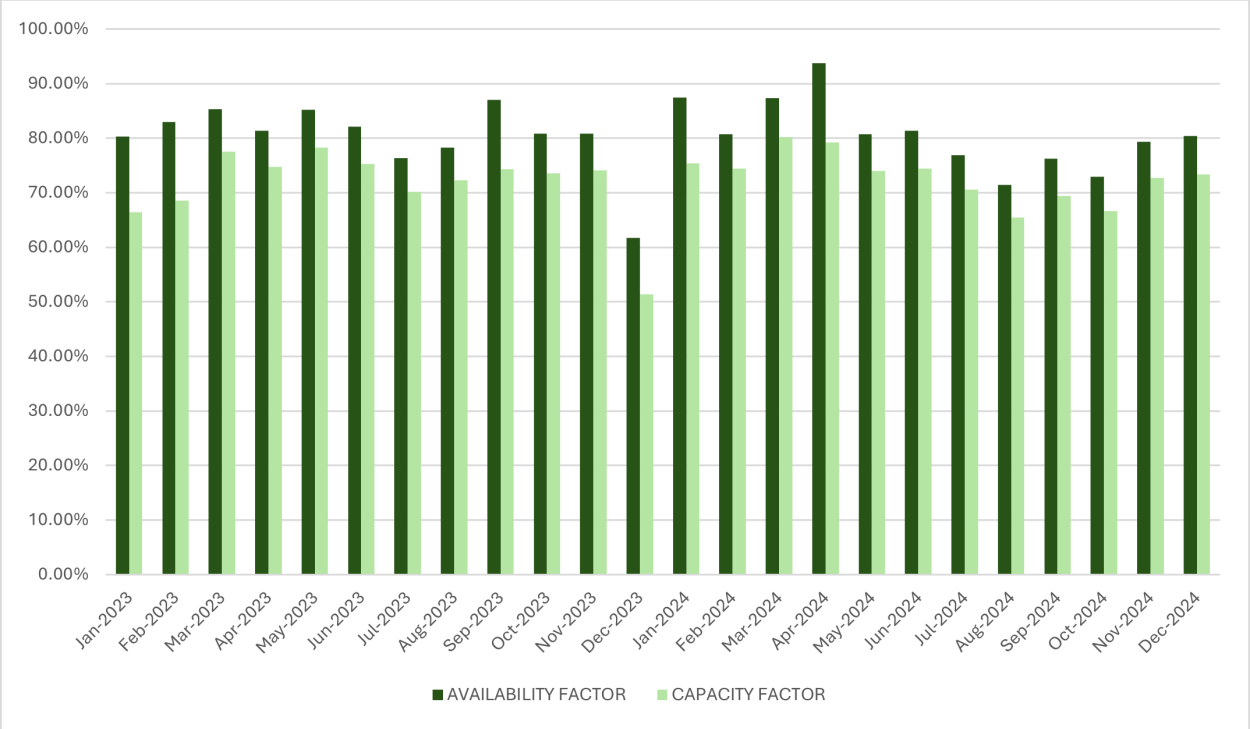


Figure 37: Availability and Capacity Factor of Geothermal Plants (Mindanao)

Apart from December 2023, where both the availability and capacity factors exhibited a noticeable decline, the factors are generally high for both 2023 and 2024. For 2024, the average availability and capacity factors were 81% and 73%, respectively, noticeably higher than Luzon. The amount of registered capacity in Mindanao is at 105 MW, as compared to Luzon and Visayas which is around 800 to 850 MW. Thus, fuel may not be a huge concern compared to the other two regions, resulting in a higher availability factor.

IMPOUNDING HYDROELECTRIC PLANTS

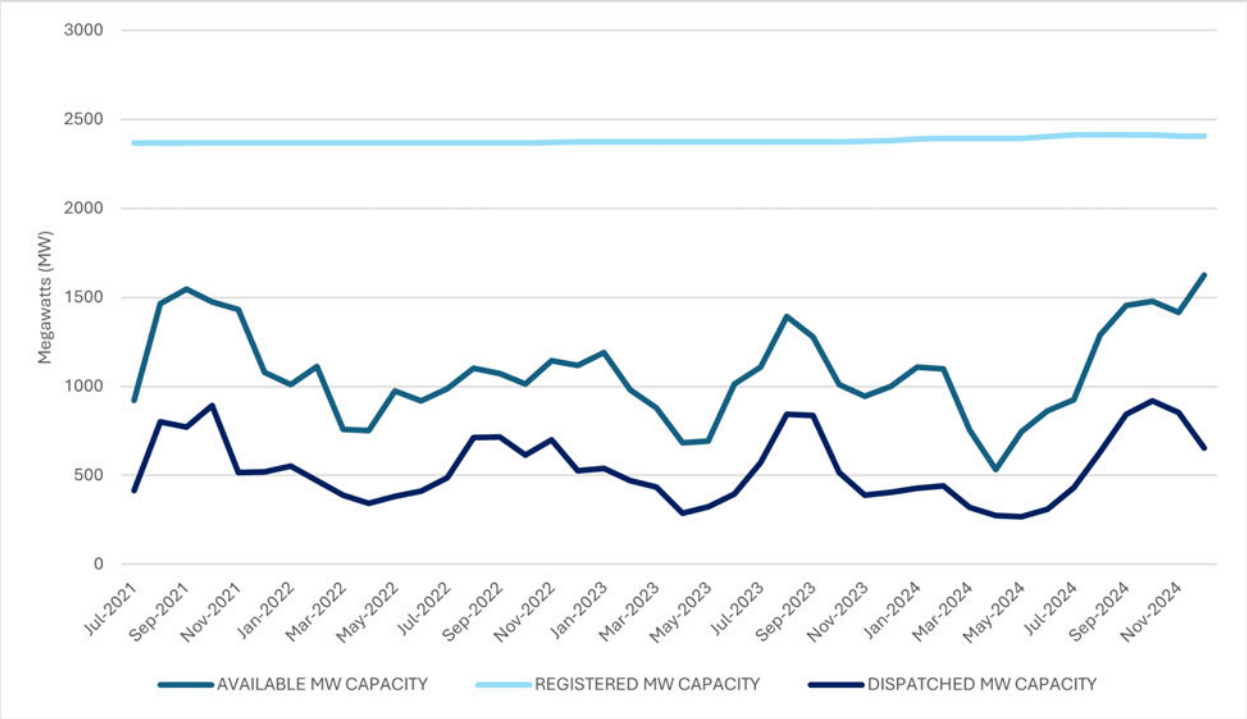


Figure 38: . Performance of Impounding Hydroelectric Plants (Luzon)

The hydroelectric plants in Luzon exhibited the same trend, with a high availability factor at the start and towards the end of the year, as compared to a decline during the mid-years, as reflected in Figure 39. In 2024, the average availability and capacity factors were 46% and 22%, respectively. The low availability factor can be attributed to seasonal changes with noticeable declines toward summer months each year. The low capacity factors are due to the power plants' capacity being on standby to support the reliable operations of the grid. Additionally, some hydroelectric power plants are designed not only for power generation, but also for purposes of irrigation and water supply, which contributes to balancing their operational roles.

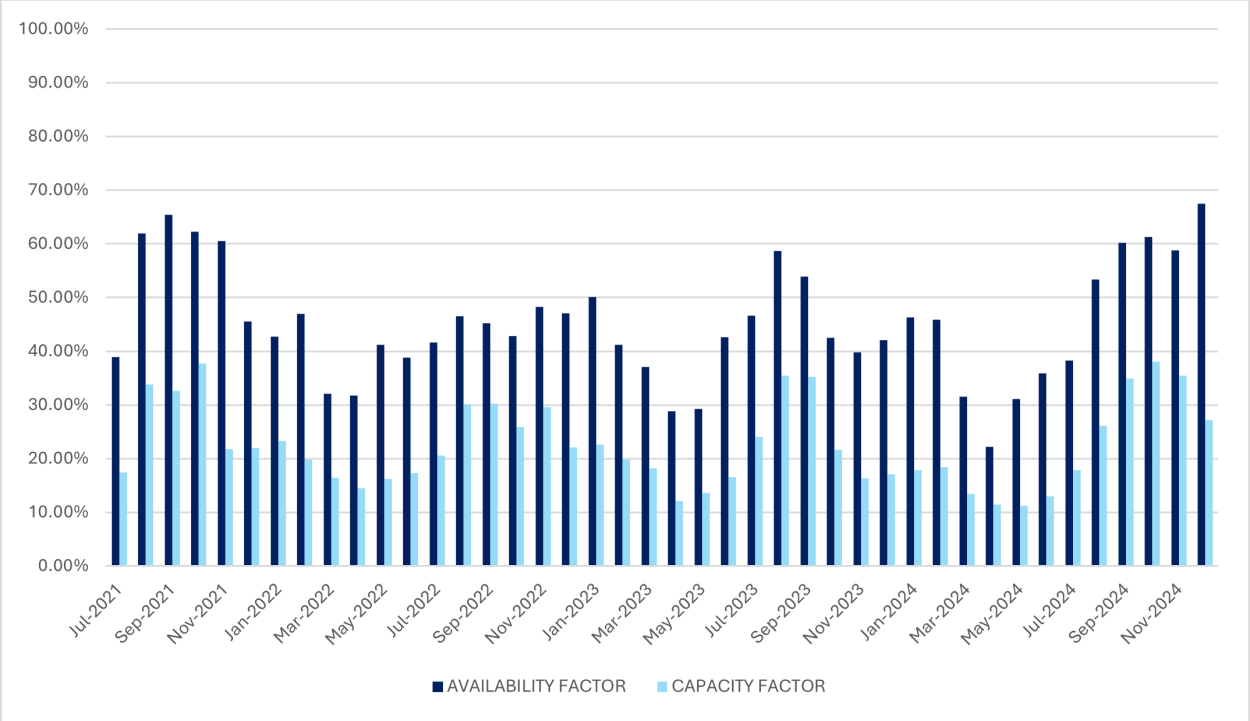


Figure 39: Availability and Capacity Factor of Impounding Hydroelectric Plants (Luzon)

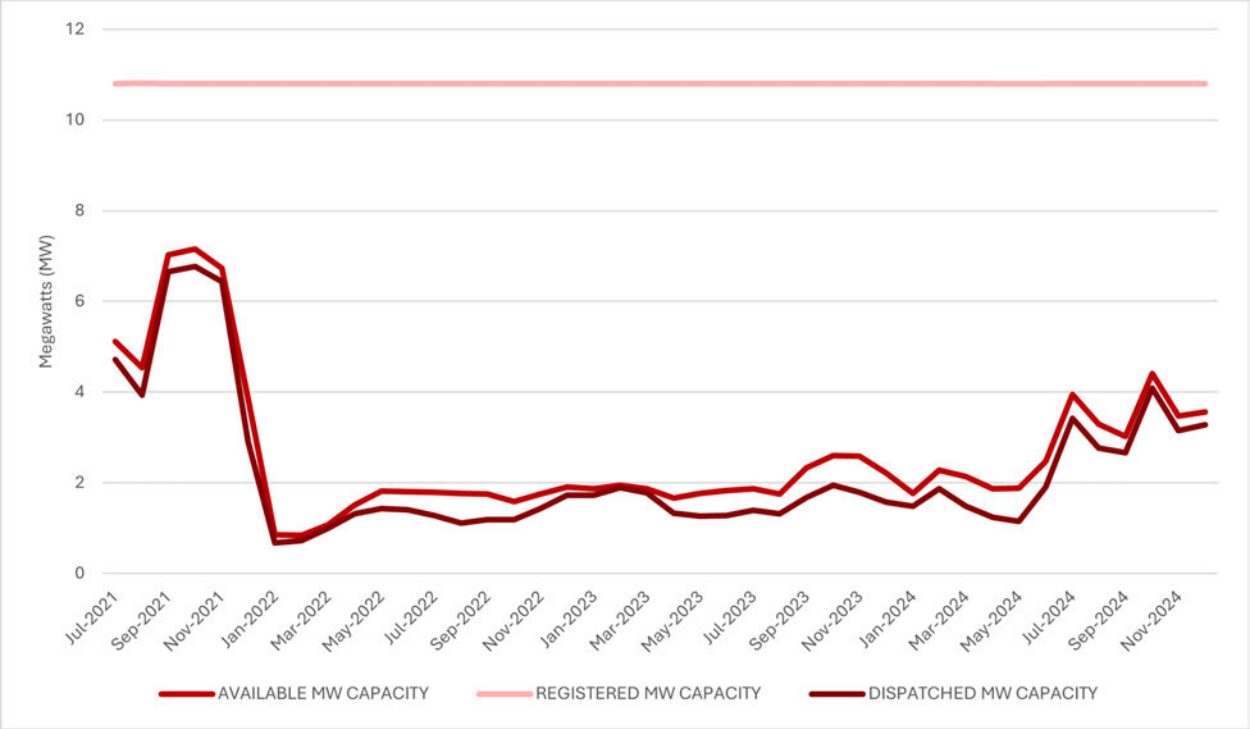


Figure 40: Performance of Impounding Hydroelectric Plants (Visayas)

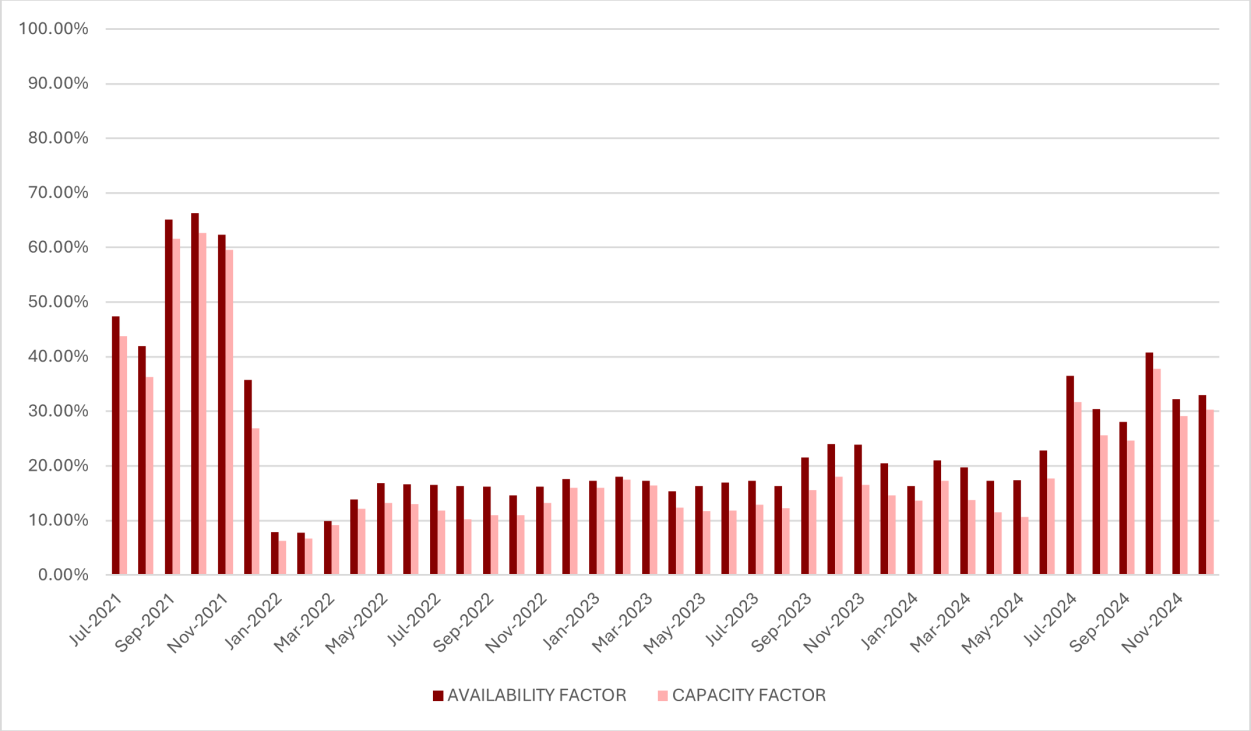


Figure 41: Availability and Capacity Factor of Impounding Hydroelectric Plants (Visayas)

In Visayas, both the availability and capacity factors of the hydroelectric plants exhibited a significant drop at the start of 2022. This continued until 2023 but slowly rose again towards the end of 2024. In 2024, the average availability factor was 26%, which was significantly lower than Luzon, while the average capacity was 22%, which was similar to the availability factor. This implies that the plants were utilized as soon as supply was available.

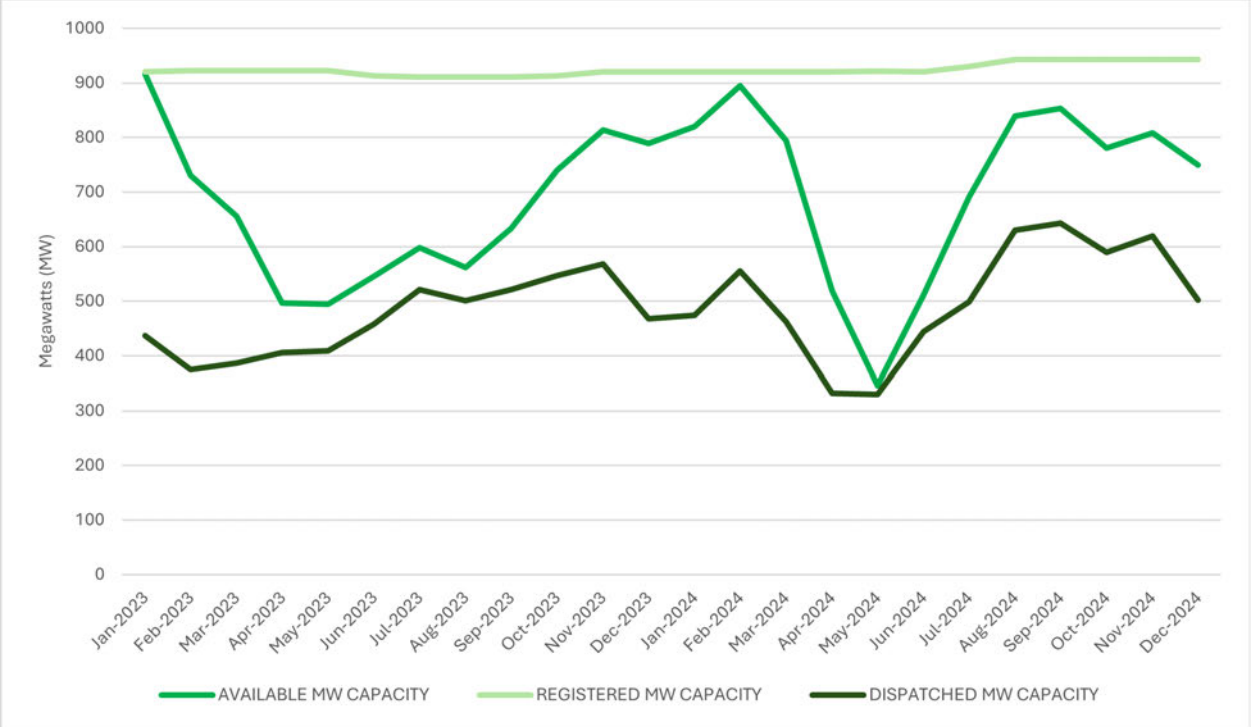


Figure 42: Performance of Impounding Hydroelectric Plants (Mindanao)

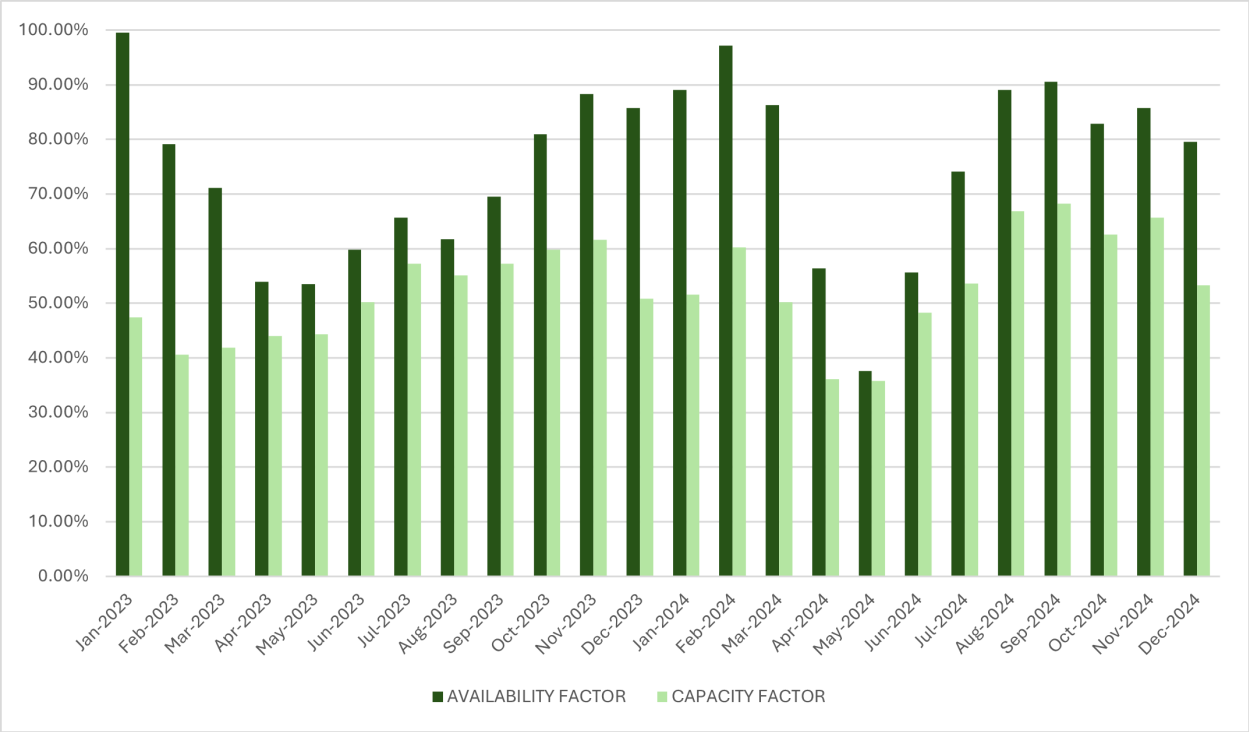


Figure 43: Availability and Capacity Factor of Impounding Hydroelectric Plants (Mindanao)

The hydroelectric power plants in Mindanao exhibited the highest availability and capacity factors with an average of 77% and 54%, respectively, in 2024, among other regions. Unlike Luzon, the hydroelectric plants in Mindanao were utilized more frequently, indicated by their high capacity factors, which suggests that the plants are mainly used for power generation.

BIOMASS PLANTS

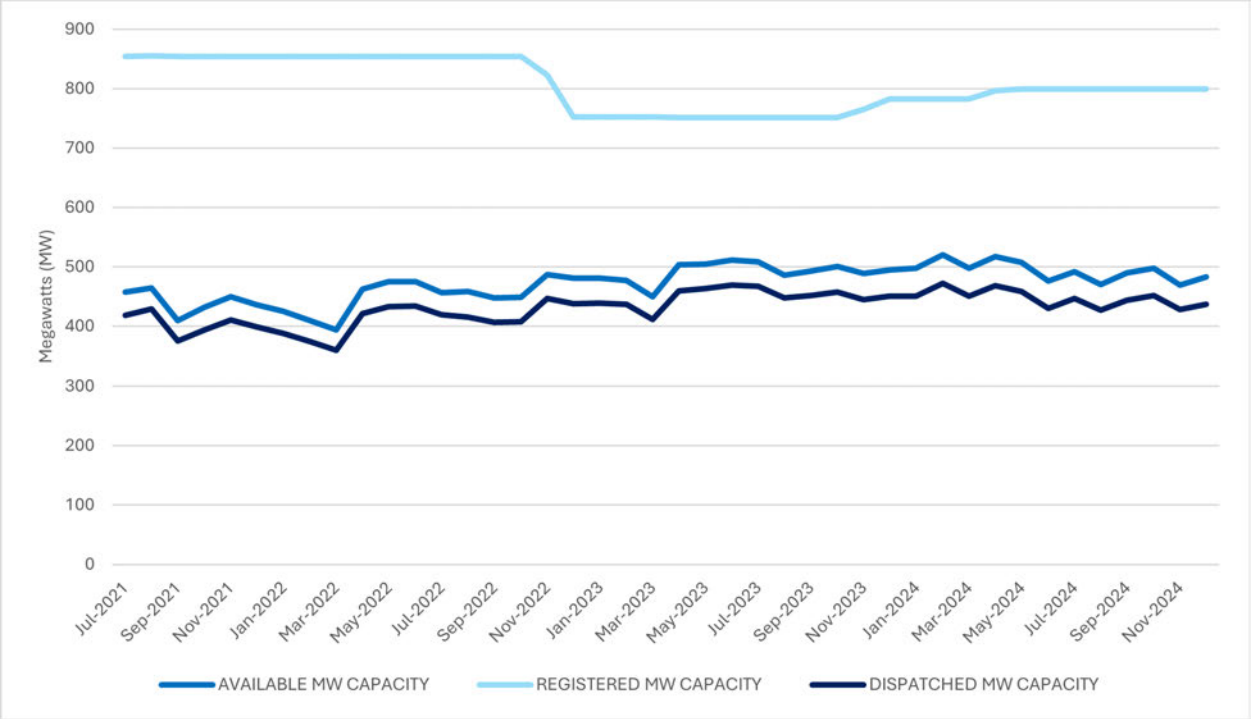


Figure 44: Performance of Biomass Plants (Luzon)

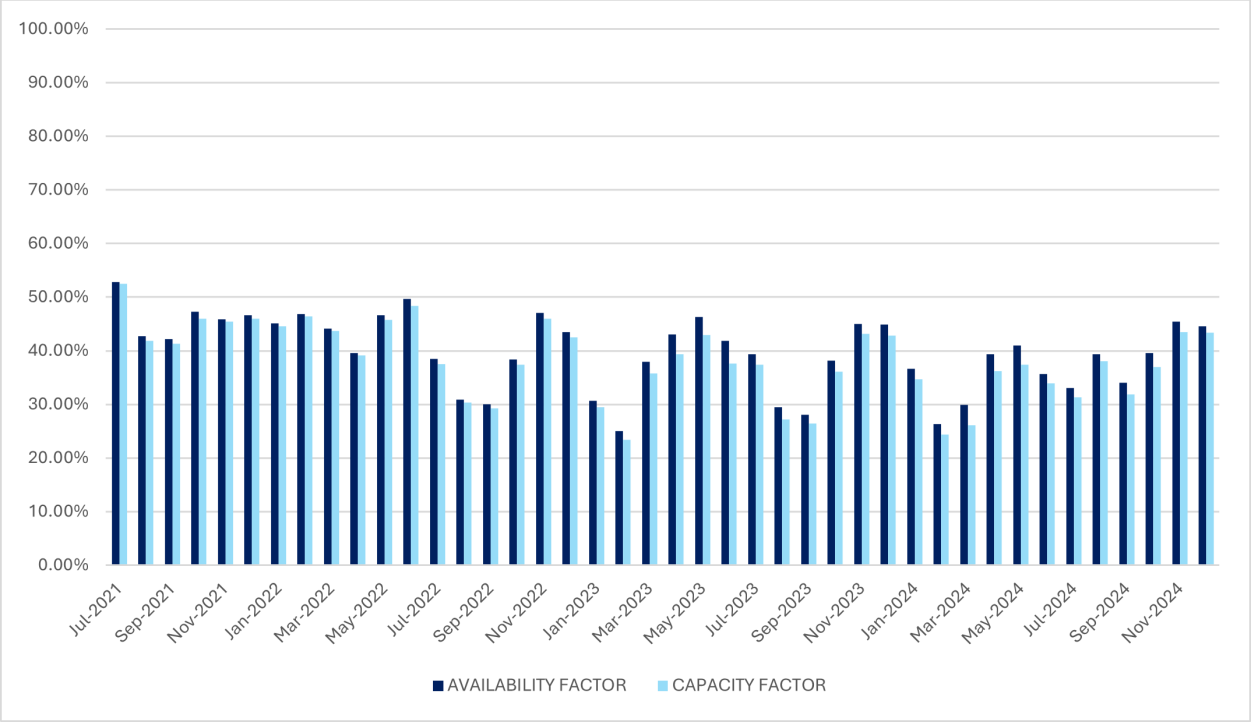


Figure 45: Availability and Capacity Factor of Biomass Plants (Luzon

Similar to the natural gas plants, the biomass plants in Luzon exhibited low availability and capacity factors, averaging 37% and 35%, respectively, for 2024. Alongside that, both the factors exhibited values with minimal differences which, like geothermal plants, mean that they generate power as soon as supply is available.

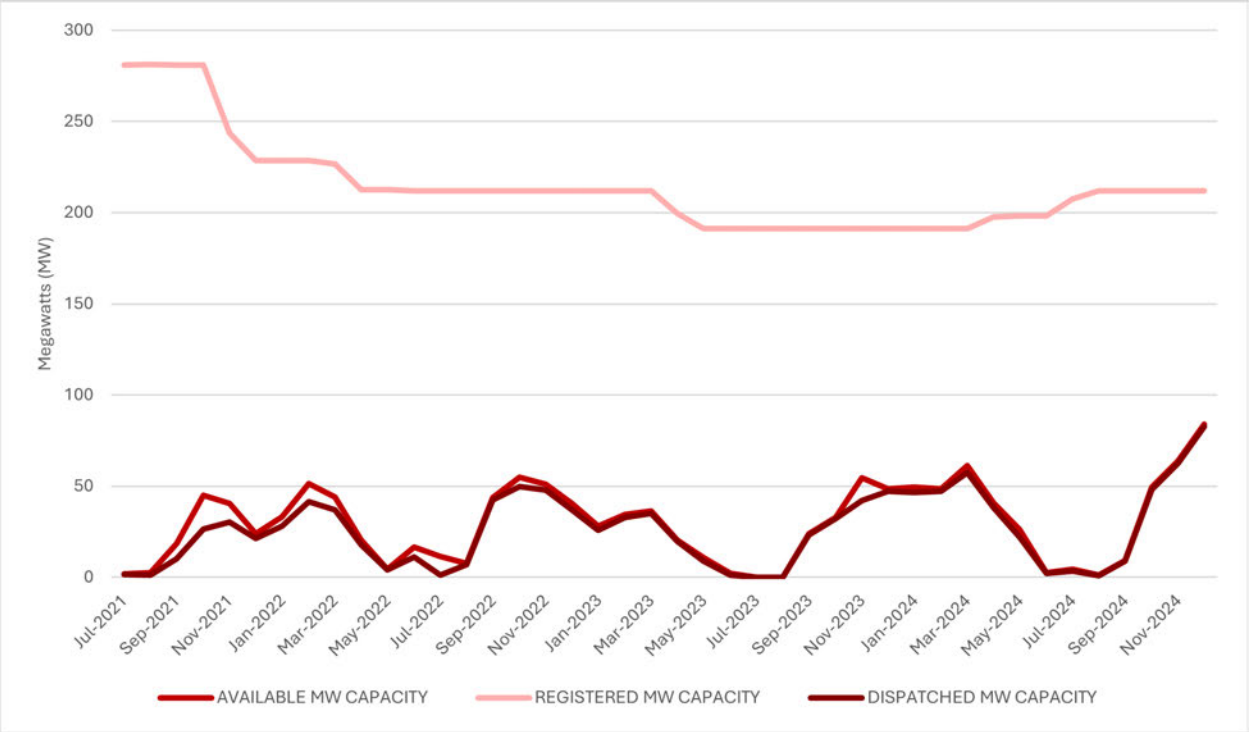


Figure 46: Performance of Biomass Plants (Visayas)

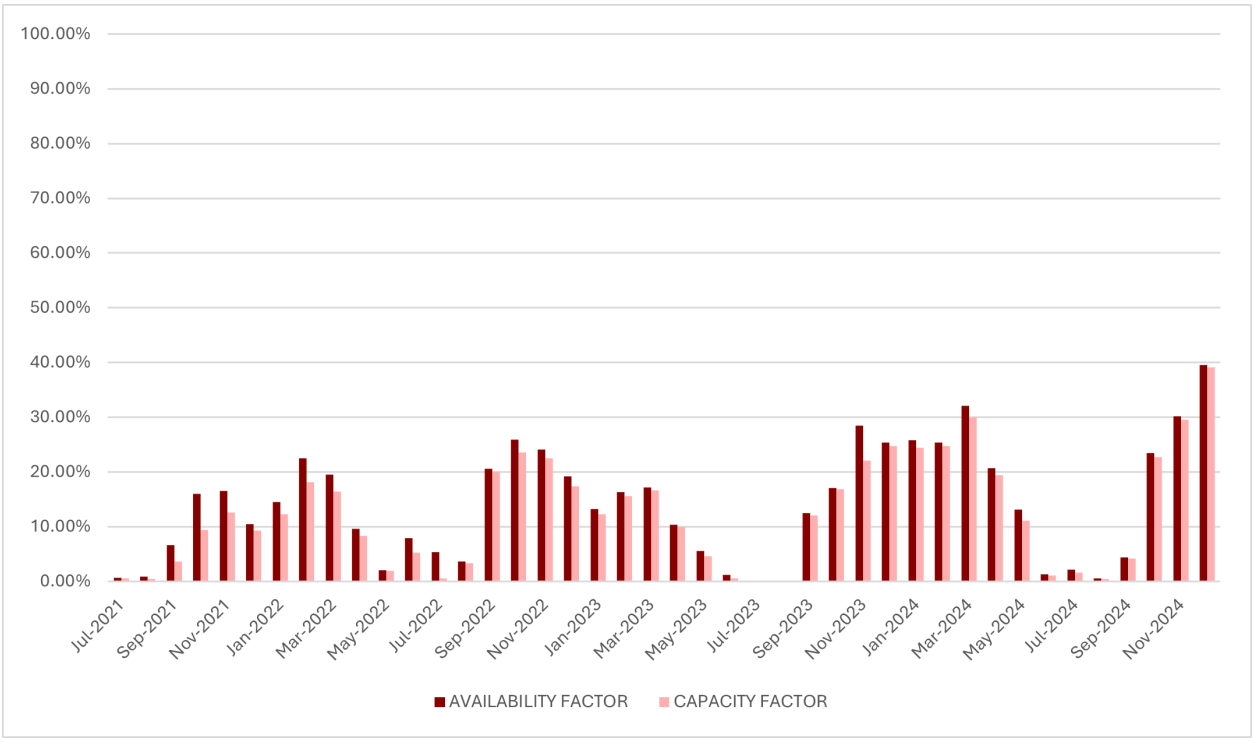


Figure 47: Availability and Capacity Factor of Biomass Plants (Visayas)

In Visayas, the biomass plants exhibited extremely low availability factors in the months of June and July which then increased toward the end of the year. This trend was observed throughout 2021 to 2024. In 2024, the average availability and capacity factors were 18% and 17%, respectively. Since many of the biomass power plants are situated in Negros and Panay, the transmission capabilities of these plants are heavily restricted due to the capacity limitations of the grid, which explains the low availability factors in Visayas.

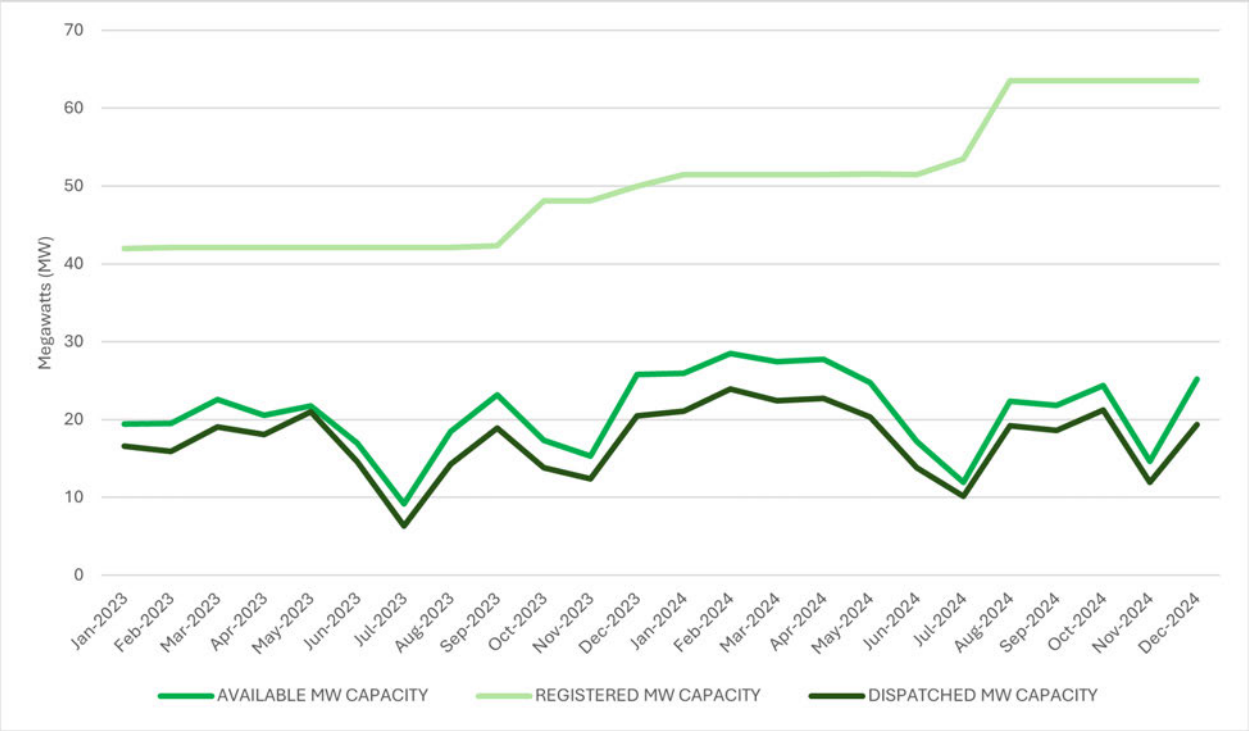


Figure 48: Performance of Biomass Plants (Mindanao)

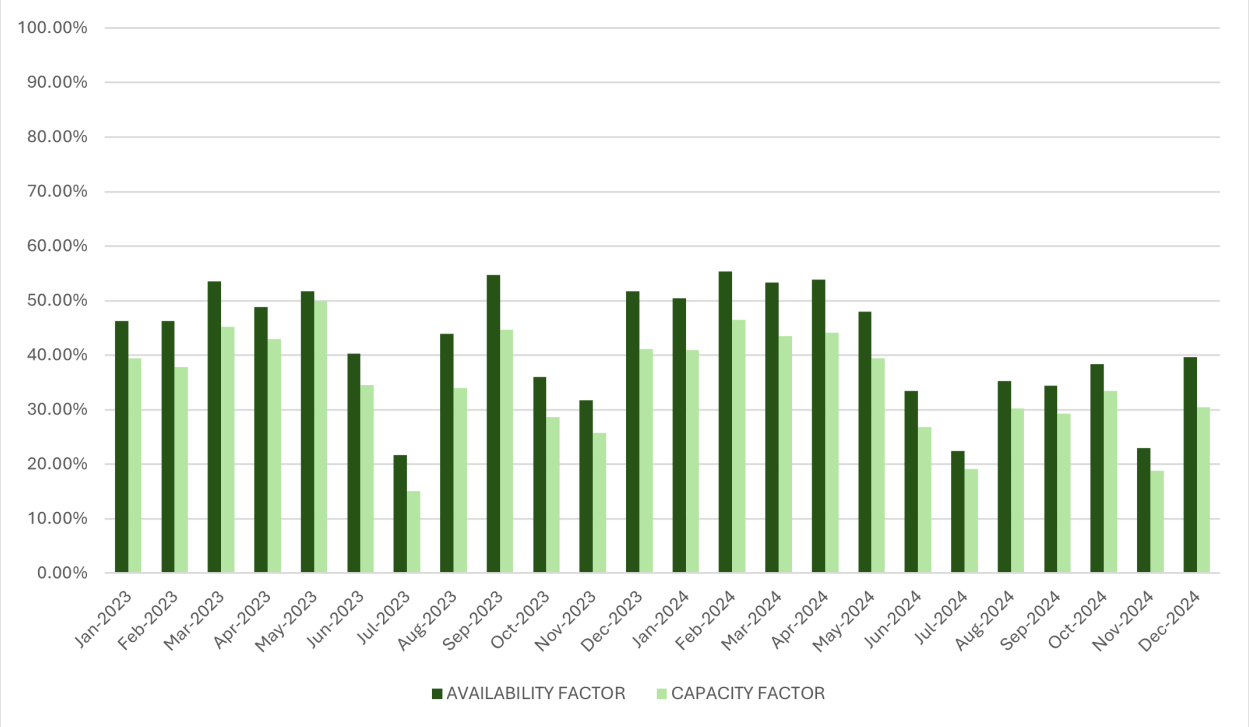


Figure 49: Availability and Capacity Factor of Biomass Plants (Mindanao)

The biomass plants in Mindanao have an average availability and capacity factors of 41% and 34% for the year 2024. Although not as severe as Visayas, the plants similarly exhibited a decrease in availability around the middle of the year. The high availability factors may be attributed to the lower registered capacity of the biomass plants in Mindanao, with only 63 MW, as compared to Luzon which has a registered capacity of 180 MW or Visayas with a registered capacity of 212 MW.

2.3.3 VARIABLE RENEWABLE ENERGY (VRE) SOURCES

SOLAR PLANTS

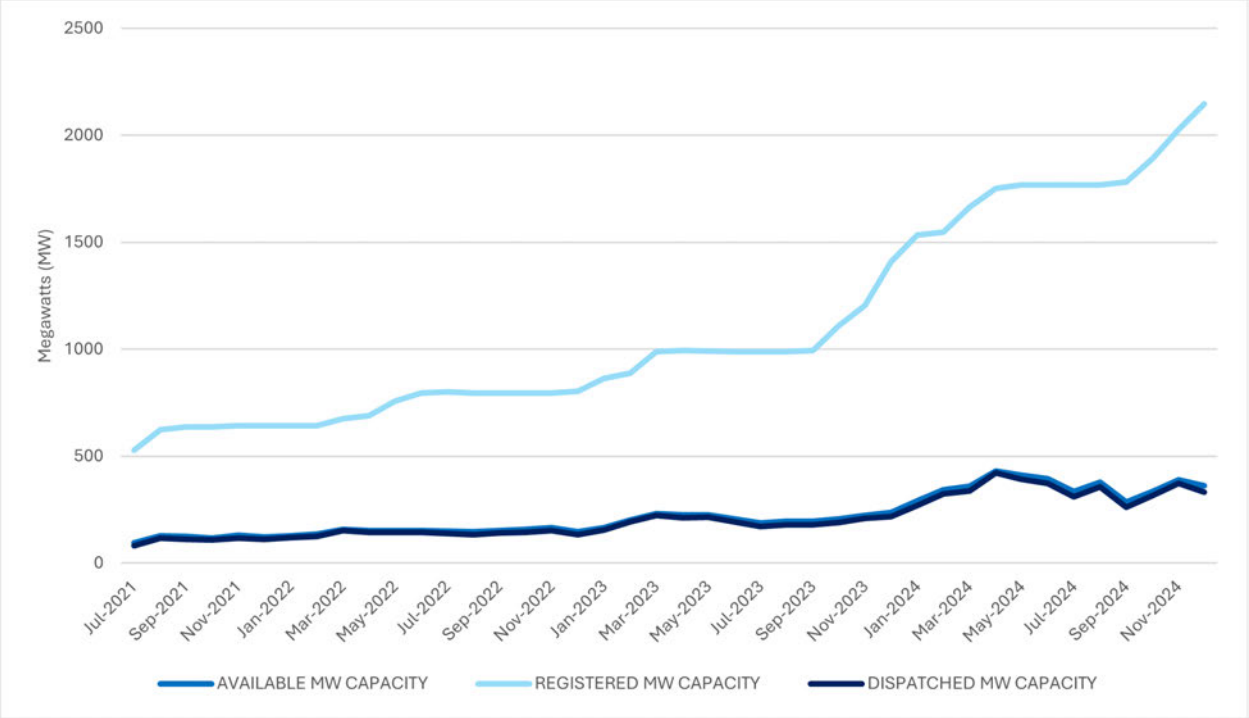


Figure 50: Performance of Solar Plants (Luzon)

The registered capacity of solar plants in Luzon exhibited a continuous increase since 2021 for a total capacity of 2140 MW at the end of 2024. This surge in capacity is mainly driven by the RE programs in the country such as the Feed-in-Tariff program. Despite this, the average availability factor was 20% in 2024. This is attributed to the intermittent nature of solar energy since it is dependent on sunlight and weather conditions.

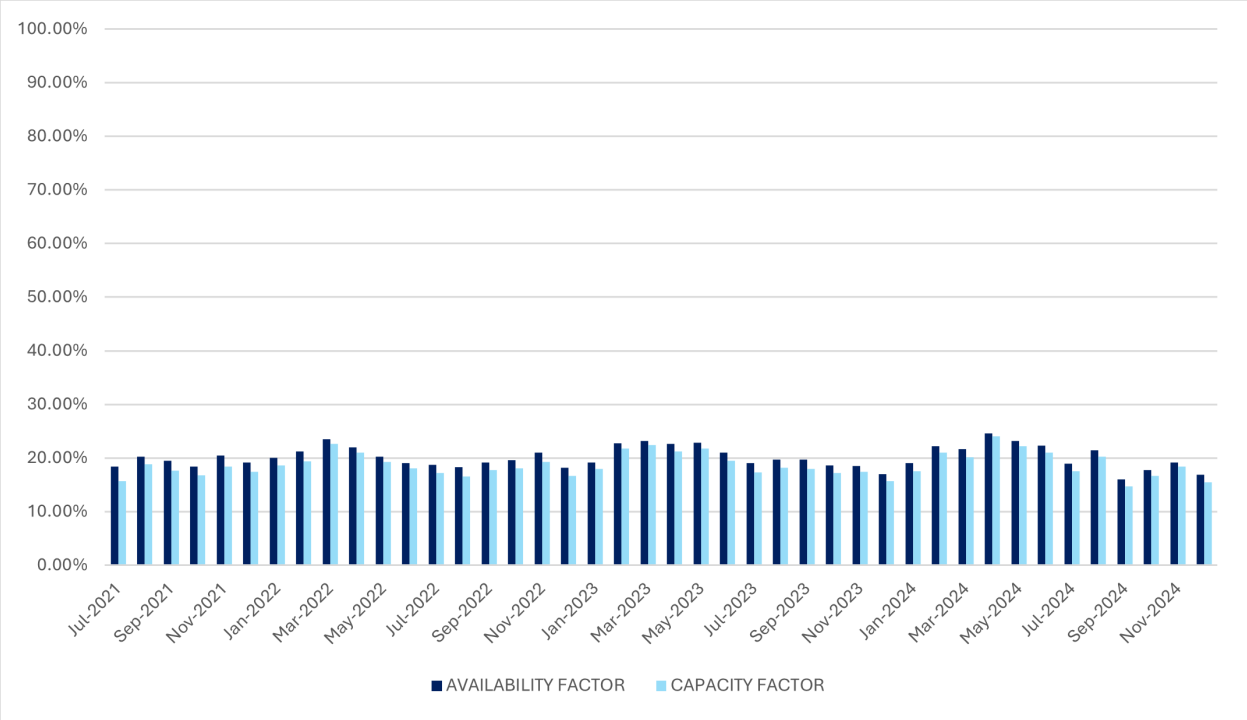


Figure 51: Availability and Capacity Factor of Solar Plants (Luzon)

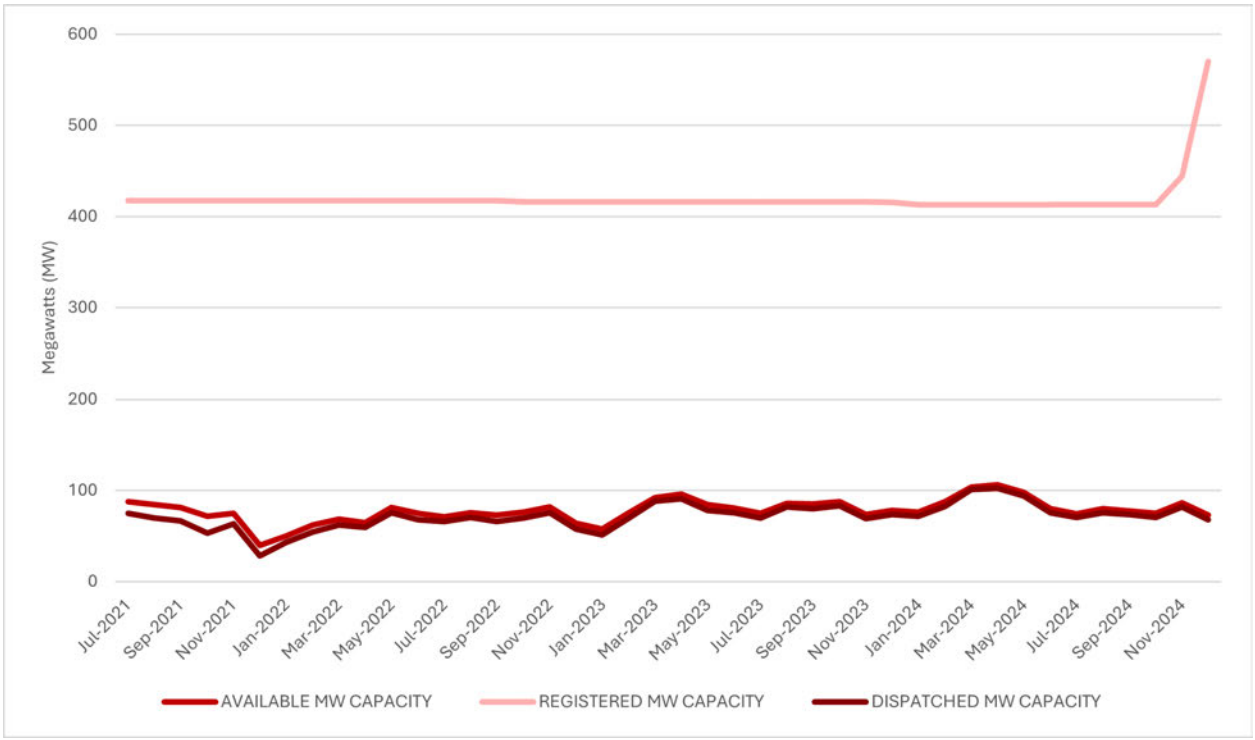


Figure 52: Performance of Solar Plants (Visayas)

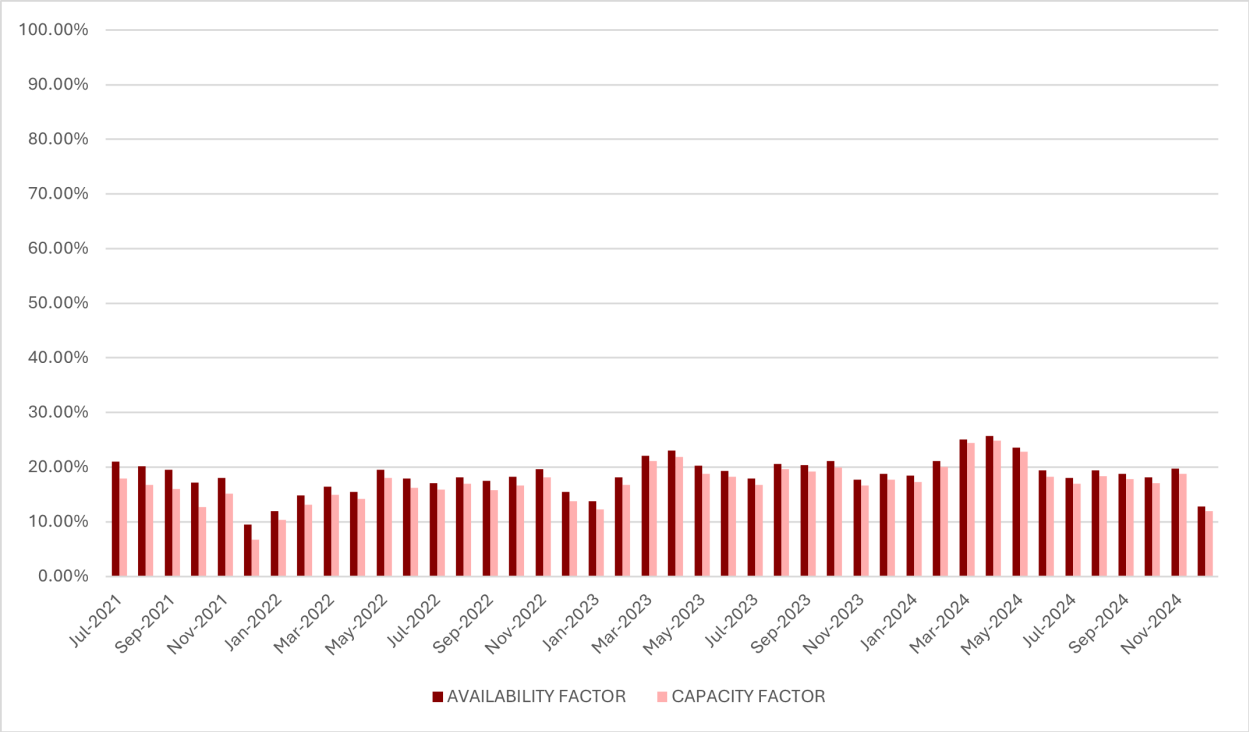


Figure 53: Availability and Capacity Factor of Solar Plants (Visayas)

The registered capacity of solar plants in Visayas mainly remained the same throughout 2021 and the majority of 2024. However, an increase of around 150 MW of registered solar capacity was observed in Visayas near the end of 2024. The average availability factor and capacity factor of the solar plants operate within the same ranges of 19 to 20%, like Luzon.

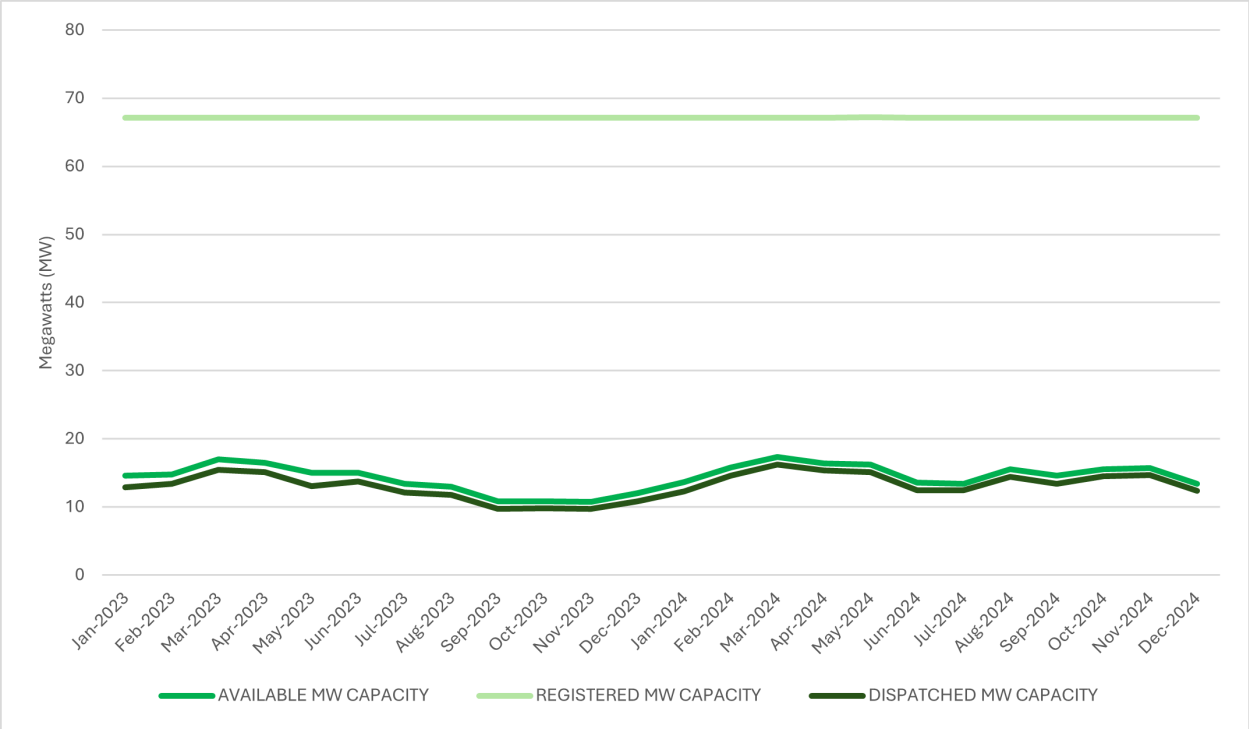


Figure 54: Performance of Solar Plants (Mindanao)

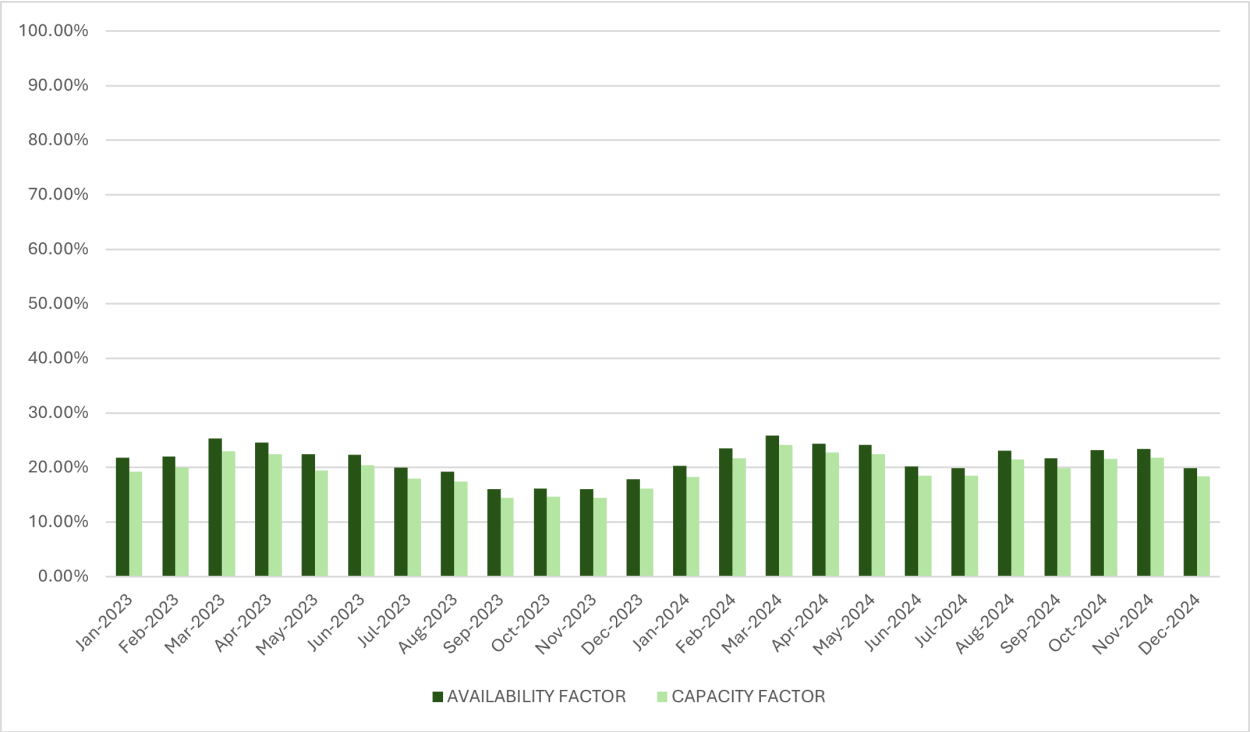


Figure 55: Availability and Capacity Factor of Solar Plants (Mindanao)

Unlike the other two regions, Mindanao did not exhibit any increase in the registered capacity of solar plants. It had the lowest solar registered capacity of 67 MW which has remained the same throughout 2023 to 2024. The average availability and capacity factors in 2024 were 22% and 21%, respectively, which were just slightly higher than the other two regions.

WIND PLANTS

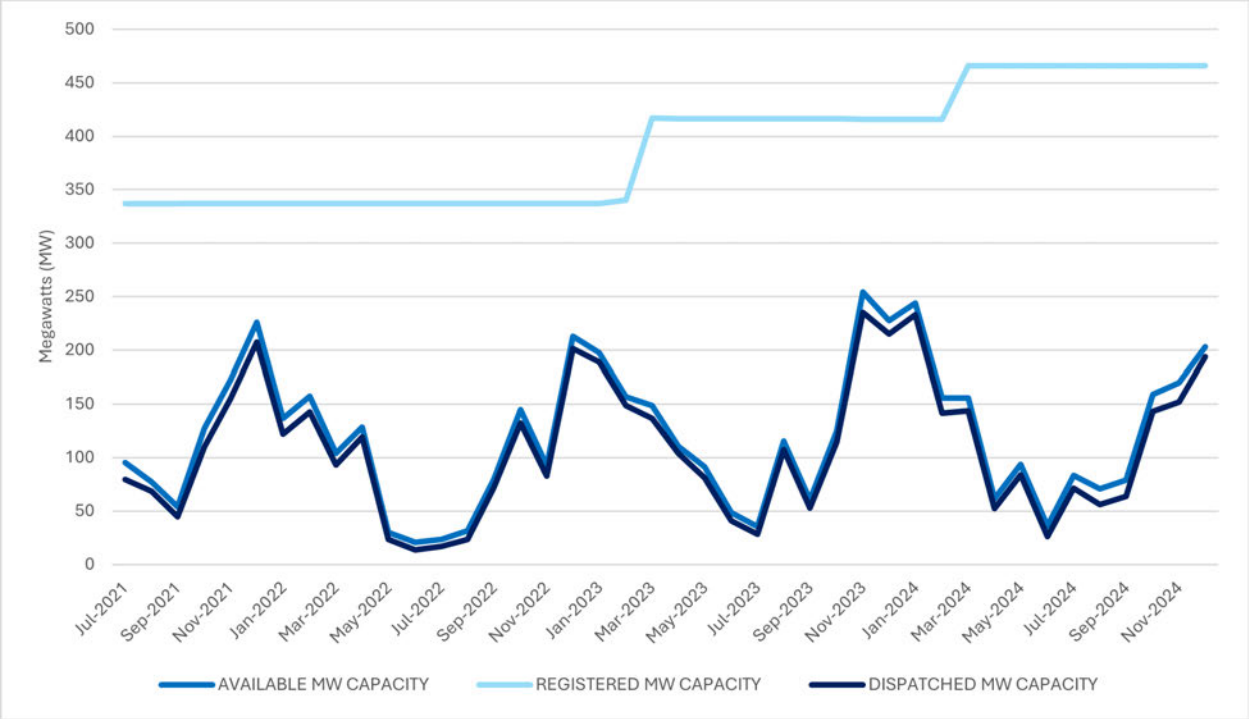


Figure 56: Performance of Wind Plants (Luzon)

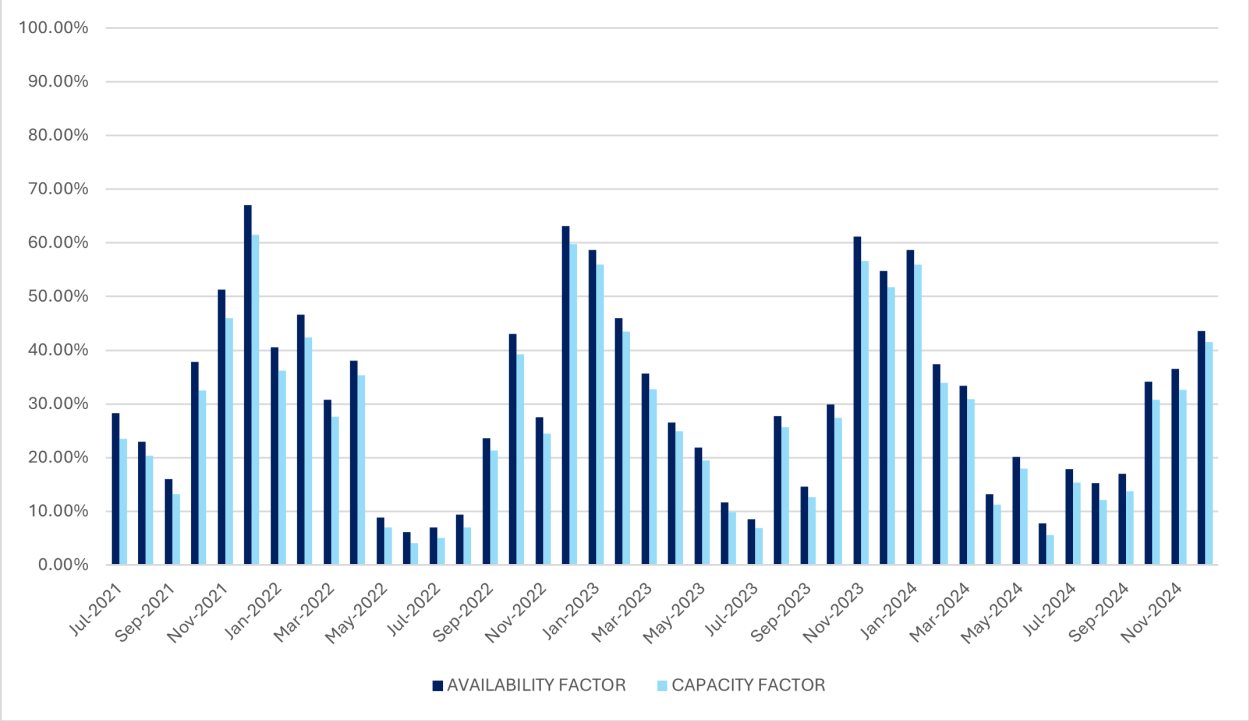


Figure 57: Availability and Capacity Factor of Wind Plants (Luzon)

In Luzon, there was an increase in wind plant capacity with the first increase occurring in early 2023 and another increase in early 2024. In 2024, the average availability and capacity factors were 28% and 25%, respectively. Although the average availability factor is low, it varied greatly throughout the year, with the availability factor reaching more than 50% during the months of November to March and reaching low values towards the middle of the year.

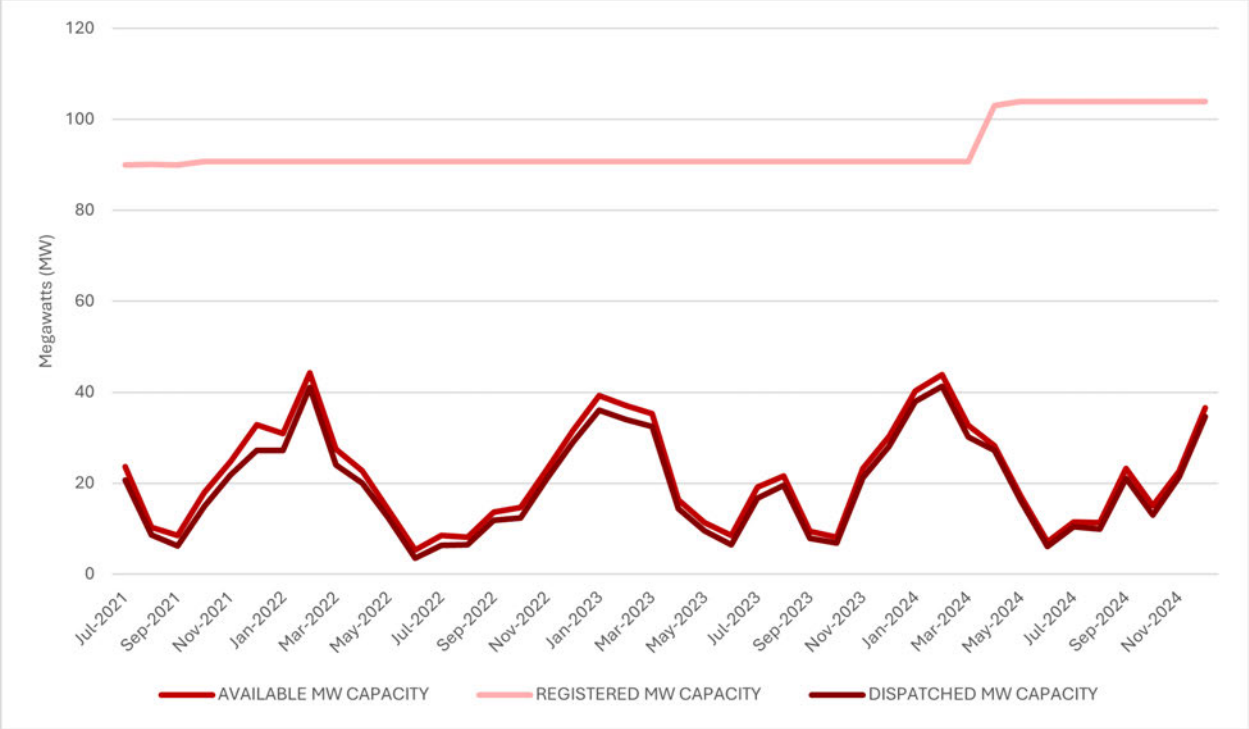


Figure 58: Performance of Wind Plants (Visayas)

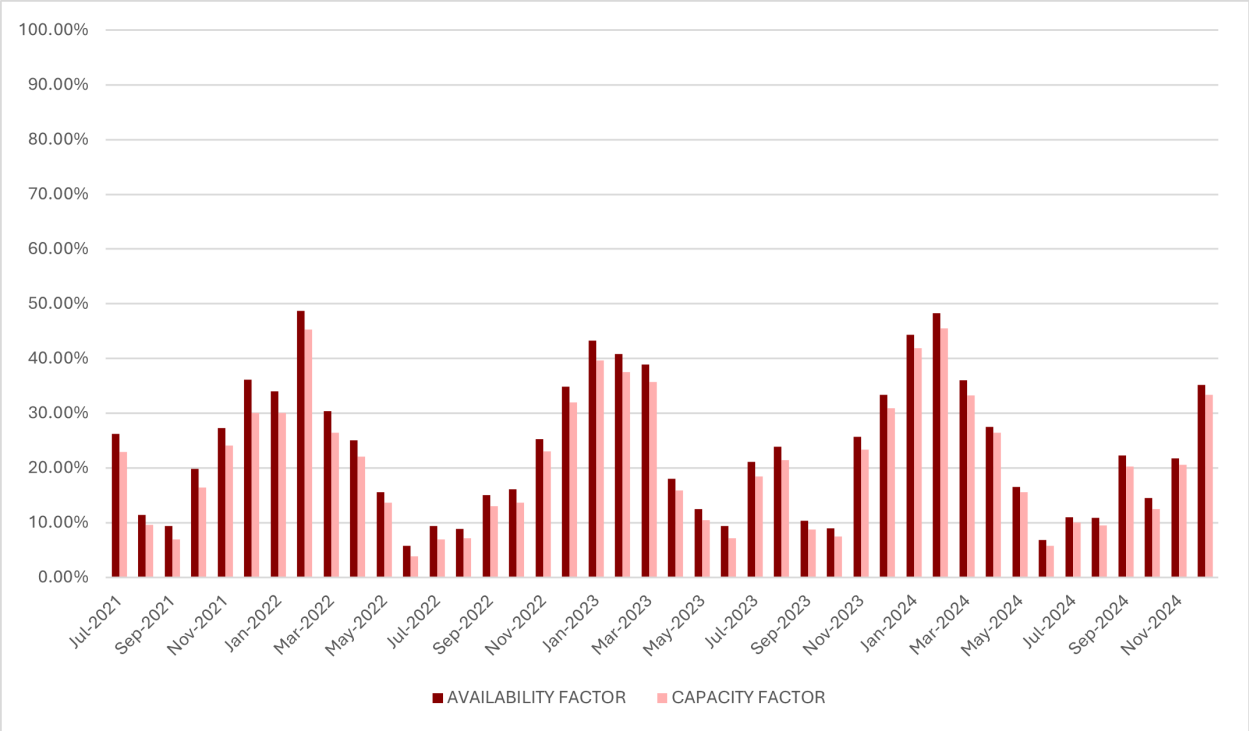


Figure 59: Availability and Capacity Factor of Wind Plants (Visayas)

In Visayas, the wind plants exhibited similar factors with those in Luzon, with an average availability and capacity factors of 25% and 23%, respectively, in 2024, which is just slightly lower than Luzon. The availability factors exhibited similar behaviors as well, peaking in the months of November to March and decreasing towards the middle of the year.

RUN-OF-RIVER HYDROELECTRIC PLANTS

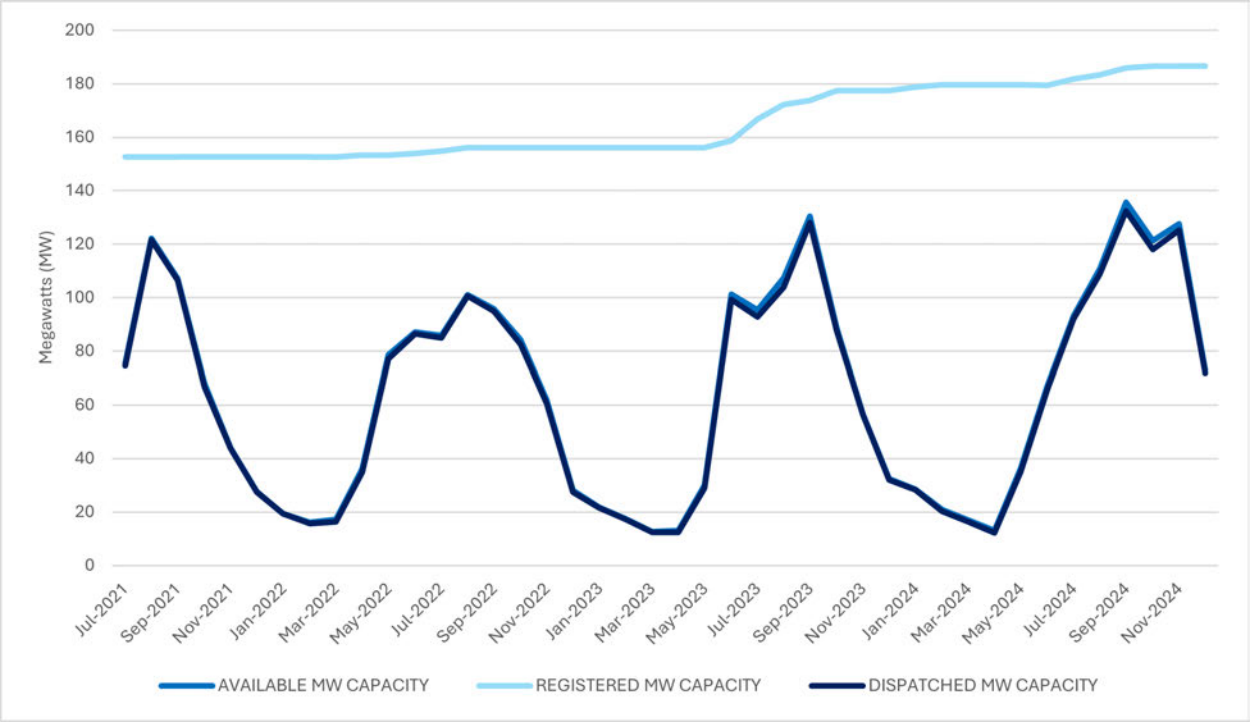


Figure 60: Performance of Run-of-River Hydroelectric Plants (Luzon)

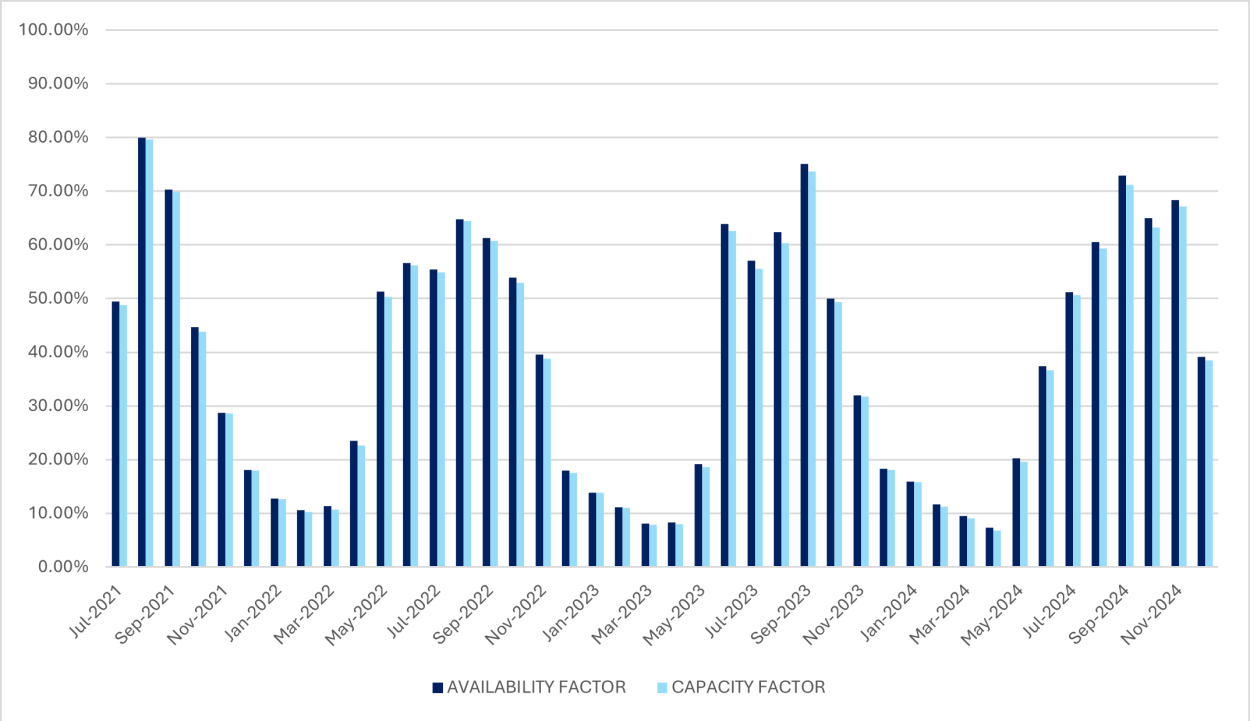


Figure 61: Availability and Capacity Factor of Run-of-River Hydroelectric Plants (Luzon)

The Run-of-River (ROR) hydro plants in Luzon exhibited a steady increase in capacity starting mid-2023. In 2024, their average availability and capacity factors were 38% and 37%, respectively. The availability factor is similar to that of hydroelectric plants, as both rely on water supply, which varies throughout the year. A key difference between the two is that the ROR plants are must-dispatch plants, meaning they are utilized as soon as supply is available. This explains the high-capacity factor which is nearly equal to the availability factor.

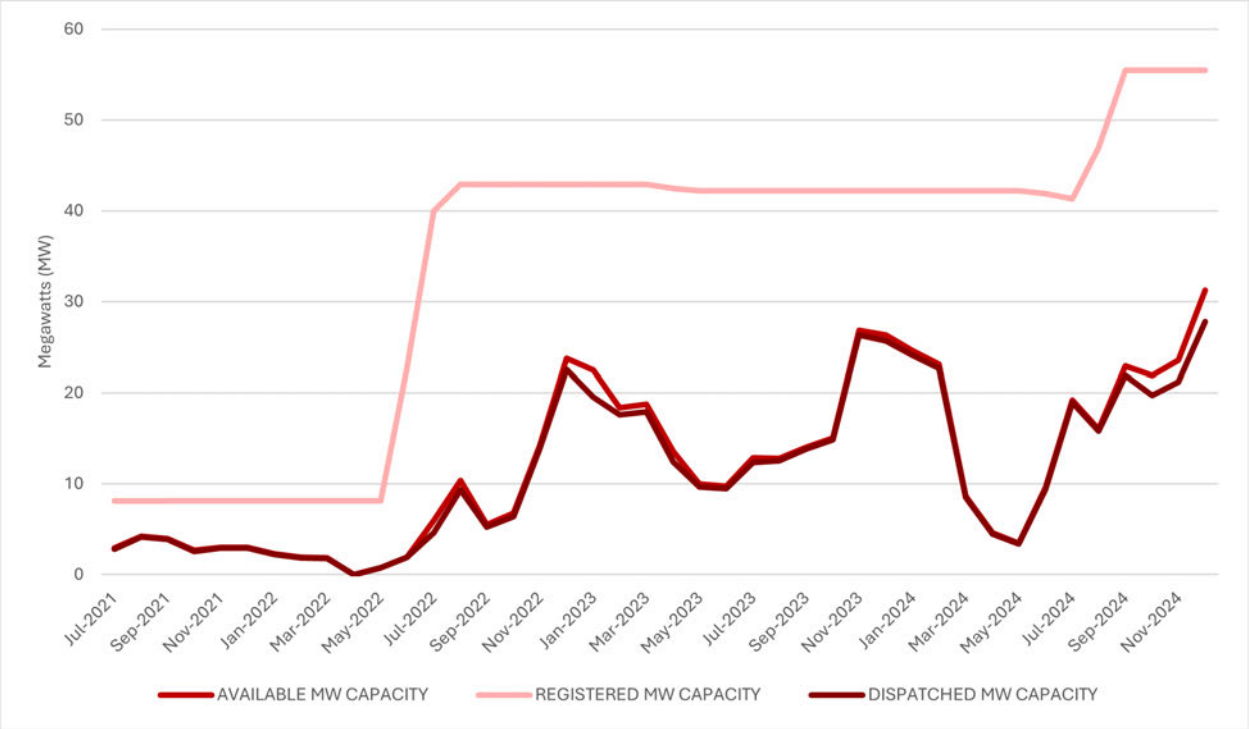


Figure 62: Performance of Run-of-River Hydroelectric Plants (Visayas)

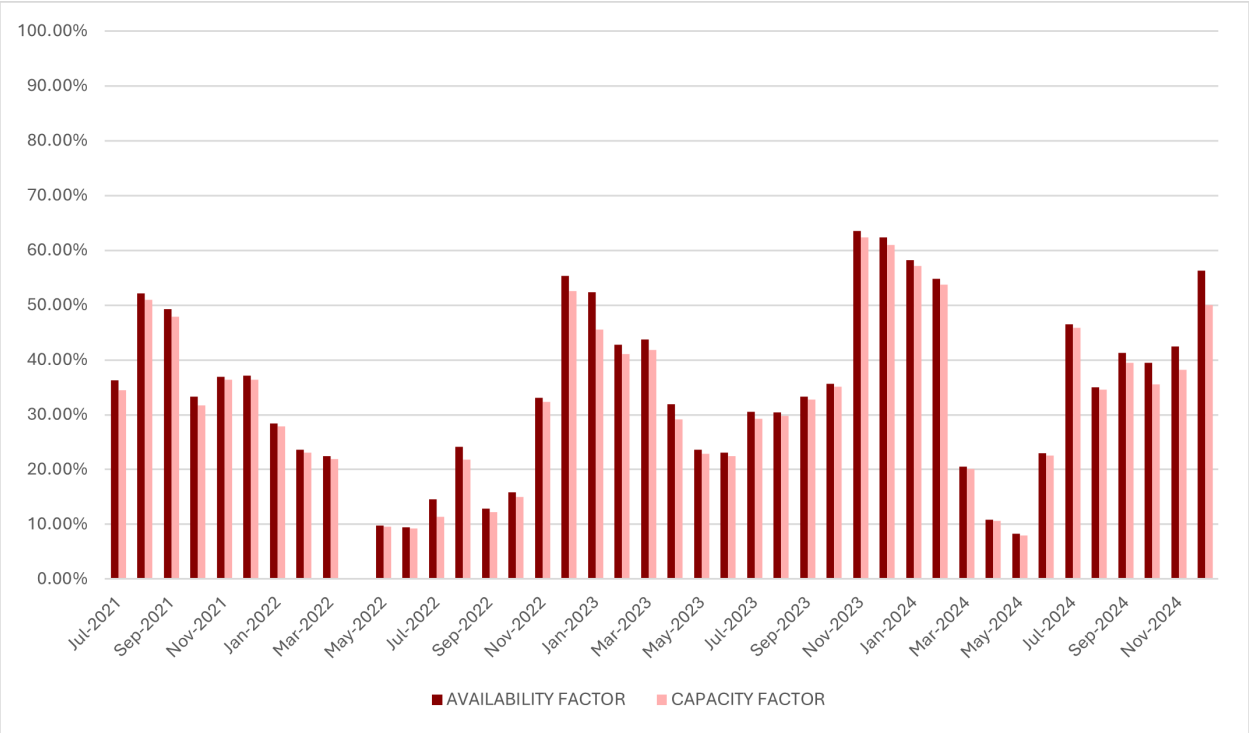


Figure 63: Availability and Capacity Factor of Run-of-River Hydroelectric Plants (Visayas)

Although the capacity of the ROR plants in Visayas wass lower compared to Luzon, it has been steadily increasing since 2022. In 2024, the availability and capacity factors of ROR plants in Visayas were on average 36% and 35%, respectively. It also exhibited the same peaks and drops in availability with the ROR plants in Luzon.

Figure 64: Performance of Run-of-River Hydroelectric Plants (Mindanao)

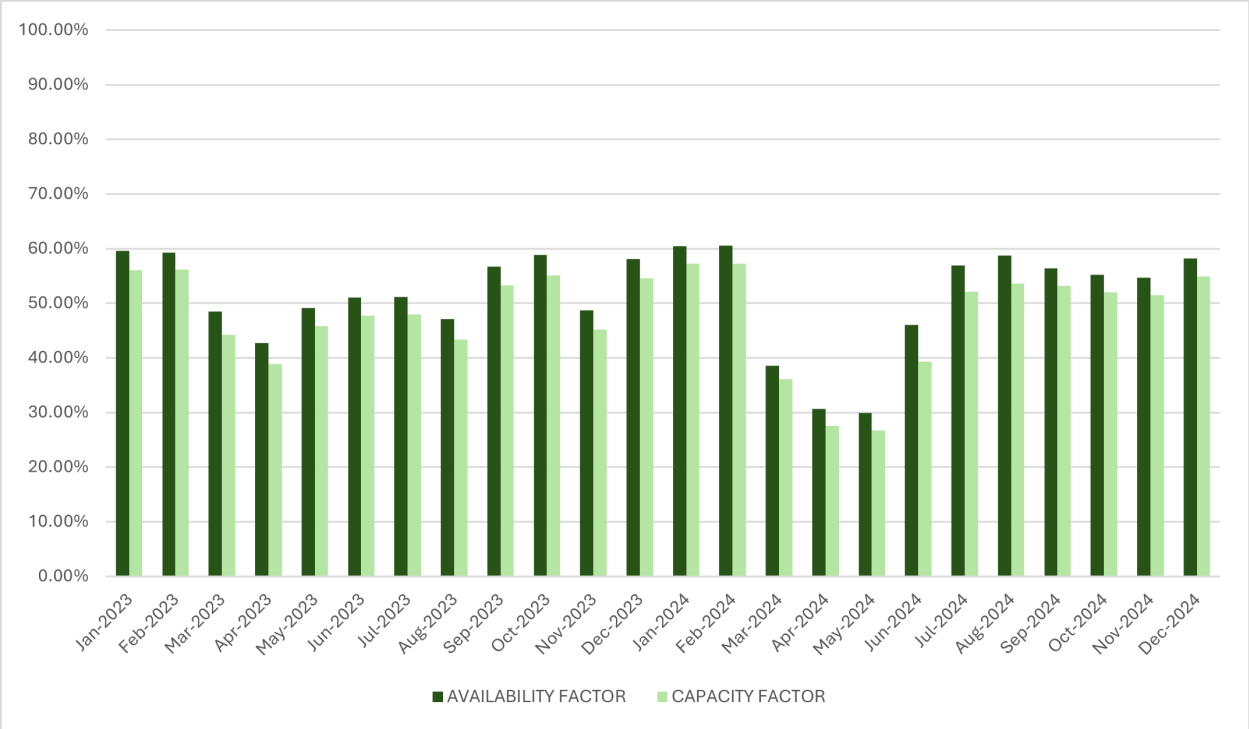


Figure 65: Availability and Capacity Factor of Run-of-River Hydroelectric Plants (Mindanao)

Mindanao exhibited the largest ROR hydro plant capacity, which has been steadily increasing since 2023 with the total registered capacity at 220 MW by the end of 2024. It also exhibited the largest availability and capacity factors among the three regions with an average of 51% and 47% in 2024, respectively.

2.3.4 BATTERY ENERGY STORAGE SYSTEMS (BESS)

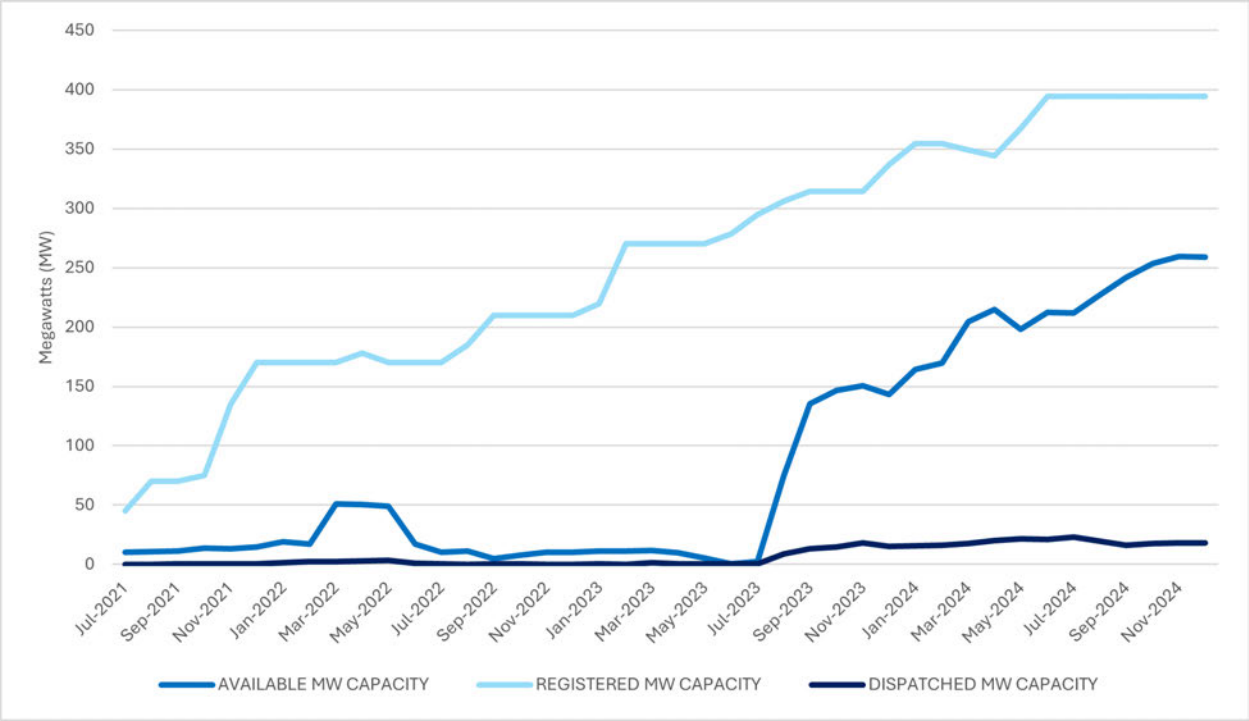


Figure 66: Performance of Battery Energy Storage Systems (Luzon)

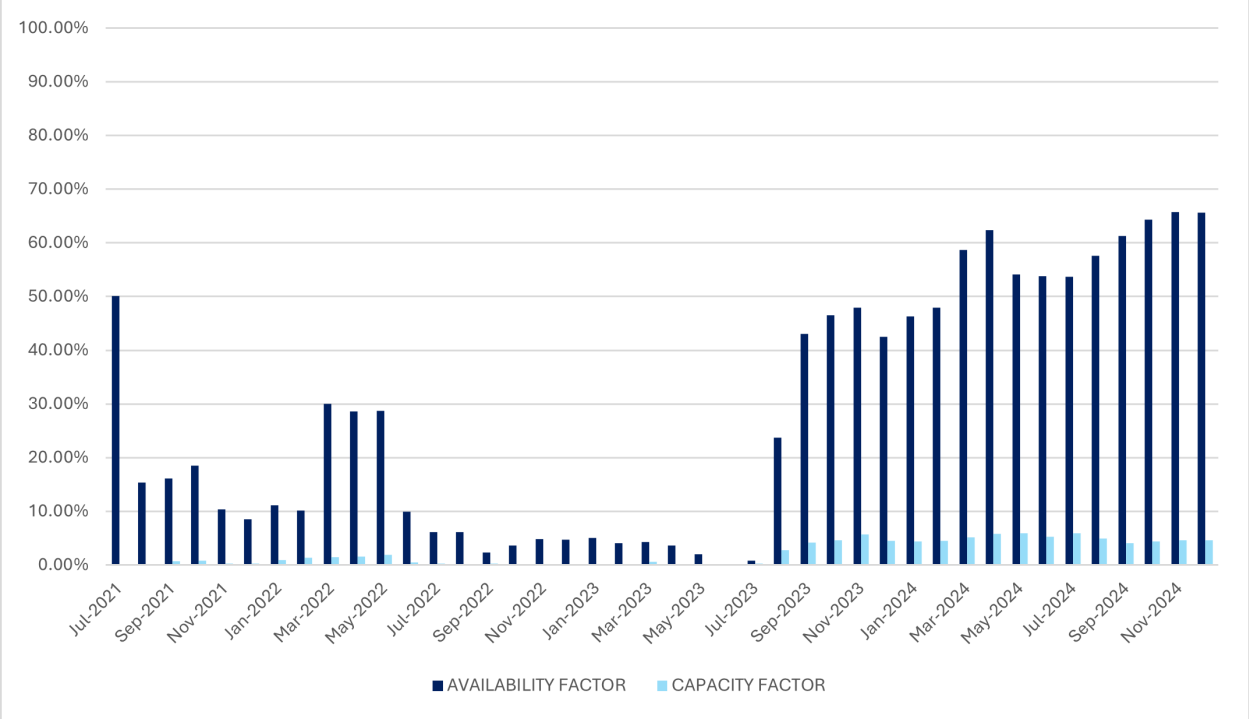


Figure 67: Availability and Capacity Factor of Battery Energy Storage Systems (Luzon)

As we transitioned to an even more diverse energy mix, the consideration of energy storage systems (ESS) was analyzed separately, alongside the availability and capacity factor trends observed in figures 66-67.

The battery energy storage system (BESS) capacity in Luzon has been steadily increasing since 2021, with a total capacity of 258 MW at the end of 2024. Despite this, its availability and capacity factor only started to rise during late 2023, with an average of 58% and 5%, respectively, in 2024.

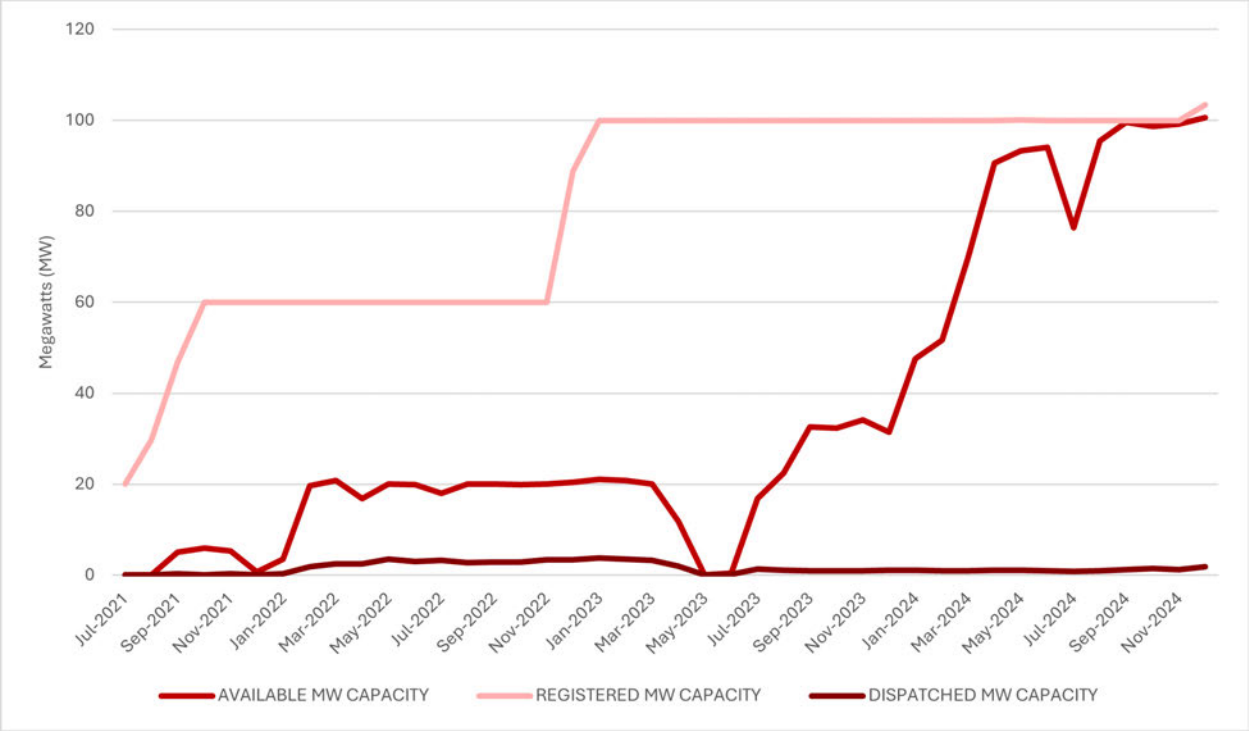


Figure 68: Performance of Battery Energy Storage Systems (Visayas)

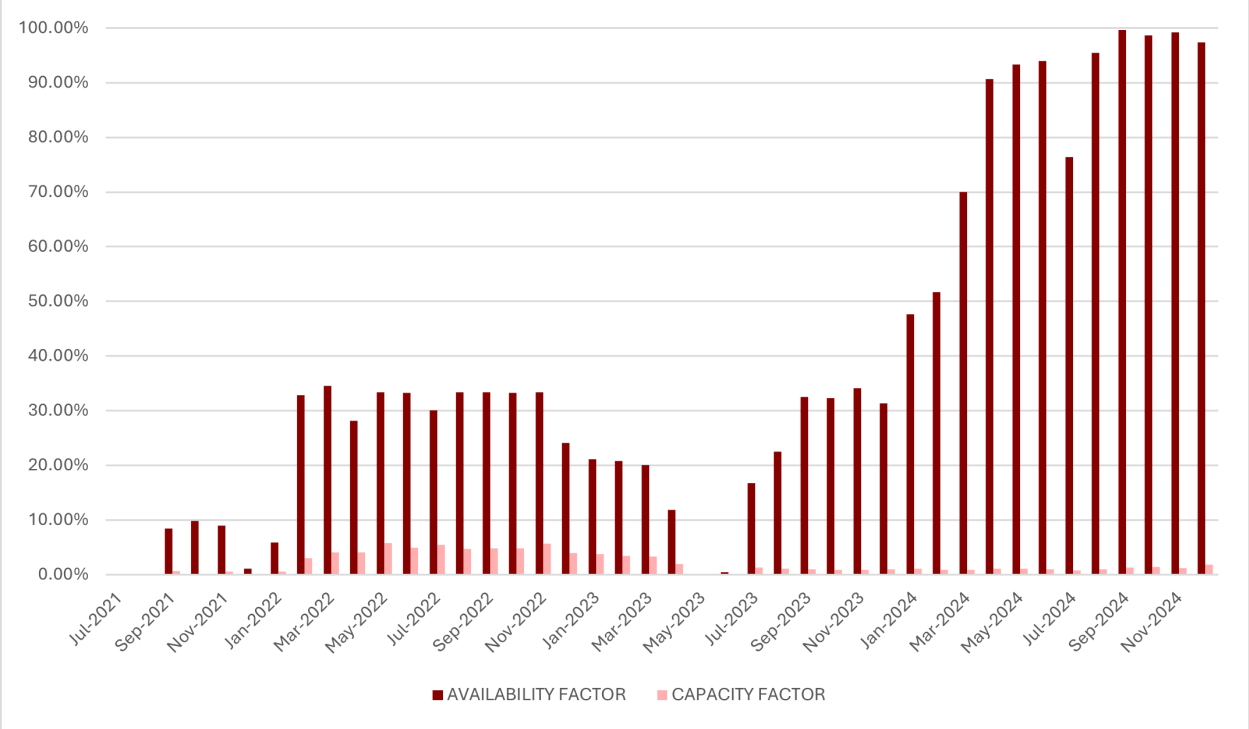


Figure 69: Availability and Capacity Factor of Battery Energy Storage Systems (Visayas)

Similarly, in Visayas and Mindanao, an increase in BESS capacity was observed from 2023 onwards. For Visayas, its registered capacities increased by 20 MW in 2021 and an additional 20 MW in 2023. While there are certain dips in its available capacity, the trend continued to increase. Its availability factor ranges from 50% to nearly 100% in 2024, with low capacity factors.

Figure 70: Performance of Battery Energy Storage Systems (Mindanao)

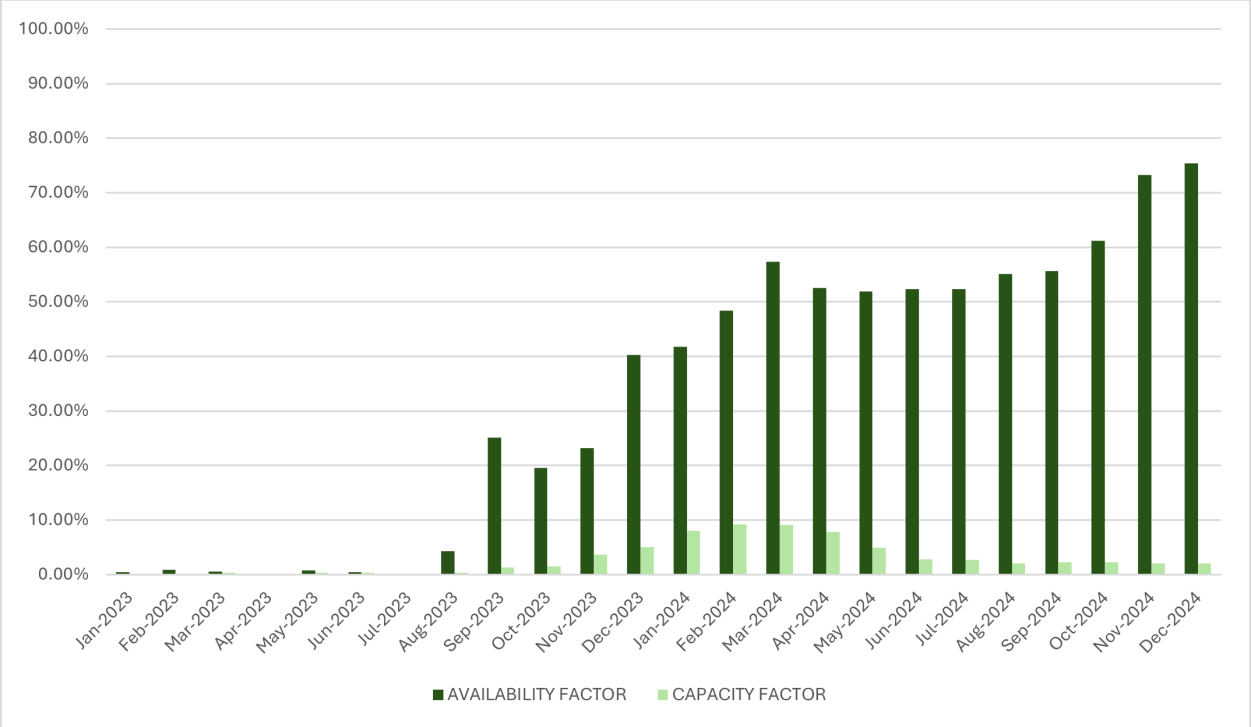


Figure 71: Availability and Capacity Factor of Battery Energy Storage Systems (Mindanao)

As for Mindanao, the availability factor ranges from 40% to almost 80% in 2024, with its available MW capacity increasing from September 2023 onwards, and maintaining at around 80 MW to 100 MW of registered capacity.

Daily Load Curve Breakdown by Power Source

A load curve represents the highlighting peak and off-peak consumption periods of electricity demand throughout the day. The shape of the load curve can be affected by some of the factors such as weather conditions, time of day, and seasonal trends. Figures 72-74 show three (3) scenarios, particularly: peak demand, low demand, and average daily demand, with a focus on how renewable energy generation, particularly solar, fluctuates based on sunlight availability and how other variable renewable energy sources (VREs), such as hydro and wind, are influenced by seasonal changes, impacting their generation output throughout the year.

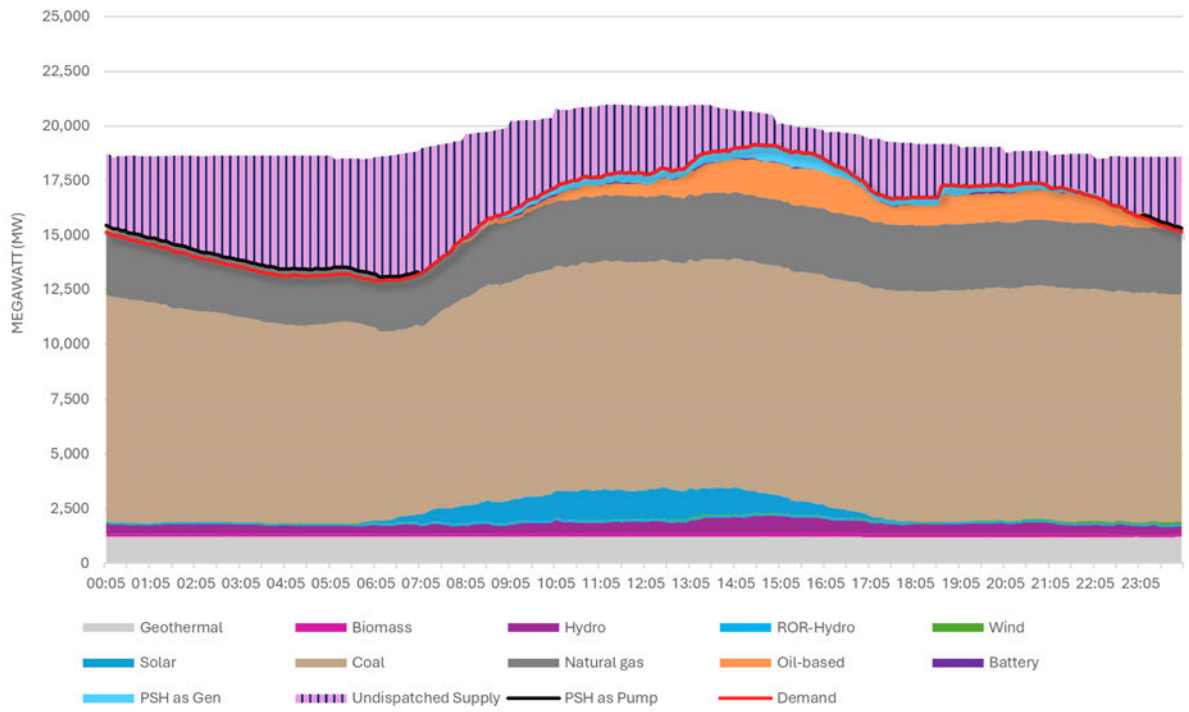


Figure 72: System-wide Daily Load Curve with Highest Demand

On 13 May 2024, at 1430H, the system (Philippines) recorded a peak demand of 19,246 MW. Since this occurred during the summer months, solar generation reached up to 1,374 MW, making it a significant contributor to midday supply. El Niño significantly affected the generation, causing run-of-river (ROR) and hydro output to be much lower than in other months due to reduced water availability.

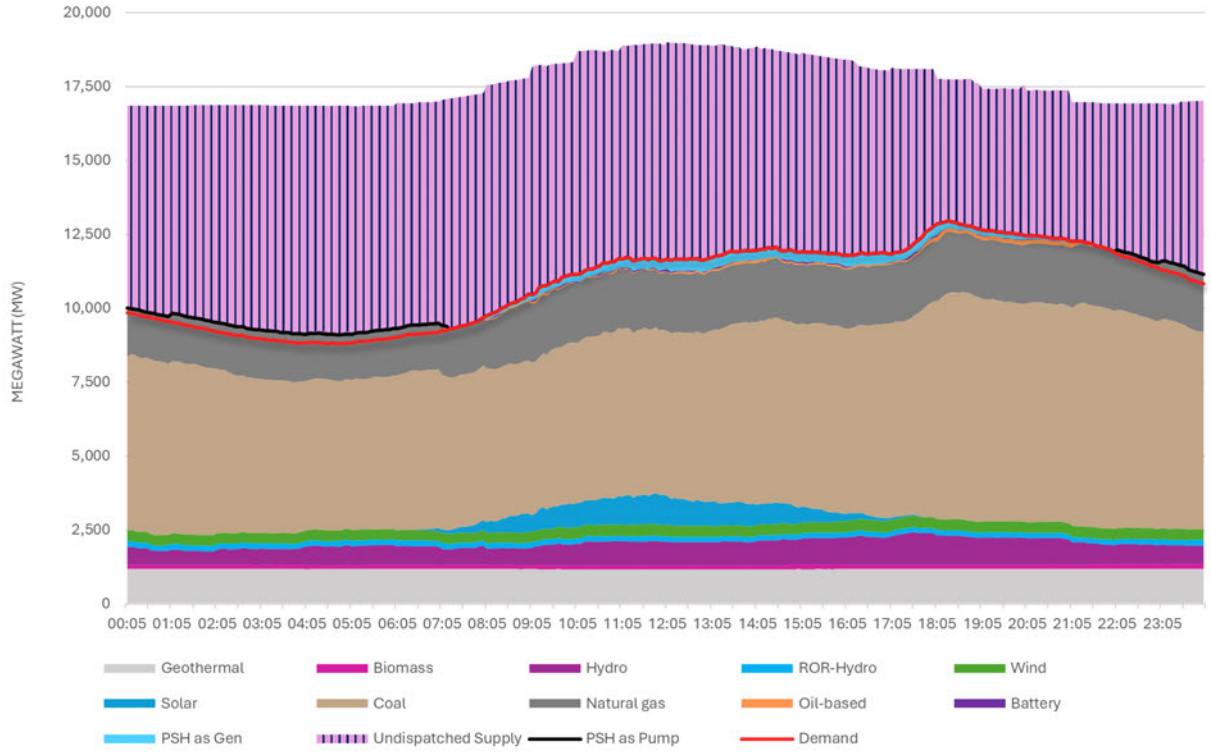


Figure 73: System-wide Daily Load Curve with Lowest Demand

Meanwhile, on 26 December 2024, at 0455H, the Philippine power system recorded its lowest demand of 8,804 MW, driven by reduced economic activity and cooler temperatures during the holiday season. Wind generation peaked at 389 MW, providing stable supply, while solar output was lower during the summer season. Hydropower generation was higher compared to the summer months due to increased water availability from the rainy season.

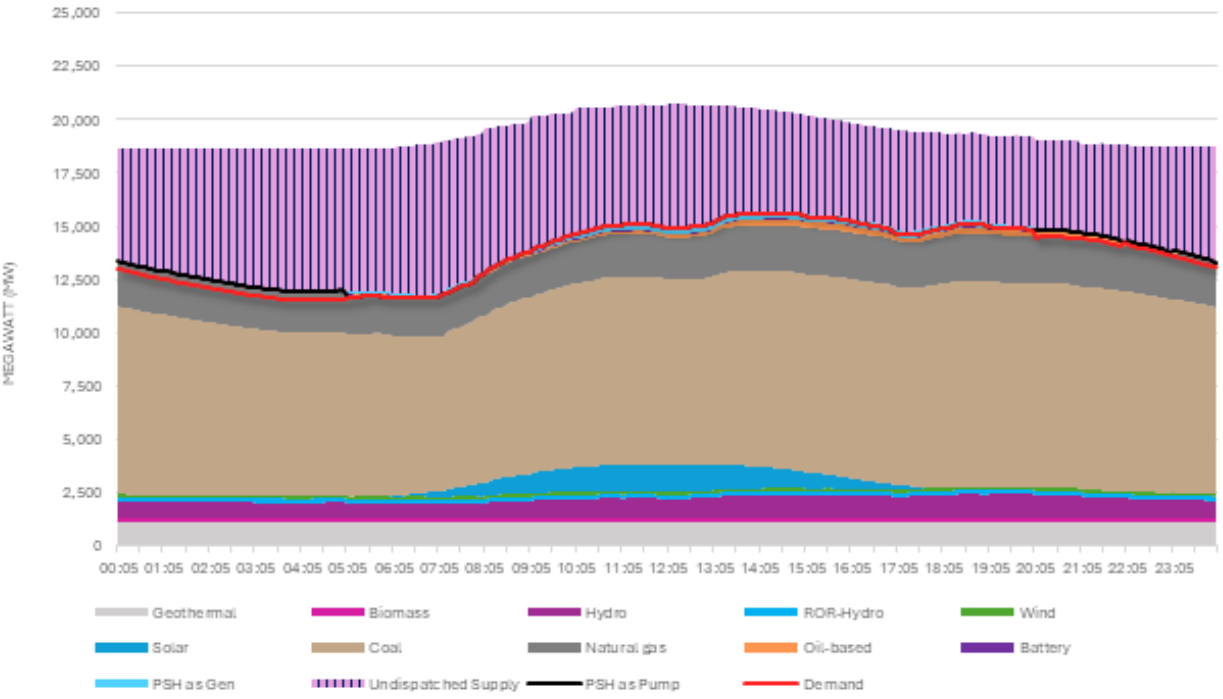


Figure 74: System-wide Daily Average Load Curve

On an annual average, the system-wide demand stood at 13,783 MW. Renewable energy sources, including geothermal, biomass, hydro, wind, and solar, accounted for approximately more than 20% of dispatched energy, contributing to the grid's sustainability. Solar generation followed the characteristic "duck curve," peaking at midday before gradually declining in the evening. Meanwhile, hydropower output was notably higher outside the summer months, benefiting from increased water availability during the rainy season.

Across all scenarios, pumped-storage hydropower (PSH) played a vital role in energy management by storing excess power during off-peak hours and generating electricity during peak demand periods, thereby enhancing grid flexibility. Additionally, un-dispatched available supply functioned as a supply margin and reserve capacity, ensuring the system's reliability and security by providing a buffer against unexpected fluctuations in both demand and generation.

In conclusion, electricity demand fluctuated throughout the year, influenced by seasonal patterns, daily consumption habits, and economic activity. The peak demand occurred during the summer months, while the lowest demand was recorded during the holiday season due to reduced business operations. Renewable energy generation varied with resource availability, with solar peaking at midday, wind generation varying with weather conditions, and hydropower production declining during dry months but increases in the rainy season. Pumped-storage hydropower currently operates by storing excess energy during low-demand hours through pumping and supplying power during peak periods. Throughout the year, un-dispatched available supply maintains a supply margin, ensuring system reliability and grid stability.

2.4 TRANSMISSION PERFORMANCE

Note: These data were sourced from the market results published daily in IEMOP's market information website. For context, "Frequently Congested" is used to refer to transmission equipment that are constrained for at least 1% of the time cumulative across the year (8,760 hours or 365 days). This list only includes transmission corridors that manifested congestion.

Tables 15 to 17 provide a summary of transmission corridors performance, highlighting those that have consistently experienced frequent congestion from January 2024 to December 2024. Transmission congestion refers to a condition where the megawatt (MW) transfer capacity of specific equipment, or a group of interconnected equipment, constrains the transport of lower-cost electricity from one region to another, thereby impacting system efficiency and increasing operational costs.

The categorizations under "Congestion Type" distinguish congestion from "Base Case", "Contingency Only", and "Both". Equipment categorized with "Base Case" considers normal congestion or occurrence that is not due to an N-1 contingency implementation—this means that the equipment used is not included in the contingency list. On the other hand, "Contingency Only" considers an N-1 contingency or the congestions are caused by equipment that are in the contingency list. Meanwhile, "Both" simply refers to congestion that occurs both through equipment placed in the contingency list or is caused by naturally occurring phenomena which could be high demands, equipment outages, and other typical congestion-causing instances.

CONGESTION TYPE	EQUIPMENT NAME	FREQUENCY
BOTH	BAUANG-BPPC 230KV LINE 1	1.77311%
BOTH	MEXICO-HERMOSA 230KV LINE 2	1.05874%
BOTH	MEXICO-HERMOSA 230KV LINE 1	0.74283%
CONTINGENCY ONLY	BAUANG-LA TRINIDAD 230KV LINE 1	0.45253%
CONTINGENCY ONLY	BAUANG-LA TRINIDAD 230KV LINE 2	0.40225%
CONTINGENCY ONLY	HERMOSA-MALOLOS 230KV LINE 1	0.23812%
CONTINGENCY ONLY	STA. ROSA-CALACA 230KV LINE 1	0.13661%
BOTH	HERMOSA-DUHAT 230KV LINE 1	0.09866%
CONTINGENCY ONLY	SAN RAFAEL-SAN JOSE 230KV LINE 1	0.04933%
BOTH	QUEZON-DONA IMELDA 230KV LINE 1	0.04459%
BASE CASE	TAYABAS-MAKBAN-A 230KV LINE 2	0.03320%
CONTINGENCY ONLY	AMADEO-CALACA 230KV LINE 1	0.02846%
CONTINGENCY ONLY	AMADEO-CALACA 230KV LINE 2	0.00664%
CONTINGENCY ONLY	DASMARINAS-AMADEO 230KV LINE 1	0.00190%
BASE CASE	BAYOMBONG-AMBUKLAO 230KV LINE 1	0.00095%
CONTINGENCY ONLY	BINAN-CALACA 230KV LINE 1	0.00095%

Table 15: Transmission Performance (Luzon)

CONGESTION TYPE	EQUIPMENT NAME	FREQUENCY
BASE CASE	MAASIN-UBAY 138KV LINE 1	12.48862%
BOTH	SAMBOAN-AMLAN 138KV LINE 1	5.86198%
CONTINGENCY ONLY	BAROTAC-DINGLE 138KV LINE 2	3.09939%
CONTINGENCY ONLY	BAROTAC-DINGLE 138KV LINE 1	2.57571%
BASE CASE	CEBU-MANDAUE 138KV LINE 2	1.11472%
CONTINGENCY ONLY	SAMBOAN-AMLAN 138KV LINE 2	0.52653%
CONTINGENCY ONLY	BACOLOD-BAROTAC 138KV LINE 1	0.05218%
BASE CASE	DAAN BANTAYAN-TABANGO 230KV LINE 1	0.02751%
BASE CASE	DAAN BANTAYAN-TABANGO 230KV LINE 2	0.01518%
BASE CASE	CEBU-MANDAUE 138KV LINE 1	0.00854%
BASE CASE	COLON-KSPC 138KV LINE 2	0.00285%
BASE CASE	BACOLOD-CADIZ 138KV LINE 1	0.00095%

Table 16: Transmission Performance (Visayas)

CONGESTION TYPE	EQUIPMENT NAME	FREQUENCY
BASE CASE	VILLANUEVA-JASAAN 138KV LINE 1	0.024666%
BASE CASE	VILLANUEVA-JASAAN 138KV LINE 2	0.005692%
BASE CASE	JASAAN-BUTUAN 138KV LINE 1	0.001897%
BASE CASE	JASAAN-NASIPIT 138KV LINE 1	0.000949%
BASE CASE	BISLIG-NABUNTURAN 138KV LINE 1	0.000949%
BASE CASE	DAVAO-BUNAWAN 138KV LINE 1	0.000949%

Table 17: Transmission Performance (Mindanao)

Prior to the third and fourth quarter transmission developments in 2024, the Hermosa-Bataan Corridor and Bauang-BPPC Line remain to be the most congested transmission backbones in Luzon, whereas the Leyte-Bohol 138kV Submarine Cable was most frequently congested in Visayas.

In Luzon, the 500kV Balsik-San Jose-Tayabas transmission lines were energized in November, consequently alleviating the congestion along the Hermosa-Bataan Corridor. Additionally, congestion is still frequently found in the Bauang-BPPC 230kV transmission line when there are maintenance activities occurring in the area.

Meanwhile, the congestion in Visayas, particularly along the Leyte-Bohol Interconnection, decreased following the completion of the Cebu-Bohol 230kV transmission lines. Additionally, congestion in the Cebu-Negros 138kV transmission lines was likewise reduced after the completion of Phase 3 of the Cebu-Negros-Panay Project. Furthermore, the capacity of the Barotac-Dingle 138kV transmission lines increased. Prior to this, the Barotac-Dingle circuit often experienced congestion due to the imposition of the N-1 contingency on both lines, a safeguard mechanism to prevent strain on the infrastructure. Moreover, Cebu-Mandaue 138kV Line 2 experienced congestion due to the tripping and subsequent outage of Cebu-Mandaue 138kV Line 1, resulting in high prices in the billing period of May 2024.

The reduction in congestion, and consequently the congestion cost in each region, substantiates the effect on market prices of energy grid improvements. This underscores the benefit of a reliable transmission system in ensuring flexible grid operations and reasonably priced electricity.

3. ASEAN COMPARATIVE ANALYSIS OF ENERGY INDUSTRY

This segment covers the overall energy industry metrics of Southeast Asian countries which shall primarily comprise of energy mix, capacity mix, electricity generation, and relevant energy advancements and market developments that these countries have progressed in. This comparative analysis shall provide a general insight on the current state of the Philippines and its neighboring countries with regard to their involvement in the electric power industry. Additionally, this shall provide a concise assessment of the Philippines' disposition in terms of energy transition and renewable energy advocation, as compared to other ASEAN and global counterparts, to grasp an international perspective.

CODE	COUNTRY	CAPACITY (GW)[1]	ELECTRICITY GENERATION (TWh)[2]	POPULATION[3]
BRN	BRUNEI	1.22*	4.46	458,949
KHM	CAMBODIA	4.26*	15.92	17,423,880
IDN	INDONESIA	92.74	350.61	281,190,067
LAO	LAOS	11.70*	57.00	7,664,993
MYS	MALAYSIA	41.39	187.79	35,126,298
MMR	MYANMAR	6.74	18.15	54,133,798
PHL	PHILIPPINES	27.63	118.26	114,891,199
SGP	SINGAPORE	11.90	57.33	5,789,090
THA	THAILAND	56.31	190.49	71,702,435
VNM	VIETNAM	81.38	265.77	100,352,192

Table 18: Industry Demographics of ASEAN Countries (2022-2023)

Table 18 was obtained from Our World in Data, which primarily focuses its datasets from Ember Energy and Energy Institute – Statistical Review of World Energy, both of which have their own means of processing and collating data as stipulated in their respective methodologies and may include standardization of data to its utmost simplified understanding.

Upon initial analysis of the capacity, electricity generation, and population of ASEAN countries, Indonesia shows to be the most populated ASEAN country, while the Philippines stands next in line and ranked 15th globally. Similarly, with regard to electricity generation, Indonesia also takes the lead with approximately 350.61 TWh in 2023 while the Philippines ranked 5th among the ASEAN countries and 34th globally,3F mainly due to its relatively low 2023 capacity among its other Southeast Asian counterparts.

[1] Ember Energy & World Bank Group, Yearly Electricity Data
[2] Our World in Data, Electricity Generation & CEIC data, Electricity Generation
[3] Worldometers, Population

To provide a different insight on the matter, the Department of Energy's 2023 Power Statistics showed that the total electricity generation, in consideration of all available technologies in the Philippines, reached at about 118,004 GWh, which was the same value for the country's electricity consumption and gross power generation. With regard to the computed dependable and installed capacity, the value reached around 24,654 MW and 28,291 MW, respectively.

To distinguish both capacities, the dependable capacity refers to the maximum capacity when modified for ambient limitations for a specified period while the installed capacity refers to the full-load continuous gross capacity of a unit under specified conditions.4F The variance in this value as compared to the demographics in the previous table may be due to the consideration of off-grid capacities.

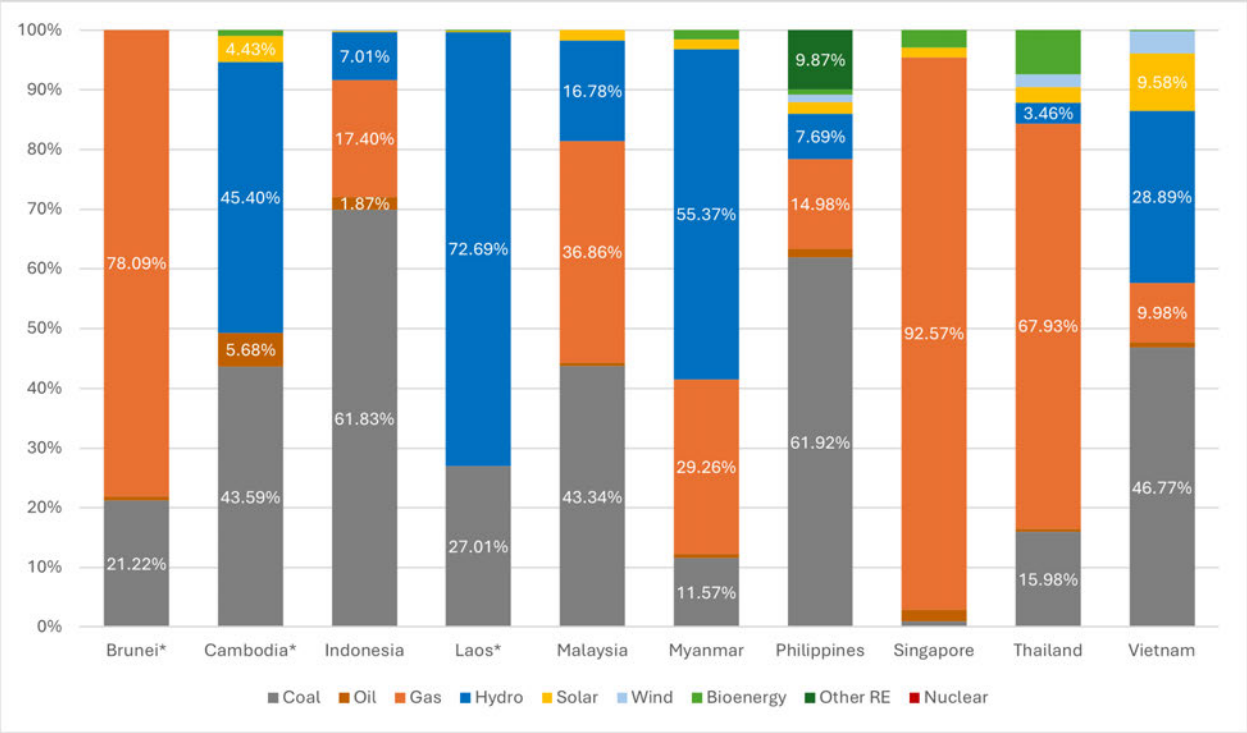


Figure 75: ASEAN Electricity Generation Mix per Country (%, 2022-2023)[6, 7]

Being one of the most diversified countries in terms of energy sourcing among the ASEAN members, the Philippines notably incorporates various technologies into its energy mix ranging from coal-fired, oil-based, natural gas, hydroelectric, solar, wind, bioenergy, and even energy storage systems. This variation generally targets the relevant issues on high energy prices, contributes to new market developments and systems towards its effective implementation and long-term functionalization, and ultimately contributes to the sustainable development goals on energy affordability and sustainability. This exhibition of a wide potential for various energy sources showcases the Philippines' commitments in providing diverse means towards meeting the country's energy requirements.

Among these ASEAN countries, Singapore was identified with the least amount of electricity generated from coal and with the most generation coming from natural gas technologies. Singapore, Thailand, and Brunei heavily rely on gas as their primary source of energy; Indonesia, Malaysia, Philippines, and Vietnam immensely rely on coal, and Cambodia, Laos, and Myanmar have the highest potential for hydroelectric energies. While the Philippines possesses a high capacity for coal-fired technologies duly labelled as a net coal importer, the potential of hydroelectric generation is highly observable from Laos.

[4] World Population Review, Electricity Production
[5] Department of Energy, 2023 Power Statistics
[6] Our World in Data, Electricity Share by Source
[7] * Earliest possible data for that country, 2022

CODE	COUNTRY	COAL	GAS	OIL	HYDRO	SOLAR	WIND	BIOENERGY	OTHER RE	NUCLEAR
BRN	BRUNEI*	1.22	4.49	0.04	0.00	0.00	0.00	0.00	0.00	0.00
KHM	CAMBODIA*	3.84	0.00	0.50	4.00	0.39	0.00	0.08	0.00	0.00
IDN	INDONESIA	**216.78**	62.04	**6.58**	24.59	0.71	0.48	**22.48**	**16.94**	0.00
LAO	LAOS*	12.41	0.00	0.00	33.40	0.06	0.00	0.08	0.00	0.00
MYS	MALAYSIA	81.40	69.23	1.19	31.51	3.24	0.00	1.23	0.00	0.00
MMR	MYANMAR	2.23	6.06	0.12	9.37	0.23	0.00	0.27	0.00	0.00
PHL	PHILIPPINES	73.23	17.71	1.71	9.08	2.23	1.51	1.11	11.67	0.00
SGP	SINGAPORE	0.57	53.06	1.09	0.00	0.94	0.00	1.66	0.00	0.00
THA	THAILAND	30.43	**129.40**	0.89	6.59	5.42	3.61	14.15	0.00	0.00
VNM	VIETNAM	129.58	26.32	1.72	**80.90**	**25.70**	**11.37**	0.85	0.00	0.00

Table 19: Electricity Generation by Source of ASEAN Countries (TWh, 2022-2023)[8]

The dataset shown in Table 19, which was duly sourced from Ember Energy, obtains and collates electricity generation through multi-country datasets with the incorporation of national sources, and considering thermal, solar, and distributed-solar photovoltaic generation. Additionally, some hydroelectric energy sources exclude pumped-hydro generation due to unavailability. The classification of "Other RE" includes geothermal, tidal, and wave generation. Lastly, the category for "Oil" includes oil-based sources, petroleum products, manufactured gases, and wastes, as applicable. The difference between the per-technology tabulation of electricity generation in Table 19 vis-à-vis the per-country tabulation of electricity generation in Table 18 may vary in its totality due to parameters considered. This difference helps us better assess and understand various considerations and informational sources thoroughly throughout the course of this comparative analysis.

Indonesia was able to produce around 216.78 TWh from its coal-fired resources, identified as the highest among the ASEAN countries, which comprises about 61.83% of its energy mix. Other than coal, Indonesia also takes precedence for electricity generation of oil-based, bioenergy, and other renewable energy resources. On the other hand, Vietnam also claims rank for the highest production of energy sourced from hydroelectricity, solar, and wind technologies, notably various renewable energies reaching at about 80.90 TWh, 25.70 TWh, and 11.37 TWh, respectively.

Another notable country for its electricity production is Thailand, with about 129.40 TWh sourced from natural gas resources. Although there are already initial plans and preparatory advancements toward nuclear energy developments as of date, taking into consideration the Philippines and Indonesia's efforts,8F there were no nuclear-sourced energy produced during 2022-2023 among the ASEAN countries.

[8] EMBER Energy & World Bank Group, Yearly Electricity Data

[9] ASEAN Centre for Energy, ASEAN Energy Booklet Volume 2: Nuclear Energy Development in ASEAN

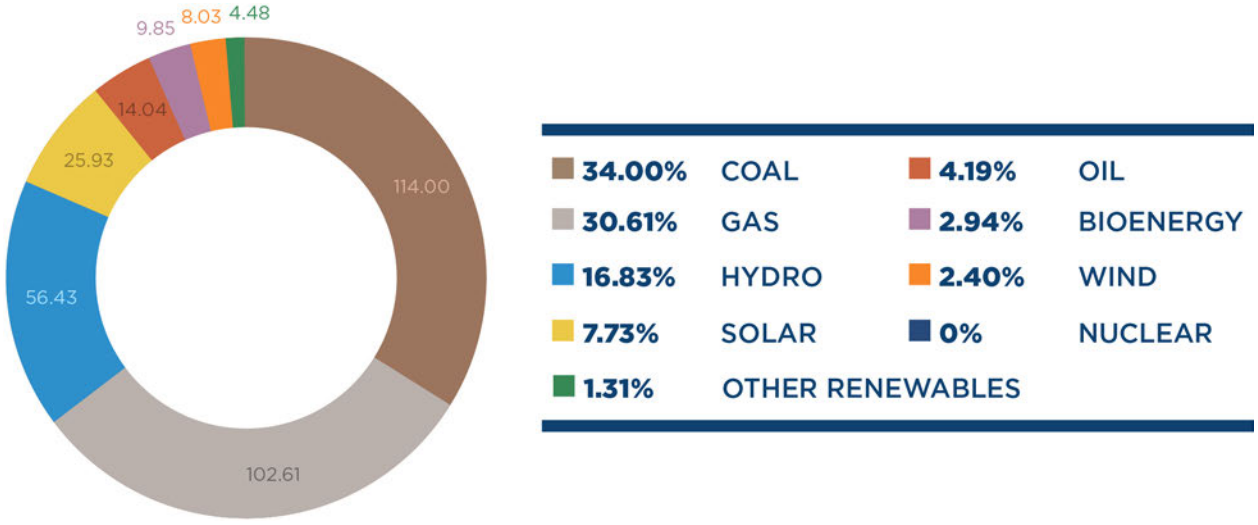


Figure 76: ASEAN Installed Power Capacity by Source (GW, 2023)[10]

In the ASEAN perspective, the electricity landscape of the entire Southeast Asian countries, primarily considering its respective installed power capacities, the ASEAN is largely dominated with the potential for coal-fired and natural gas technologies with approximately 34.00% and 30.61% in the ASEAN energy mix, respectively. With the addition of oil-based technologies incorporated in the mix, the non-renewable energy capacity totals to around 230.65 GW of installed power capacity, which is around 68.80% from the mix. This would mean that the ASEAN member states collectively possess approximately 104.62 GW of installed capacity or at about 31.20% of the mix for renewable energy resources, all the while having the highest potential for renewable energies. This means that the economic growth of the ASEAN region is robust in nature yet remains immensely reliant on fossil fuels which constitute about 80% of its primary energy consumption.[11]

Noteworthy is the prominent contribution of hydroelectric energies to the mix, dominating all RE technologies which substantiate at about 56.43 GW on capacity or at around 16.83% of the mix, which is significantly higher than the previous year. In its totality, the ASEAN installed power capacity reaches about 335.27 GW which is evidently higher than that of the previously recorded 2022 installed capacity of 310 GW, around 8.15% increase.

Based on the Electricity Landscape in ASEAN as reported in Ember's "ASEAN's Clean Power Pathways: 2024 Insights", the ASEAN member states' demand collectively increased by 3.6% in the year 2023 with which demand was met through fossil fuels.[12] While the non-renewable energies nearly maintained percentages as compared to the previous year, there were still observable increases of carbon emissions at around 6.6%. Although, there were observably higher surges in peak demand during daylight hours which directly provided the opportunity for more solar investments supposedly for 2023.

[10] EMBER Energy & World Bank Group, Yearly Electricity Data

[11] Enerdata, Energy Connectivity in ASEAN, Power Grids and Market Integration as a Milestone for Energy Security and Transition

[12] Ember Energy, ASEAN's Clean Power Pathways: 2024 Insights

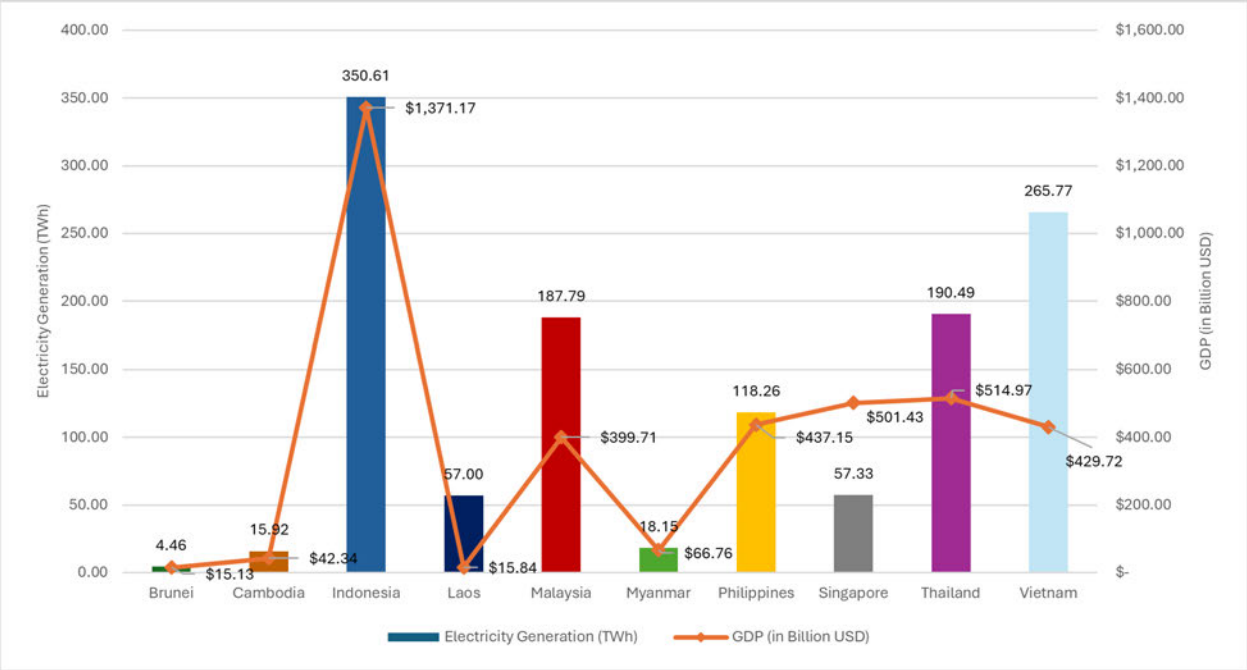


Figure 77. Electricity Generation vis-à-vis GDP of ASEAN Countries (2023)[13]

The gross domestic product (GDP) measures the monetary value of final goods and services produced in a certain country under a specific period.[14] Historically, it has been identified that a country's economic activity and growth experiences significant association from the trend of electricity use, energy production, and even population growth. The Department of Energy (DOE), through their 2020 Power Situation Report, also concluded that there is a strong correlative relationship between the two where a continuous GDP growth entailed a consistently rising demand in electricity.[15] Although, it is important to note that the correlation between the two variables may vary due to developmental levels, electrification, economic makeup, and income levels.[16] In this segment of the report, the relationship specifically between electricity generation and GDP of Southeast Asian countries shall be substantiated accordingly in the figures inclusive of GDP values.

While Indonesia is identified with the highest GDP and electricity generation among ASEAN members, Brunei is tagged with the lowest GDP and electricity generation in 2023, which can also be a direct reflection and associated with this country's population and land area.

When it comes to energy efficiency, the Philippines ranked 3rd among ASEAN countries, moving up two places from its rank in 2022. Energy intensity is a measure of how much energy is consumed per unit of GDP, or simply, the electricity generation divided by the GDP, as computed in Figure 78. This measure generally refers to the amount of energy needed to produce one unit of economic output. Following through with its definition, a country with lower energy intensity signifies a higher efficiency in using energy which contributes to producing an active unit of GDP. In other words, a lower value indicates that the economies in these countries produce their economic values through less energy-intensive means.[18]

Laos noticeably has the highest energy intensity among all other ASEAN members which may be reflective of their country being primarily categorized as a net exporter of energy to other neighboring countries. This affects their general and per capita energy consumption which shall then affect with the formula's output upon computation. As the "Battery of Southeast Asia", domestic energy consumption in Laos is relatively low while the country's population and energy infrastructure limits maximum electrification for all its citizens.[20]

Comparatively, the Philippines has a similar GDP to Malaysia, Singapore, Thailand, and Vietnam. Considering the computed values for energy intensity, the data shows that Singapore is most efficient in using electricity in driving their economy, directly followed by Indonesia and closely followed by the Philippines.

[13] Our World in Data & World Bank Group, Electricity Generation & ASEAN GDP
[14] International Monetary Fund, Gross Domestic Product: An Economy's All
[15] Department of Energy, 2020 Power Situation Report
[16] U.S. Energy Information Administration, Economic Activity and Electricity Use
[18] Our World in Data, Energy Intensity
[19] Review of the Lao People's Democratic Republic energy policies for sustainable development, Energy Conversion and Management
[20] Foreign Policy Research Institute, The Battery of Southeast Asia: Challenge to Building a Regional Transmission Grid

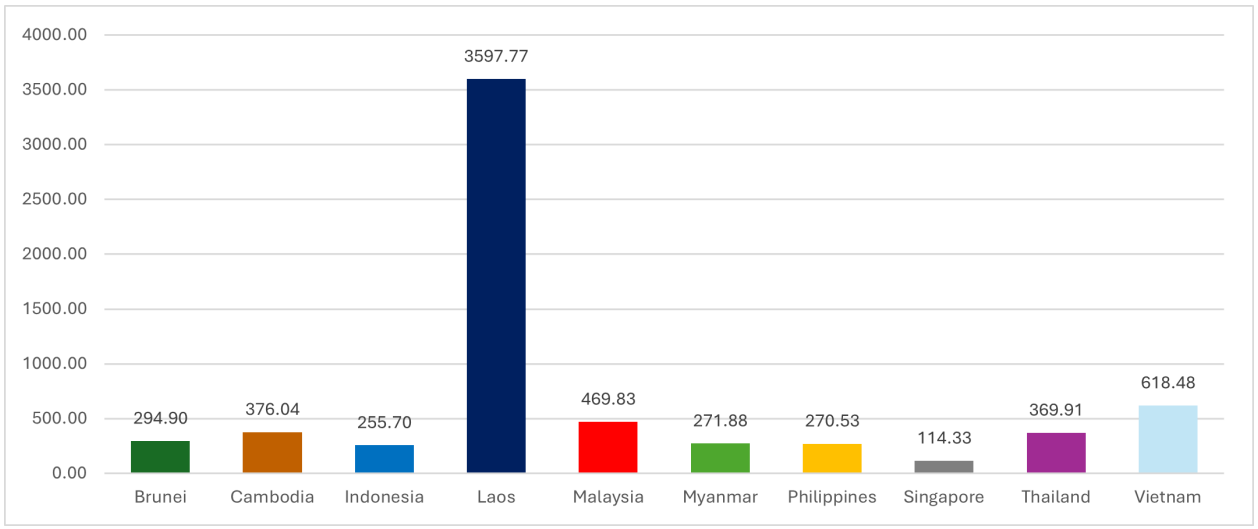


Figure 78. Energy Intensity of ASEAN Countries (2023)[17]

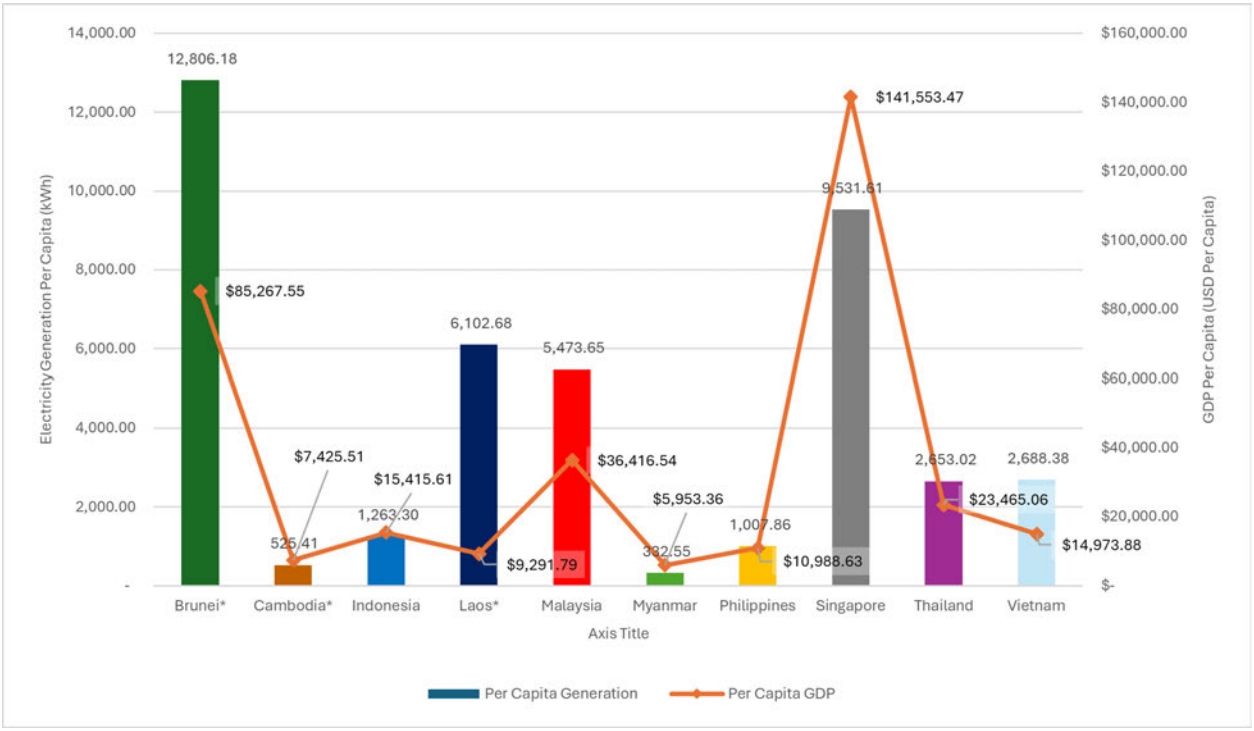


Figure 79. Per Capita Generation vis-à-vis Per Capita GDP of ASEAN Countries (2022-2023)[21,22,23]

[17] Computed values, Energy Intensity
[21] Our World in Data, Per Capita Generation
[22] World Bank Group, Per Capita GDP
[23] * Earliest possible data for that country, 2022

The per capita generation refers to the average annual electricity consumption per person while the per capita GDP measures a country's economic output per person. To place the per capita generation in perspective, the Philippines retained its 8th rank among the ASEAN countries while Singapore remains to have the highest in the same measure. High values of per capita generation typically suggest that there are high levels of electrification in the country, or the process at which the country replaces fossil fuel technologies or processes with RE alternatives.[24] Despite this finding, it may also indicate lower levels of electricity usage efficiency.

Based on DOE's 2023-2032 National Total Electrification Roadmap, the household electrification levels estimated to have reached about 91.10% in 2023.[25] This estimation can also be a direct reflection of the Philippines' expansive utilization of various technologies while considering the effectivity at which it contributes RE to its energy mix. The Philippines' statistics being virtually average among most of the ASEAN countries, specifically in terms of per capita GDP growth rate, further supports the implications of per capita GDP. Significantly, the country's efforts toward electrification can be clearly observed through its energy mix.

Looking at a different perspective on each ASEAN member state's efforts to diversify energy and create an energy industry structure of their own, the Philippines notably continues to implement the Philippine Wholesale Electricity Spot Market (WESM) and has a series of market developments currently being implemented along the pipeline. This includes the continuous implementation of the WESM Mindanao, the Reserve Market, which duly aims for the co-optimization of energy and reserves to optimize scheduling and prices, and the Renewable Energy Market, incentivizing the requirement to source energy from renewable energy resources and contributing towards the country's goal of 35% and 50% renewable energies reflected in the country's energy mix by 2030 and 2040, respectively.[26]

ASEAN Country	Net Zero Emissions Golas[27,28]	2030 Targets for Greenhouse Gas Emissions[27]	Renewable Energy Commitments[27]	Nuclear Development Readiness[27]	Electricity Market Liberalization[29]	Energy Industry Structure[29]
BRUNEI	Net Zero by 2050	20% GHG emission reduction	30% RE mix by 2035 (mainly solar PV)	-	Limited Liberalization	-
CAMBODIA	Net Zero Carbon-neutral economy by 2050	41.7% GHG emission reduction	25% RE mix by 2030 (mainly from solar PV) and 35% RE mix by 2050	Potentially ready by 2050	Partial Liberalization	-
INDONESIA	Net zero by 2060 or sooner	32% GHG emission reduction	43% RE mix by 2050 Increase RE capacity(2021-30)	Potentially ready by 2030	Moderate Liberalization	-
LAOS	Net Zero GHG emissions by 2050	60% GHG emission reduction	30% RE (hydro) mix by 2025	Unlikely ready by 2050	Limited Liberalization	-
MALAYSIA	Net Zero by 2050 or sooner	45% GHG emission reduction (emission intensity)	40% RE mix by 2035	Potentially ready by 2050	Moderate Liberalization	-
MYANMAR	Net zero from forestry and other land use by 2040	GHG emission reduction of about 244.5 MtCO2e (2021-2030)	39% RE mix by 2030	-	Limited Liberalization	-
PHILIPPINES	No specific targets	2.7% cumulative GHG emission reduction (2020-2030)	35% RE mix by 2030 and 50% RE mix by	Potentially ready by 2030	Full Liberalization	Wholesale Electricity Spot Market (WESM): - 5-minute Market - Reserve Market - Renewable Energy Market

[24] International Energy Agency, Electrification – Energy System
[25] Department of Energy, 2023-2032 National Total Electrification Roadmap
[26] Department of Energy, National Renewable Energy Programme (NREP)
[27] ASEAN +3 Macroeconomic Research Office (AMRO), ASEAN+3 Regional Economic Outlook 2023
[28] International Energy Agency (IEA), Southeast Asia Energy Outlook 2024
[29] ASEAN Centre for Energy, ASEAN Energy Investment 2024

SINGAPORE	Net Zero by 2050	GHG emission reduction of about 60 $MtCO_2e$	30% RE mix by 2035	Unlikely ready by 2050	Full Liberalization	Electricity Market
THAILAND	Carbon neutrality by 2050, net zero by 2065	30% GHG emission reduction	50% RE mix by 2040	Potentially ready by 2030	Moderate Liberalization	-
VIETNAM	Carbon neutrality by 2050	16% GHG emission reduction	52% RE mix by 2045	Ready by 2030	Partial Liberalization	-

Table 20: ASEAN Energy Developments for Energy Transition (2023)

Table 20 shows the ASEAN member states' most recent energy developments and commitments toward full energy transition and the general principle of energy sustainability, efficiency, and affordability. These advancements include net zero emission goals, 2030 targets for greenhouse gas emission (GHG) reduction, renewable energy commitments in the pipeline, nuclear development readiness projection, and energy market or industry structure developments. While the ASEAN countries pose diversified electricity market structures from each other, centralized state-owned utilities, competitive markets, and other similar categories, create a more complex cross-border integration.[30]

Several developments during 2023 to 2024 occurred with regard to the implementation of electricity markets across the ASEAN region. These market developmental efforts were generally classified with their respective liberalization statuses. Full liberalization means that the independent power producers (IPPs) of the country are the key suppliers and developers of electricity sources. Moderate liberalization implies that the IPPs are allowed to generate electricity, but state-owned enterprises (SOE) still possess full control of distribution and transmission which entails a higher competition among IPPs. Partial liberalization indicates similar entailments with moderate liberalization, however, their market structures are less complex. Lastly, limited liberalization means that the IPPs' participation is minimal or close to none, with SOE generating electricity.[31]

While some ASEAN countries are already in the works for liberalizing their respective energy markets, the Philippines and Singapore remain fully liberalized with their electricity market operations while the other countries have monopolized their generation, transmission, and distribution capacities. Although there are notable efforts from Vietnam, Thailand, Malaysia, and Indonesia, these countries remain moderately, if not, partially liberalized. Meanwhile, Brunei, Laos, and Myanmar remain limited in their liberalization status. Although the challenges experienced per country vary, most reasons listed revolve around the underdevelopment of supposed governing policies and regulations, lack of market competitiveness, and limited grid accessibility and infrastructure.[31]

With its continuous and recent electricity market developments, the Philippines remains as the titleholder of having the most diversified energy mix and existing energy markets, ranging from the Wholesale Electricity Spot Market, Reserve Market, and the Renewable Energy Market.

In consideration of the recent contemporary developments on power integration projects from the 8th ASEAN Energy Outlook, the Lao PDR (Laos)-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP), commenced operations since way back June 2022. This power project can import up to 100 MW of energy from hydroelectric resources to Laos and Singapore through Malaysia and Thailand and is now expected to increase to 300 MW after the extension of the agreement. On the other hand, the Brunei Darussalam-Indonesia-Malaysia-Philippines Power Integration Project (BIMP-PIP) was expected to reduce electricity price and limit the overutilization of fossil fuels. Upon the completion of discussion and preparatory stages, the project is expected to integrate higher levels of energy integration through new overland and subsea cables for bidirectional energy trading.[32]

[30] Enerdata, Energy Connectivity in ASEAN, Power Grids and Market Integration as a Milestone for Energy Security and Transition

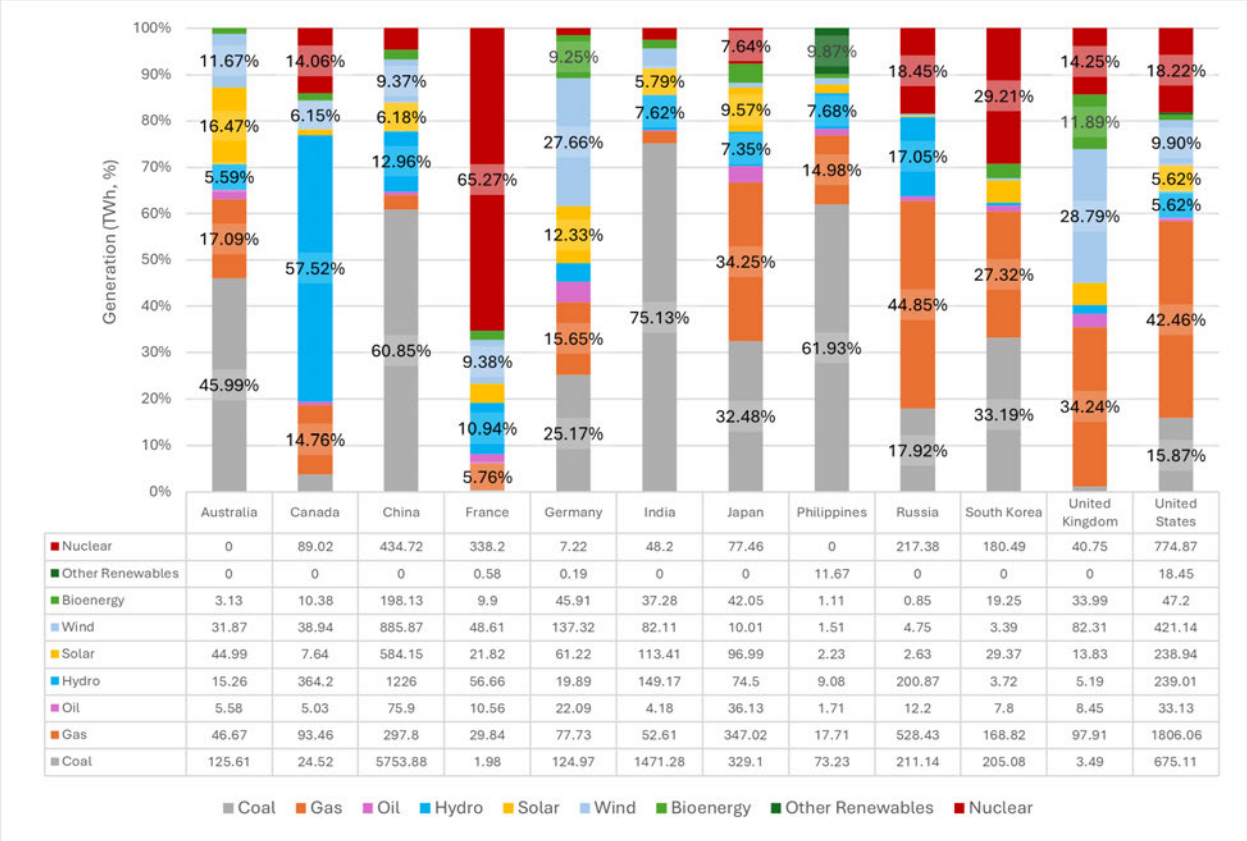
[31] ASEAN Centre for Energy, ASEAN Energy Investment 2024

[32] ASEAN Centre for Energy, 8th ASEAN Energy Outlook

	ECONOMY	BRN	KHM	IDN	LAO	MYS	MMR	PHL	SGP	THA	VNM
REGULATORY	Feed-in-tariff / premium payment			✓		✓		✓		✓	✓
	Electric utility quota obligation / renewable portfolio standards			✓		✓		✓			✓
	Net metering / billing					✓		✓	✓	✓	✓
	Biofuel blend, renewable transport obligation / mandate			✓		✓		✓		✓	✓
	Renewable heat obligation or mandate, heat feed-in tariff, fossil fuel ban for heating										
	Tradable renewable energy certificates								✓		✓
	Tendering		✓	✓		✓	✓	✓	✓		✓
FISCAL	Tax reductions			✓		✓	✓	✓		✓	✓
	Investment or production tax credits			✓		✓		✓			✓
	Energy production payment							✓		✓	✓
	Public investment, loans, grants, capital subsidies, or rebates			✓		✓		✓	✓	✓	✓

Table 21: ASEAN Energy Developments for on Renewable Energy Policies (2023)

Table 21 provides a general update on regulatory and fiscal RE policies and incentives that are implemented and being observed in each respective ASEAN member state. Observably, the Philippines and Vietnam have implemented several regulatory and fiscal incentives which mostly directs support towards renewable energies and its policies, all the while being closely followed by Indonesia and Malaysia in terms of the number of respective energy developments.



	Australia	Canada	China	France	Germany	India	Japan	Philippines	Russia	South Korea	United Kingdom	United States
Nuclear	0	89.02	434.72	338.2	7.22	48.2	77.46	0	217.38	180.49	40.75	774.87
Other Renewables	0	0	0	0.58	0.19	0	0	11.67	0	0	0	18.45
Bioenergy	3.13	10.38	198.13	9.9	45.91	37.28	42.05	1.11	0.85	19.25	33.99	47.2
Wind	31.87	38.94	885.87	48.61	137.32	82.11	10.01	1.51	4.75	3.39	82.31	421.14
Solar	44.99	7.64	584.15	21.82	61.22	113.41	96.99	2.23	2.63	29.37	13.83	238.94
Hydro	15.26	364.2	1226	56.66	19.89	149.17	74.5	9.08	200.87	3.72	5.19	239.01
Oil	5.58	5.03	75.9	10.56	22.09	4.18	36.13	1.71	12.2	7.8	8.45	33.13
Gas	46.67	93.46	297.8	29.84	77.73	52.61	347.02	17.71	528.43	168.82	97.91	1806.06
Coal	125.61	24.52	5753.88	1.98	124.97	1471.28	329.1	73.23	211.14	205.08	3.49	675.11

Figure 80. Shares of Global Energy Mix (2023)[33]

[33] Our World in Data, Global Energy Mix

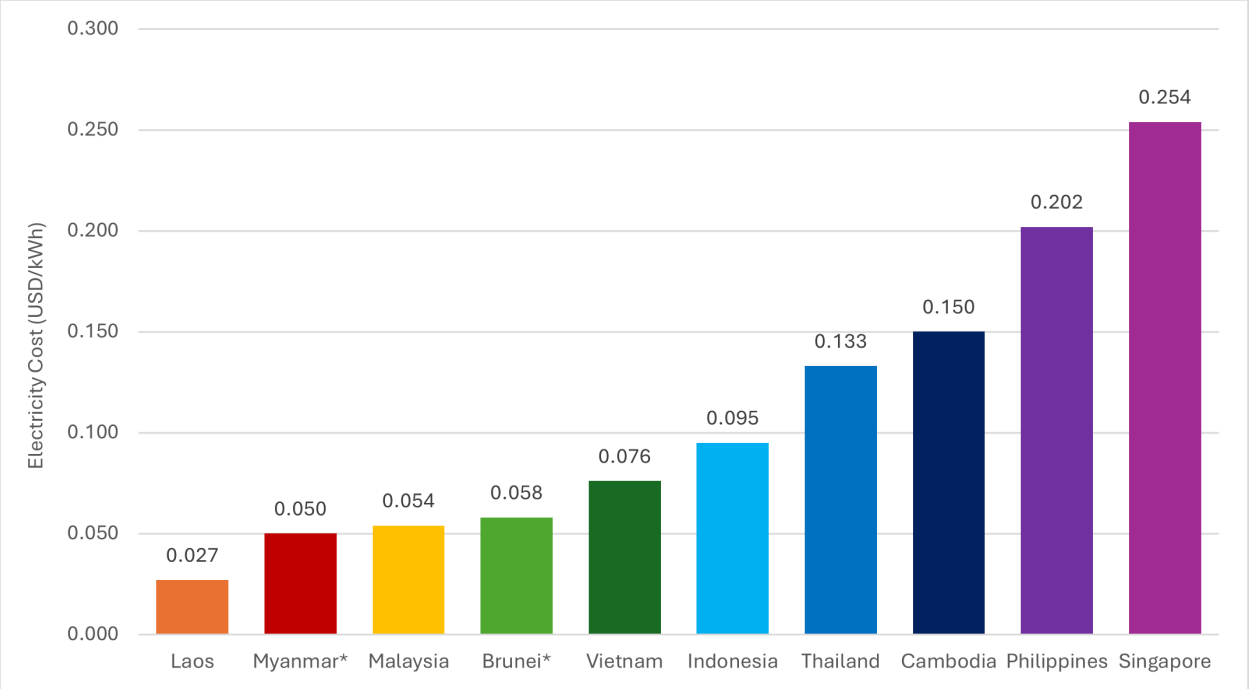


Figure 81. ASEAN Electricity Rates (2024)[34]

Myanmar* - average residential and business electricity rates from Voronoi & Cable.Co.[35, 37]
Brunei* - average electricity cost considering fixed rates for energy tariffs from Voronoi & Cable.Co.[36]

Based on the World Population Review's statistical data on electricity rates, the Philippines ranks second with the highest electricity rate among the other ASEAN member states while Singapore takes first at around 0.254 USD/kWh in 2024. On the other side, Laos, Myanmar, Malaysia, and Brunei have relatively low electricity rates which may be reflective of their energy mixes or the state of its energy sector. Furthermore, Laos possesses high capacities for hydroelectric technologies as observed in their generation mix while Myanmar's energy sector, although challenged with frequent power outages which limits electrical supply, implements government subsidies and tariff increases, addressing the country's main energy concerns. Malaysia has relatively low electricity rates due to its well-implemented governmental subsidies while Brunei has a subsidized electricity tariff set up.

[34] World Population Review, Electricity Cost (USD/kWh)
[35] Global Petrol Prices, Electricity Cost – June 2024
[36] Voronoi by Visual Capitalist & Cable.Co UK, Average Cost of 1 kWh Electricity around the World

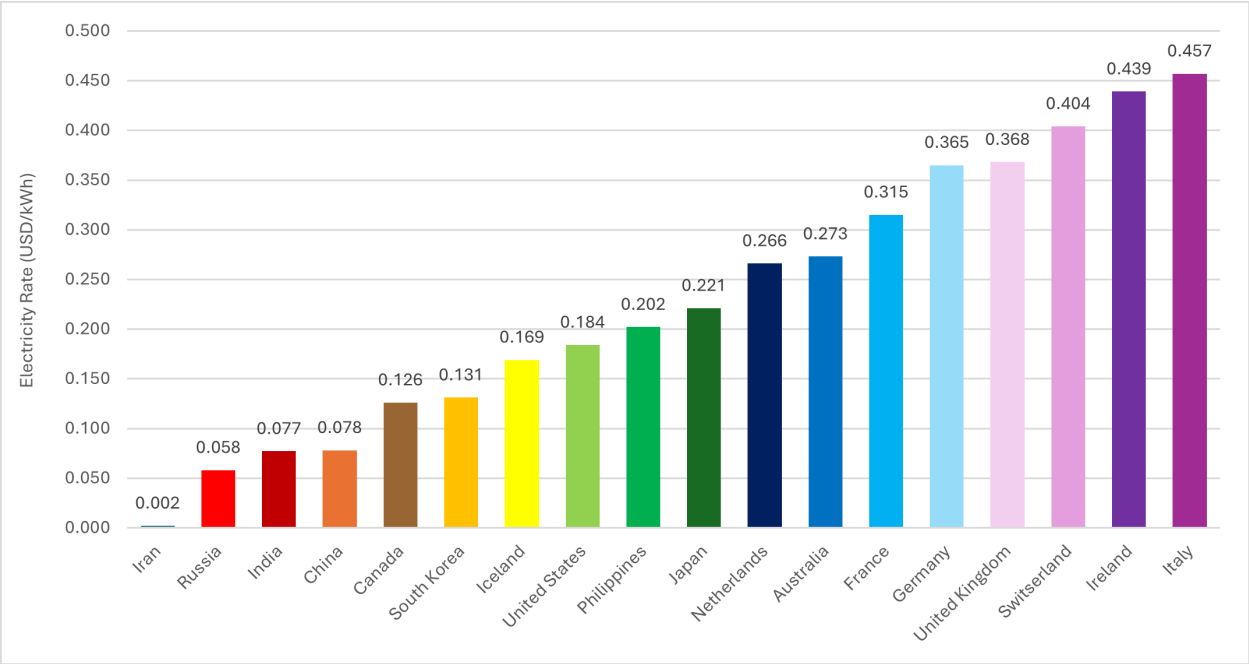


Figure 82. Global Electricity Rates (March 2024)[37]

Overall, the Philippines' electricity rates stand slightly higher than the average electricity rate among all countries, as reflected and obtained through the World Population Review on electricity costs as of March 2024, being approximately 0.202 USD per kWh. Iran was identified as the country with one of the most inexpensive electricity rates together with Ethiopia, Cuba, and other countries, while Ireland was identified as the country with one of the most expensive electricity rates along with Italy, Switzerland, and other countries. These groupings generally reflect the country's current economic state, population, land area, and other factors directly affecting electricity rates.

[37] World Population Review, Electricity Cost (USD/kWh)

4. MARKET DEVELOPMENT UPDATES

This section provides updates on various market developments that were operationalized in 2024. These include the integration of the Reserve Market into the WESM, RCOA and GEOP in Mindanao, and the Renewable Energy Market.

4.1 RESERVE MARKET

Consistent with the general framework governing the operationalization of the reserve market and the price determination methodology for the implementation of the co-optimized energy and reserve market, IEMOP has integrated the trading of reserves in the WESM. The DOE, through Advisory No. 2024-01-001-SEC, announced on 25 January 2024 the commencement of the full commercial operations of the reserve market starting 26 January 2024.

Reserves (or Ancillary Services) refer to services necessary to support the transmission of capacity and energy from resources to loads. These are "stand-by" capacities scheduled by the System Operator to ensure a stable and reliable operation of the Grid. Generators are the primary providers of reserves. For a generator to provide Reserves to the grid, they must be certified by the System Operator. As per DOE policy, the System Operator is mandated to test the capabilities of all generators to provide reserves.

Ancillary services are capacities "on stand-by" to support a secure and reliable operation of the grid. They can be largely grouped into two types: (a) frequency control (operating reserves) and (b) black-start and reactive support.

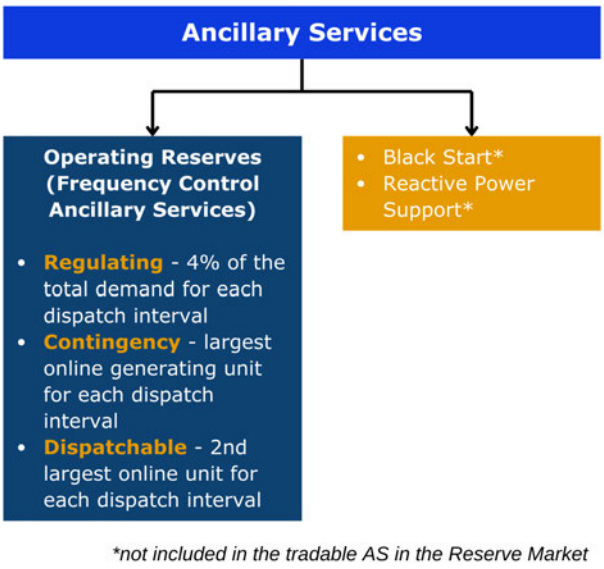


Figure 83. Types of Ancillary Services

Frequency Control Ancillary Services, or operating reserves, are generating capacities scheduled by the System Operator to provide immediate response to ensure maintained balance between generation and load at all times. The basic types of operating reserves involve Regulation, Contingency, and Dispatchable Reserves, each of which performs a distinct role in the delicate instantaneous balance in the grid.

In the current single buyer model of the reserve market, the System Operator procures Reserves via direct negotiations with generators, subject to the approval of the Energy Regulatory Commission (ERC). Such contracts are called Ancillary Services Procurement Agreements (ASPA). Currently, reserve (or ancillary services) contracts executed by the System Operator with the reserve providers are categorized into firm and non-firm contracts.

Generators with firm contracts with the System Operator commit a portion of their capacity to provide reserves as stipulated in their agreement.

On the other hand, generators under non-firm contracts have no committed obligation to make their capacities available for reserves. The decision on whether they will nominate capacities for reserves is made in consideration of the prevailing prices in the WESM, and their existing energy bilateral contracts. In tight supply scenarios, the reserve providers under non-firm contracts may decide to offer their capacities in the WESM.

4.1.1 RESERVE REQUIREMENTS

With the commercial operations of the reserve market on 26 January 2024, the reserve requirements set by the Grid Code were met, with the exception of Visayas for certain trading dates due to deficit in regulation reserves. Prior to this, available capacity often fell short of the required levels, which necessitated the scheduling of uncontracted capacity or capacity not covered by the Ancillary Services Procurement Agreement (ASPA) to ensure the grid's reliability, security, and stability.

Based on the policy issued by the DOE, the operating reserve requirements needed to ensure stable and reliable power system operation are as follows:

- **Regulating Reserves** – refer to reserves that cover the incremental imbalances in supply and demand. This is equivalent to 4% of the system demand for every Grid.
- **Contingency Reserves** – refer to generating capacities intended to replace the loss of the largest operating generating unit. They are allocated and immediately available when the total supply is suddenly reduced due to tripping of a generating unit or loss of a transmission line. The current requirement is set based on the maximum capacity among the largest synchronized unit online or a transmission element, or the power import for the circuit interconnection.
- **Dispatchable Reserves** – refer to generating or interruptible load capacities that are readily available for dispatch to replenish the Contingency Reserves whenever they are utilized. The maximum capacity among the second largest synchronized unit online or a transmission element, or the power import for the circuit interconnection.

Figures 84 to 86 illustrate how regional reserve requirements were met from the 26 January 2024 to 25 December 2024. Dips across the months of April until early August 2024 can be observed as it will be recalled that on 26 March 2024, the ERC issued an Order suspending the settlement of all capacities offered in the Reserve Market, except those offered and dispatched with respect to Ancillary Service Purchase Agreements (ASPA). The ERC then lifted the suspension of the Billing and Settlement provisions of the Price Determination Methodology (PDM), paving the way for the resumption of the full commercial operations of the Reserve Market on 5 August 2024.

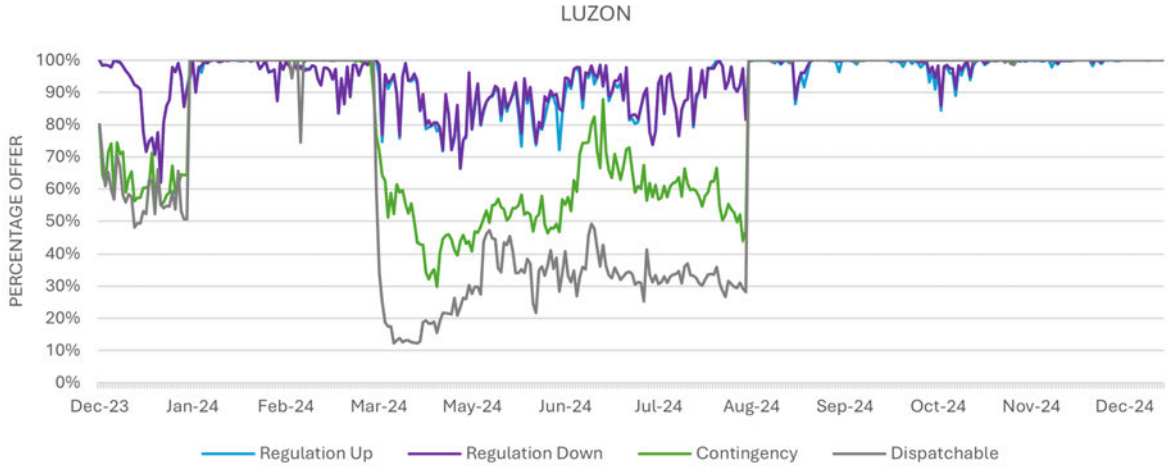


Figure 84. Scheduled Reserve vs. Requirement (Luzon, 2024)

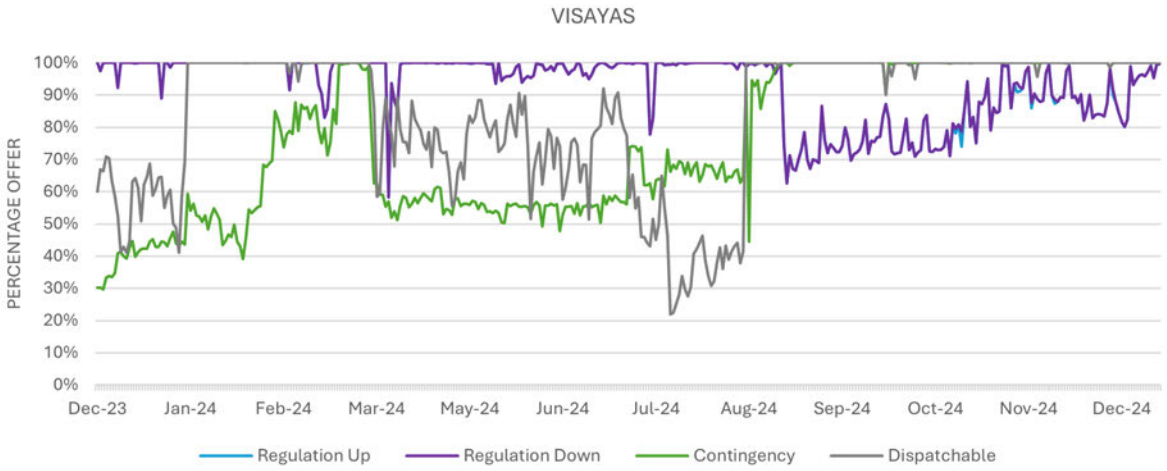


Figure 85. Scheduled Reserve vs. Requirement (Visayas, 2024)

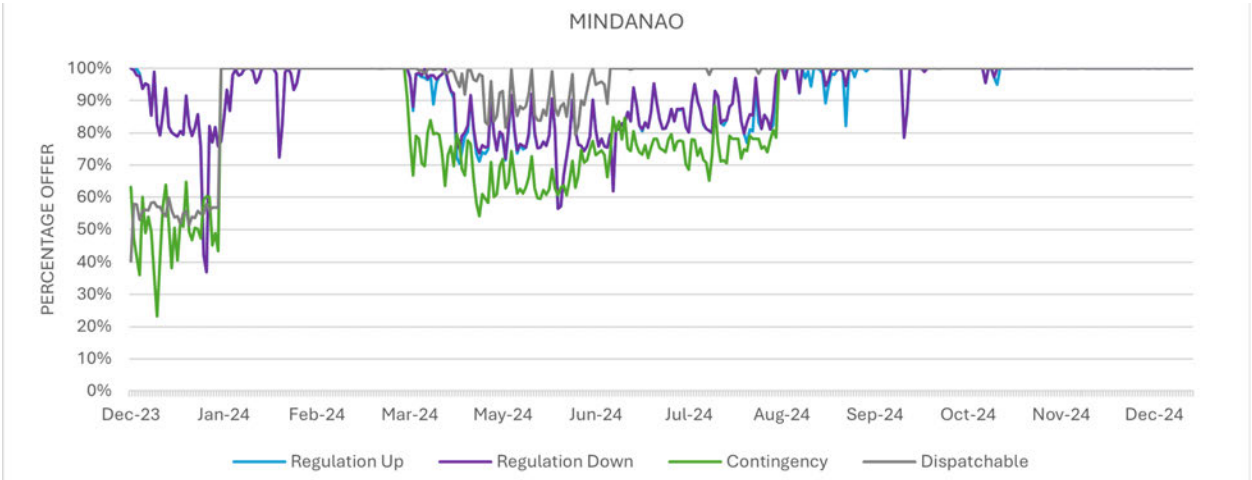


Figure 86. Scheduled Reserve vs. Requirement (Mindanao, 2024)

4.1.2 RESERVE MARKET OUTCOMES

As noted in the previous section, the ERC issued an Order suspending the settlement of all capacities offered in the Reserve Market starting 26 March 2024, except those offered and dispatched with respect to Ancillary Service Purchase Agreements (ASPA) which was lifted via an ERC Order dated 1 August 2024. The Reserve Market effectively resumed full commercial operations on 5 August 2024. These inclusive months are reflected in the following tables below with their respective supply offers, market requirements or the demand, real-time dispatch (RTD) schedules, and zonal prices:

BILLING PERIOD	SUPPLY OFFER				MARKET REQUIREMENT (DEMAND)				RTD SCHEDULE				ZONAL PRICE			
	Reg Down (MW)	Reg Up (MW)	Con (MW)	Dis (MW)	Reg Down (MW)	Reg Up (MW)	Con (MW)	Dis (MW)	Reg Down (MW)	Reg Up (MW)	Con (MW)	Dis (MW)	Reg Down (Php/kWh)	Reg Up (Php/kWh)	Con (Php/kWh)	Dis (Php/kWh)
FEB 2024	251	251	778	998	174	174	516	500	171	171	516	500	6.28	8.39	9.06	0.57
MAR 2024	198	198	760	912	188	188	577	548	180	180	576	541	6.83	9.69	12.56	2.34
AUG 2024	323	324	926	850	203	203	617	611	200	200	617	610	7.34	7.04	5.61	4.77
SEP 2024	335	335	1,083	785	199	199	633	598	199	199	633	598	2.83	4.07	3.20	2.34
OCT 2024	269	269	1,236	828	202	202	655	616	198	198	655	616	10.64	6.34	2.92	2.07
NOV 2024	281	281	1,172	847	192	192	648	583	192	192	648	582	10.50	12.54	2.64	1.40
DEC 2024	273	273	1,132	975	190	190	651	623	190	190	651	623	5.51	5.44	3.93	0.70

Table 22: Reserve Offers, Market Requirements, RTD Schedules, and Zonal Prices (Luzon)

BILLING PERIOD	SUPPLY OFFER				MARKET REQUIREMENT (DEMAND)				RTD SCHEDULE				ZONAL PRICE			
	Reg Down (MW)	Reg Up (MW)	Con (MW)	Dis (MW)	Reg Down (MW)	Reg Up (MW)	Con (MW)	Dis (MW)	Reg Down (MW)	Reg Up (MW)	Con (MW)	Dis (MW)	Reg Down (Php/kWh)	Reg Up (Php/kWh)	Con (Php/kWh)	Dis (Php/kWh)
FEB 2024	53	53	89	338	36	36	163	143	36	36	88	143	27.44	7.87	9.66	0.48
MAR 2024	41	41	150	305	38	38	168	157	37	37	145	157	16.06	9.97	19.92	1.85
AUG 2024	37	37	172	281	40	40	169	153	35	35	154	153	13.71	13.06	14.01	4.80
SEP 2024	34	34	212	273	40	40	159	155	30	30	158	154	27.27	26.95	6.94	6.41
OCT 2024	39	39	218	302	40	40	159	155	31	31	159	155	26.63	21.73	8.02	4.66
NOV 2024	49	49	207	306	39	39	157	156	36	36	157	156	27.25	22.11	7.43	3.01
DEC 2024	50	50	203	320	40	40	158	156	36	36	158	156	25.20	20.66	9.95	4.01

Table 23: Reserve Offers, Market Requirements, RTD Schedules, and Zonal Prices (Visayas)

BILLING PERIOD	SUPPLY OFFER				MARKET REQUIREMENT (DEMAND)				RTD SCHEDULE				ZONAL PRICE			
	Reg Down (MW)	Reg Up (MW)	Con (MW)	Dis (MW)	Reg Down (MW)	Reg Up (MW)	Con (MW)	Dis (MW)	Reg Down (MW)	Reg Up (MW)	Con (MW)	Dis (MW)	Reg Down (Php/kWh)	Reg Up (Php/kWh)	Con (Php/kWh)	Dis (Php/kWh)
FEB 2024	77	77	342	281	36	36	102	99	34	34	102	99	11	12	3	0
MAR 2024	116	116	403	408	38	38	101	100	38	38	101	100	2.72	3.05	2.26	0.78
AUG 2024	75	75	317	375	40	40	105	102	40	39	105	104	3.81	4.97	1.25	0.03
SEP 2024	91	91	402	388	40	40	107	105	39	39	107	108	1.28	1.91	1.65	0.14
OCT 2024	107	107	406	526	41	41	112	110	41	40	112	112	5.38	6.10	3.52	0.56
NOV 2024	94	94	421	619	40	40	113	111	40	40	113	113	7.22	7.57	2.30	0.13
DEC 2024	95	95	423	535	40	40	116	112	40	40	116	112	8.52	8.53	1.39	0.13

Table 23: Reserve Offers, Market Requirements, RTD Schedules, and Zonal Prices (Mindanao)

4.1.3 REGISTRATION DEMOGRAPHICS

Table 25 shows the total registered A/S capacity per reserve type per grid. This includes capacities under ASPA firm contracts and capacity that are tradable in the WESM.

	RESERVE TYPE	LUZON	VISAYAS	MINDANAO
A/S REGISTERED CAPACITY (in MW)	REGULATION	2,011	196	537
	CONTINGENCY	2,340	293	925
	DISPATCHABLE	2,559	361	1,136

Table 24: Registered Reserve Capacity per Region as of 26 December 2024

The following figures illustrate the demographics of registered reserve capacity per type per technology. The graphs are labeled as follows: (i) Regulation - innermost ring; (ii) Contingency - middle ring; (iii) Dispatchable - outermost ring.

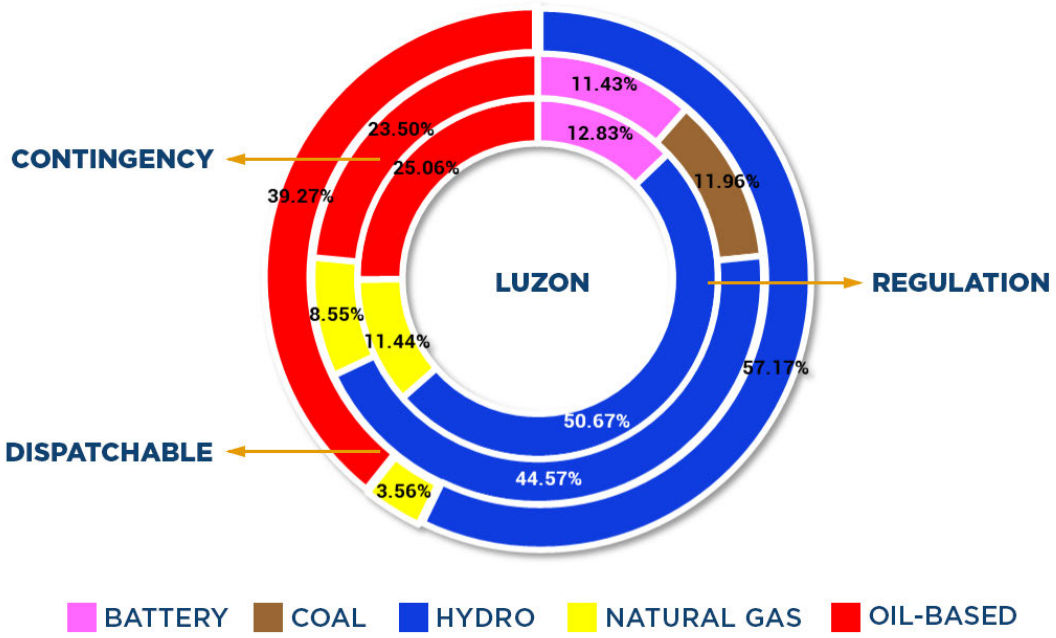


Figure 87. Registered Reserve Capacity per Technology (Luzon)

In Luzon grid, all reserve types are dominated by impounding hydro facility types followed by oil-based plants. Natural gas plants are registered to provide all reserve types whilst battery energy storage systems (BESS) are set to provide regulation and contingency reserves. Meanwhile, coal plants participate in the market as contingency reserve providers.

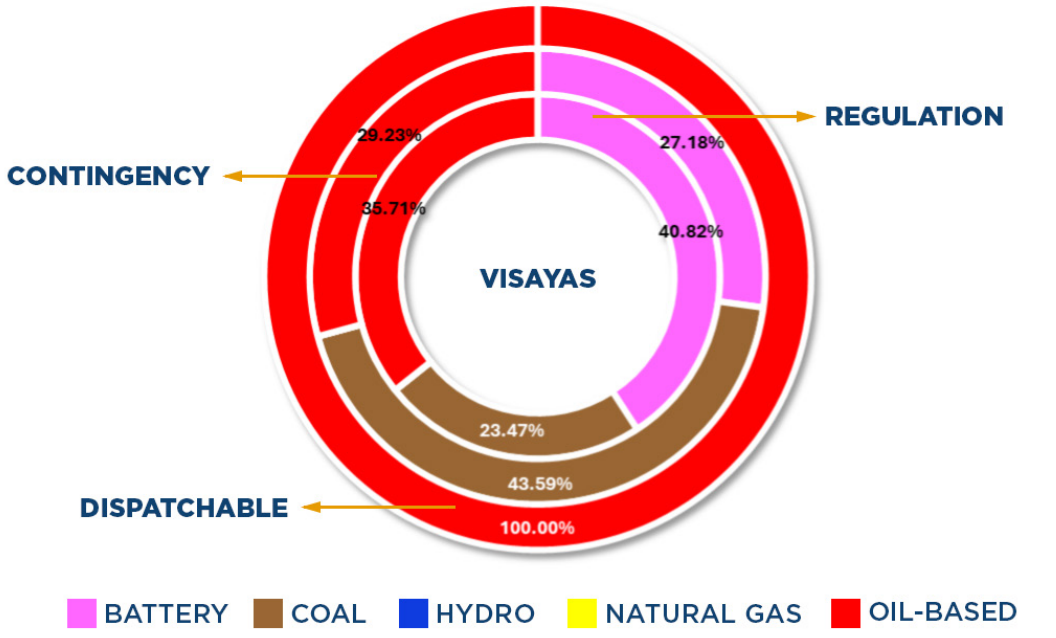


Figure 88. Registered Reserve Capacity per Technology (Visayas)

For the Visayas grid, registered ancillary services providers are only BESS, oil-based and coal fired plants with BESS as the most available for regulation and coal for contingency. Dispatchable reserves in Visayas are purely oil-based.

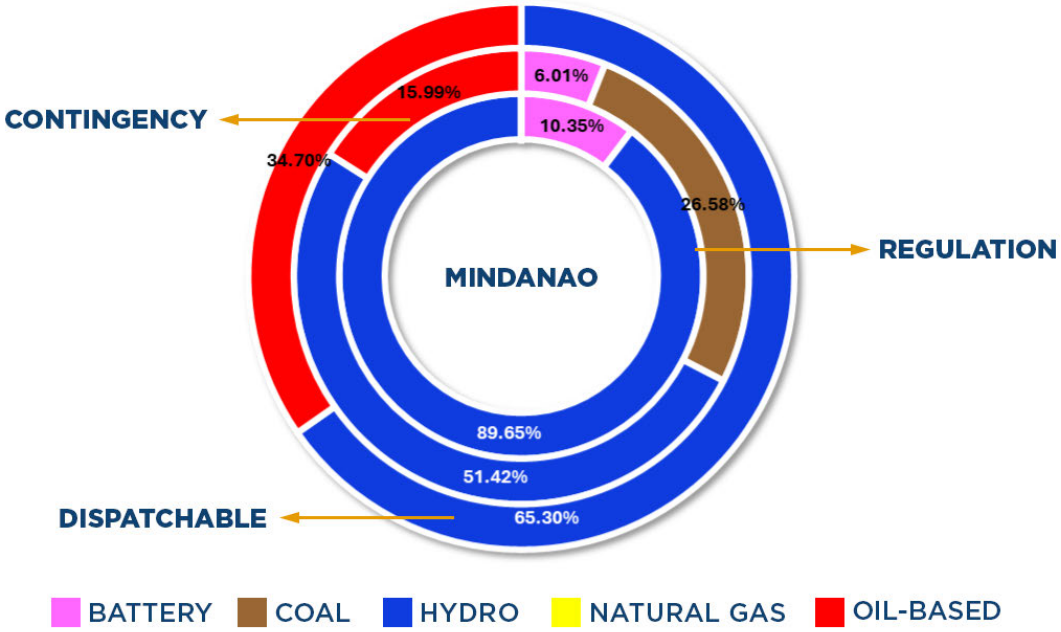


Figure 89. Registered Reserve Capacity per Technology (Mindanao)

In Mindanao, the registered ancillary services are principally hydro facilities for all reserve types with BESS also offering for regulation and contingency, coal-fired facilities supplementing contingency requirements, and oil-based plants offering for both contingency and dispatchable reserve requirements.

With regard to companies that have registered facilities certified to be capable of providing ancillary services, Table 26 shows the registered generating units per reserve type per grid. Likewise, this includes facilities under ASPA firm contracts and those that are offered in the spot market.

REGION	REGISTERED A/S PROVIDERS (per Company)	REGISTERED A/S PROVIDERS PER GENERATING UNIT		
		Regulation Reserve	Contingency Reserve	Dispatchable Reserve
LUZON	20	40	49	41
VISAYAS	17	12	19	51
MINDANAO	12	16	33	41

Table 26: Registered A/S Providers as of 26 December 2024

4.2 RCOA AND GEOP IN MINDANAO

With the DOE's promulgation on 11 March of the 2024 Department Circular DC2024-03-0009 Declaring the Commercial Operations Date of Retail Competition and Open Access (RCOA) and Green Energy Option program (GEOP) in Mindanao, the whole Philippines is now unified in the effort to lower electricity costs for all Filipinos. This is in line with the Electric Power Industry Reform Act of 2001 or the EPIRA, which declares the policy of the State, among others, to ensure the quality, reliability, security, and affordability of the supply of electric power and to ensure transparent and reasonable prices of electricity in a regime of free and fair competition and full public accountability to achieve greater operational and economic efficiency and enhance the competitiveness of the Philippine products in the global market.

The Concept of RCOA and GEOP

In the Philippines, the Retail Competition and Open Access (RCOA) and the Green Energy Option Program (GEOP) are two vital initiatives aimed at transforming the country's energy landscape. Both programs work toward achieving a more competitive, sustainable, and consumer-oriented power market. RCOA focuses on giving consumers, particularly large ones, the ability to choose their electricity suppliers, fostering competition and price transparency. On the other hand, GEOP is designed to promote the use of renewable energy by allowing consumers to opt for clean energy sources, supporting the government's goals of increasing the share of renewables in the national energy mix.

Retail Competition and Open Access (RCOA)

RCOA allows electricity consumers, particularly those with electricity demand of 500kW and above (e.g., industrial, commercial, and government consumers), to choose their electricity supplier. Under the traditional system, consumers are tied to a single electricity distribution utility that also provides generation services. However, under RCOA, consumers can select from a pool of Retail Electricity Suppliers (RES), which offer competitive pricing, service options, and contract terms. This shift from a monopolistic system to a competitive retail market aims to lower electricity costs, improve service quality, and increase overall market efficiency. Key benefits of RCOA include:

1. **Price Competition:** With multiple RESs in the market, competition can help reduce electricity prices, benefiting consumers.
2. **Improved Service Quality:** Consumers can select suppliers based on service offerings, responsiveness, and reliability, leading to better customer experience.
3. **Efficient Market Operations:** The competitive environment incentivizes electricity suppliers to operate efficiently, reducing costs and improving the overall functioning of the power market.
4. **Increased Market Participation:** It allows more players to enter the market, thus encouraging the development of new technologies and business models in the energy sector.

RCOA has been implemented in phases (from 1MW then 750kW, and now at 500kW demand threshold) with large consumers in Luzon and Visayas being the first to participate in 2013, and then Mindanao in March 2024. While challenges remain—such as the need for adequate market infrastructure and grid stability—RCOA offers significant potential for transforming the energy market.

Green Energy Option Program (GEOP)

The Green Energy Option Program (GEOP) is designed to provide consumers with the option to choose renewable energy sources for their electricity supply. Under GEOP, any consumer with a demand of at least 100 kW can voluntarily opt to source their electricity from renewable energy sources such as solar, wind, hydro, or biomass. This program aligns with the Philippine government's goal of fast tracking RE development. Key benefits of GEOP include:

1. **Promotion of Renewable Energy:** By encouraging consumers to shift to renewable energy sources, GEOP contributes to the Philippines' goal of increasing the share of renewables in the energy mix.
2. **Environmental Impact:** GEOP helps reduce the carbon footprint of electricity consumption, contributing to climate change mitigation efforts.
3. **Consumer Empowerment:** GEOP gives consumers the ability to make environmentally conscious choices about their energy consumption, aligning with growing global and local interest in sustainability.

RCOA and GEOP empowers consumers while advancing the goals of competition, efficiency, and sustainability in the Philippine power sector. These programs foster a Consumer-Centric Energy Market- a consumer-driven energy market where consumers not only benefit from competitive pricing but can also make a positive impact on the environment by choosing renewable energy sources. This empowers consumers to play an active role in shaping the future of the energy sector.

As of 26 December 2024, Mindanao participants that have registered RCOA and GEOP are as follow:

CATEGORY	TOTAL	DIRECT		INDIRECT	CRB ONLY
		MIN	NATIONWIDE	MIN	MIN
Retail Metering Services Providers	17	-	0	-	0
Local Retail Electricity Suppliers	0	-	0	-	0
Retail Electricity Suppliers	50	-	50	-	0
Suppliers of Last Resort	0	-	0	-	0
Contestable Customers	26	-	0	0	26
Directly Connected Contestable Customer	1	-	0	1	0
TOTAL PARTICIPANTS	**94**	**-**	**50**	**1**	**26**

Table 27: Mindanao RCOA Registration Demographics as of 26 December 2024

CATEGORY	TOTAL	DIRECT		CRB ONLY
		MIN	NATIONWIDE	MIN
DU-Connected End-User	0	0	0	0
Directly Connected End-User	0	0	0	0
GEOP Metering Services Provider	7	7	-	-
Renewable Energy (RE) Supplier	18	0	18	-
Local Retail Electricity Supplier	0	0	0	-
Supplier of Last Resort - GEOP	0	0	0	-
TOTAL PARTICIPANTS	**25**	**7**	**18**	**0**

Table 28: Mindanao GEOP Registration Demographics as of 26 December 2024

While the Retail Aggregation Program forms part of the Customer Choice programs under the retail market, intending aggregated end users have yet to register as of end of December 2024.

4.3 RENEWABLE ENERGY MARKET

Full Commercial Operations

The Renewable Energy Market (REM) officially began its full commercial operations on 26 December 2024, following the Department of Energy's (DOE) issuance of Department Circular No. 2024-12-0031, titled "Declaration of the Full Commercial Operations of the Renewable Energy Market." Following the same, the Independent Electricity Market Operator of the Philippines (IEMOP) has started carrying out the RE Registrar functions.

The REM is a venue for trading Renewable Energy Certificates (RECs) which are market-based instruments representing renewable and environmental attributes of one (1) MWh of power generation from duly registered eligible Renewable Energy (RE) facilities. The RECs are issued to and traded between Market Participants for them to meet their Renewable Portfolio Standards (RPS) obligations. The RPS refers to the policy established under the Renewable Energy Act of 2008 requiring Mandated Participants to source a portion of their energy supply from renewable energy.

On 10 June 2022, the DOE issued Department Circular (DOE DC) No. 2022-06-0019 declaring the interim commercial operations (I-COP) of the REM, which aims to prepare the market for full commercial operations while awaiting the determination of the REC price cap and its methodology, rules on the cost recovery mechanism of RPS compliance by regulated entities, and the structure and level of REM transaction fees. These regulatory frameworks form part of the readiness criteria to enable the effective implementation of the REM. Through the Memorandum of Agreement dated 21 June 2023 executed by the Department of Energy (DOE), the Independent Electricity Operator of the Philippines (IEMOP) and the Philippine Electricity Market Corporation (PEMC), the parties, agreed on the terms of the transfer of the maintenance and operations of PREMS assets as well as the transfer of the RE Registrar functions from PEMC to IEMOP in further preparation for the launch of full commercial operations of the REM. The physical transfer of the Philippine Renewable Energy Market System (PREMS) infrastructure, including software configuration under the IEMOP network from PEMC to IEMOP Market Operations Center was completed on 5 June 2024. IEMOP and PEMC have since jointly conducted the necessary activities in preparation for the full commercial operations of the REM.

On 23 April 2024, the Energy Regulatory Commission (ERC) published the price cap initially set at PhP 241.56/MWh subject to review every two years or as deemed necessary and the Cost Recovery Mechanism of On-Grid Distribution Utilities in Compliance with the RPS. These regulatory frameworks complete the hard requirements for the REM to go on full commercial operations. As of 25 December 2024, 90% or 295 of the expected 328 on-grid participants – which include RE Generators and Mandated Participants such as Distribution Utilities, Electric Cooperatives, Retail Electricity Suppliers, and Generators serving Directly Connected Customers – have registered in the REM and have active access to the Philippine Renewable Energy Market System (PREMS).

The REM operations will be facilitated through the PREMS, an enterprise-grade system developed by Exist Software Labs, Inc. through the partnership between the DOE and United Nations Development Programme (UNDP) under its Development for Renewable Energy Application Mainstreaming and Market Sustainability (DREAMS) Project.

Pursuant to the mandate of the Republic Act (RA) No. 9513, or the “Renewable Energy Act of 2008”, the REM is one of the DOE’s RE transition pathway programs focused on accelerating RE development in the country by achieving the aspirational RE target share in the country’s energy mix at 35% by 2030 and 50% by 2040, thereby reducing reliance on imported fossil fuel and bolstering utilization of indigenous renewable energy resources.

The DOE held a ceremonial launch of the REM full commercial operations last 12 December 2024 in Makati City during the inaugural Sustainable Energy Awards presented by the department.

Registration Demographics and RECs Registry

As of 26 Dec 2024, 308 participants have registered in the REM. Out of these, 99 participants (32.14%) are Mandatory REM Generators, 27 (8.77%) are Generators serving Directly Connected Customers, 99 (32.14%) are Electric Cooperatives, 41 (13.96%) are Retail Electricity Suppliers, 29 (9.42%) are Private Distribution Utilities, 4 (1.30%) are Off-Grid Generators, and 7 (2.27%) of which are Local Retail Electricity Suppliers.

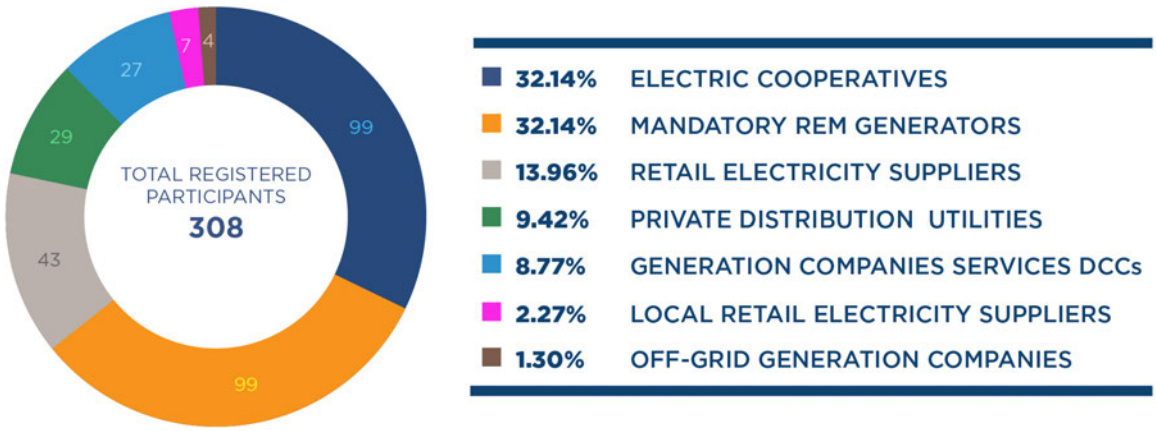


Figure 90. REM Registration Demographics (as of 25 December 2024)

RECs also have been issued to various participants in the REM starting May 2023 (REM was still under Interim Commercial Operations) with an increasing trend observed from billing periods 2018 to 2022 as illustrated in Figure 91. Under the three REC issuance mechanisms: the (1) Power Supply Agreement or also known as the Non-FIT mechanism, (2) Feed-in-tariff or FIT mechanism, and (3) Voluntary Mechanism, 5.36 million RECs were issued in 2018. This is followed by 5.53 million RECs for 2019 where the increase is mainly contributed by RECs from the FIT mechanism. In 2020, 5.84 million RECs were issued where a considerable amount of the increase was sourced from the Voluntary and FIT mechanism. Up to 2020, Non-FIT RECs continue to be at the 2.55-2.56 million range. Starting 2021 to 2022, the total RECs issued continues to grow but now driven by the increase of RECs from the Non-FIT and Voluntary mechanisms. In 2023 and 2024, there is a significant increase of Non-FIT RECs, from the 3.22 million RECs in 2022 to 4.47 and 5.50 million for 2023 and 2024, respectively. RECs for the FIT and Voluntary Mechanism for the years 2023 and 2024 have yet to be issued.

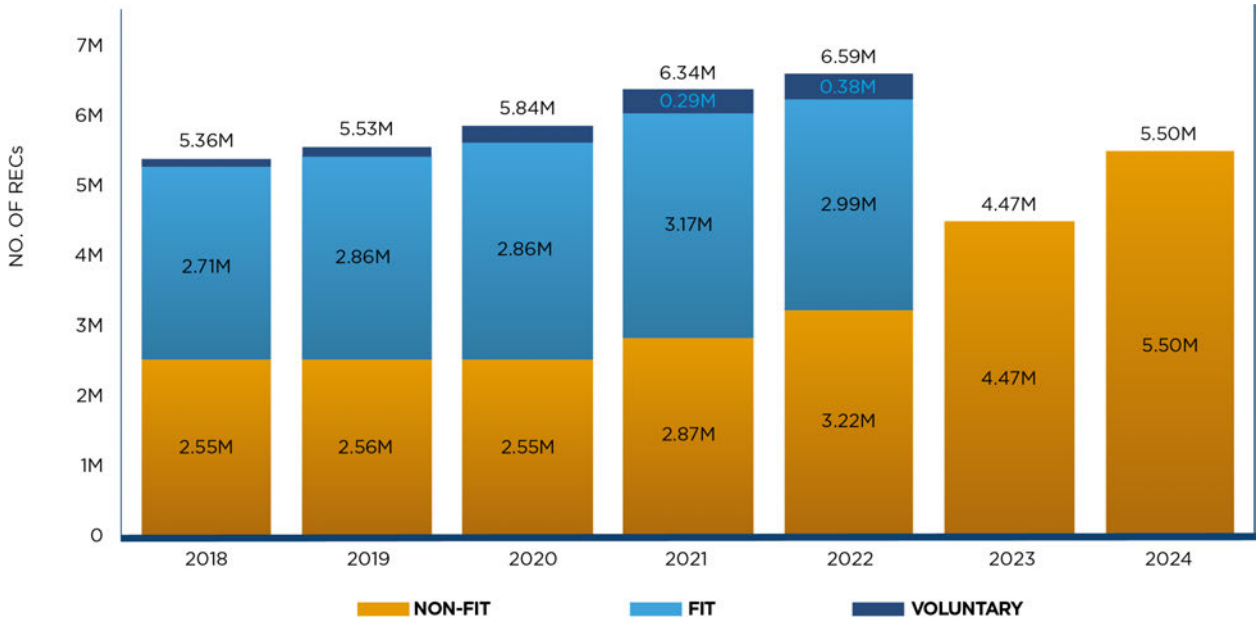


Figure 91. Generated Renewable Energy Certificates (RECs) per Year

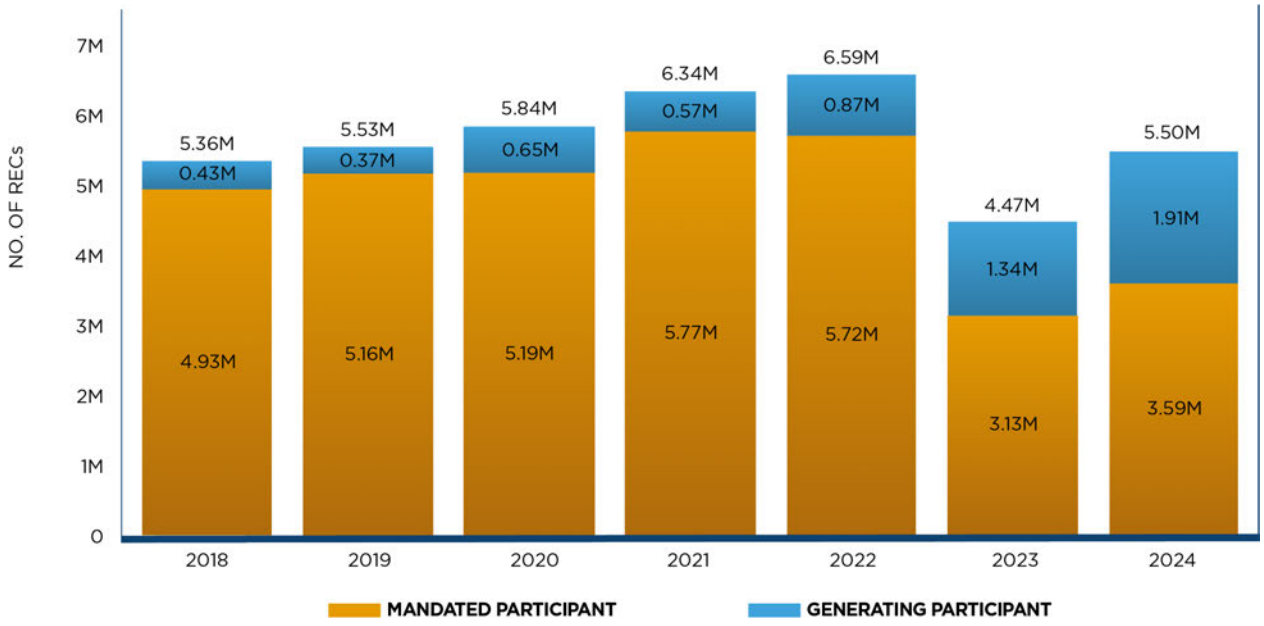


Figure 92. Issued Renewable Energy Certificates (RECs) per Participant Category

5. POWER OUTLOOK: RENEWABLE ENERGY INTEGRATION IN A CO-OPTIMIZED ENERGY AND RESERVE MARKET

Under the Renewable Energy (RE) development in the Philippines, several mechanisms have been developed to promote the sustainable development goal of affordable and clean energy. This includes the Net-metering program, Feed-in-Tariff (FiT) system, Green Energy Option Program (GEOP), and the Renewable Energy Market (REM). In addition to these, the Green Energy Auction Program (GEAP), which facilitates contracting suppliers and customers through a competitive process or auction, is set to fast track achieving the country's renewable energy targets.

Apart from its competitive nature to regulate costs and ensure renewable alternatives, the GEAP incentivizes RE investors to have additional means of complying with the Renewable Portfolio Standards (RPS) and their long-term power supply requirements. The program is composed of an auction called the Green Energy Auction (GEA) where each auction has various installation targets, which are based on year and grid connection, determined by the Department of Energy (DOE). The installation targets (in MW) are separated by technology type and the facilities can be existing facilities or upcoming RE projects. Qualified suppliers can offer the capacity of their eligible RE facilities at a specified price. Each GEA round is preceded by a Notice of Auction (NOA) from the DOE. The NOA contains the installation targets, the actual date of the auction, and various deadlines and timelines for submission of requirements and inquiries. To date, GEA rounds 1 and 2 have already been conducted back in June 2022 and June 2023, respectively. Meanwhile, the NOA for GEA 3 has been published and its auction is expected to be conducted in 2025.

Through the GEAP, additional RE capacities were committed to be developed. GEA 1, for instance, is set to bring 1,866 MW of RE capacity consisting of biomass, solar, hydro, and wind with delivery targets from 2024 to 2027. GEA 2 is set to bring 3,457 MW of RE capacity with delivery targets from 2024 to 2026, the majority of which are solar facilities. On top of these, there are three (3) more auction rounds set to be conducted. With the incorporation of these new and upcoming renewable energy projects, these additional RE capacities will, in turn, have an effect on both the energy and reserve markets.

In this regard, IEMOP conducted a study to assess the impact of these additional RE capacities to the co-optimization of the Energy and Reserve markets by year 2030. The demand was projected using the Average Annual Growth Rate (AAGR) for Luzon (5.04%), Visayas (5.61%), and Mindanao (5.53%) based on DOE's Philippine Energy Plan 2023-2050. Projected frequent and average offer prices used in the simulation for both the Energy and Reserve markets which were based on the latest offers of conventional power plants and nominations of renewable energy plants using data of the year 2023 and year 2024.

The study is composed of simulations for 2 cases: Case 1 considered the additional committed capacities and the capacities from GEA 1-5, while Case 2 considered the additional indicative capacities as well as the capacities from Case 1. Committed capacities are projects that have secured funding and with a target date of delivery or operation at present while indicative capacities are projects which have yet to be funded.

The system-wide results show that the additional RE capacities reduce the energy prices to zero or to negative values during the daytime when solar generation is at its peak, but the prices increase or may spike during the evening where conventional generation is still mostly used. These evening price spikes can be addressed by fast ramping RE plants like hydro power plants, or through the utilization of battery energy storage systems (BESS) or hybrid systems.

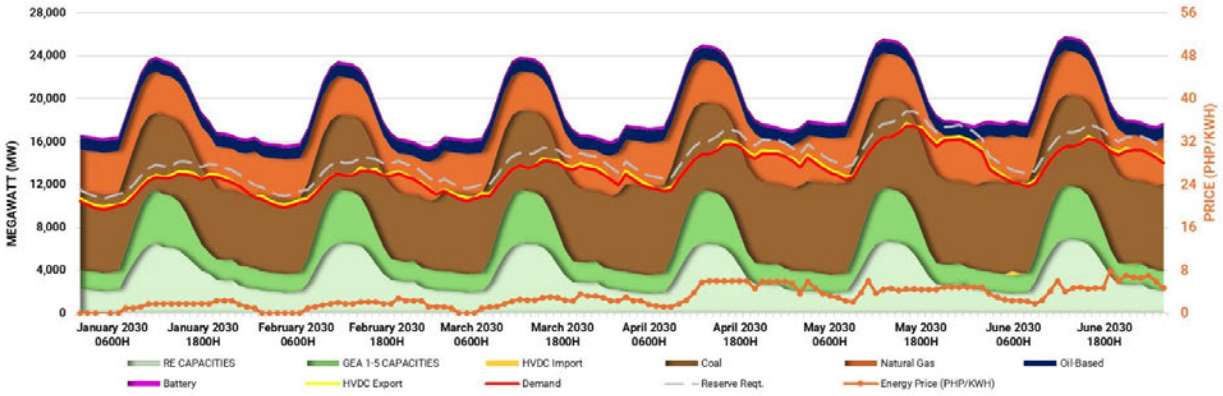


Figure 93. Luzon Energy Market Projections under Case 1 (January to June 2030)

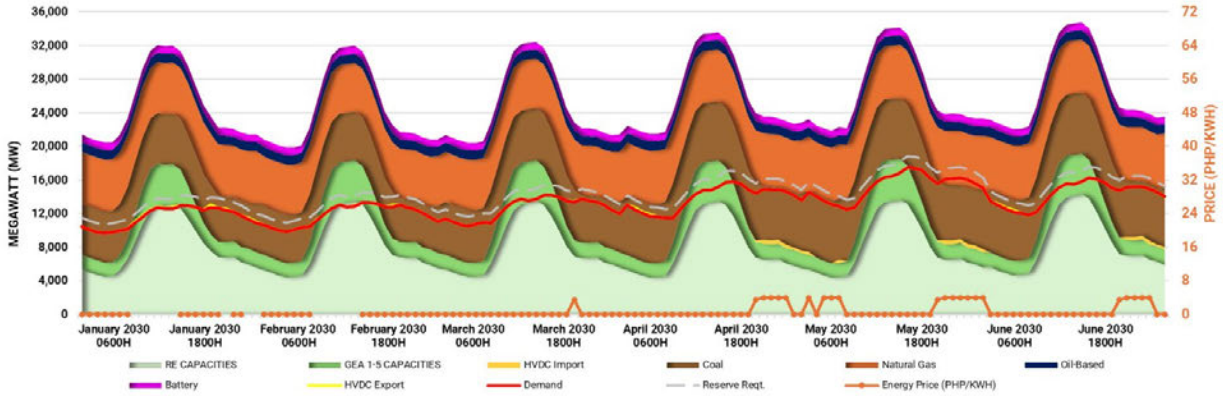


Figure 94. Luzon Energy Market Projections under Case 2 (January to June 2030)

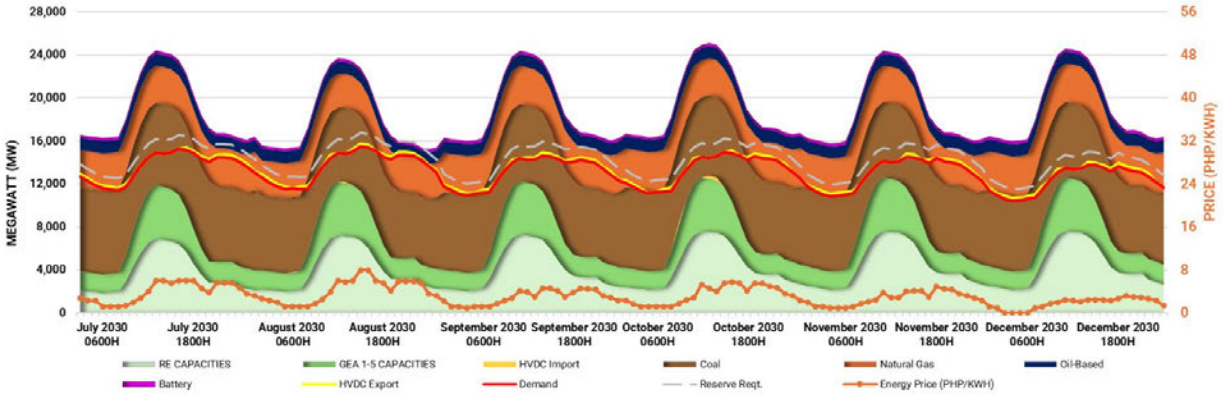


Figure 95. Luzon Energy Market Projections under Case 1 (July to December 2030)

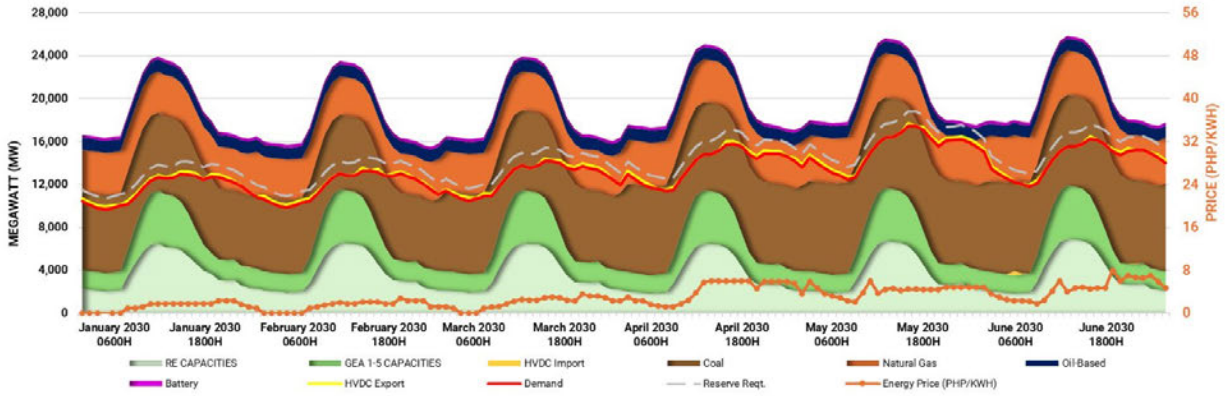


Figure 96. Luzon Energy Market Projections under Case 2 (July to December 2030)

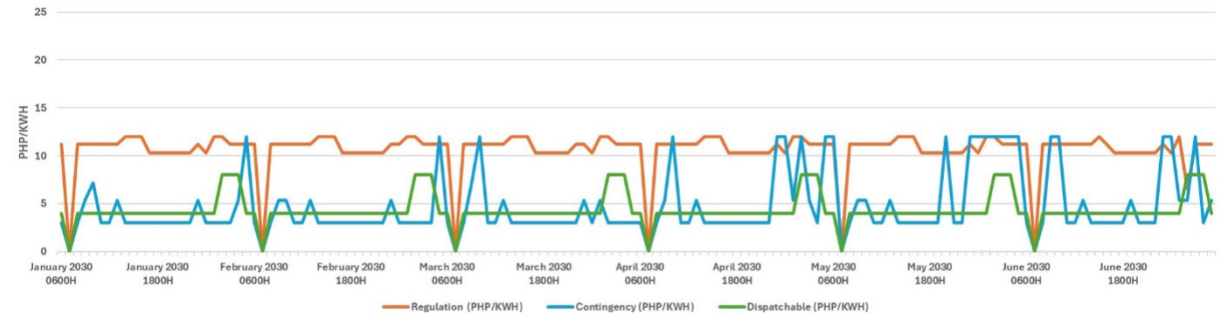


Figure 97. Luzon Reserve Market Projections under Case 1 (January to June 2030)

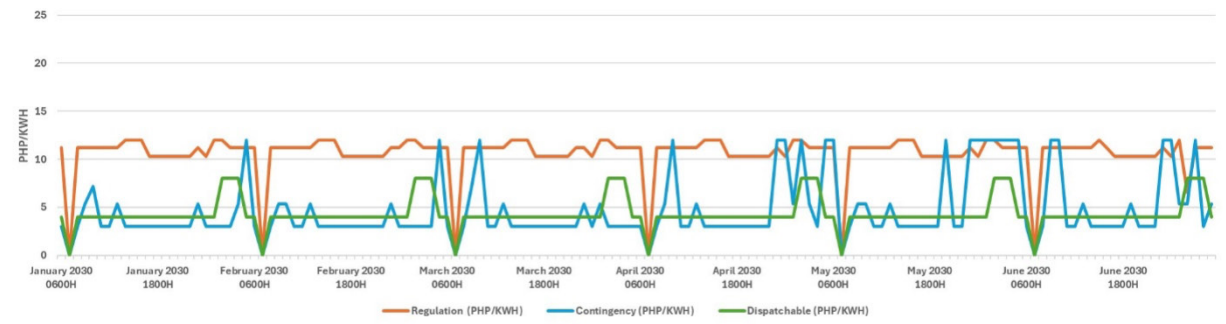


Figure 98. Luzon Reserve Market Projections under Case 2 (January to June 2030)

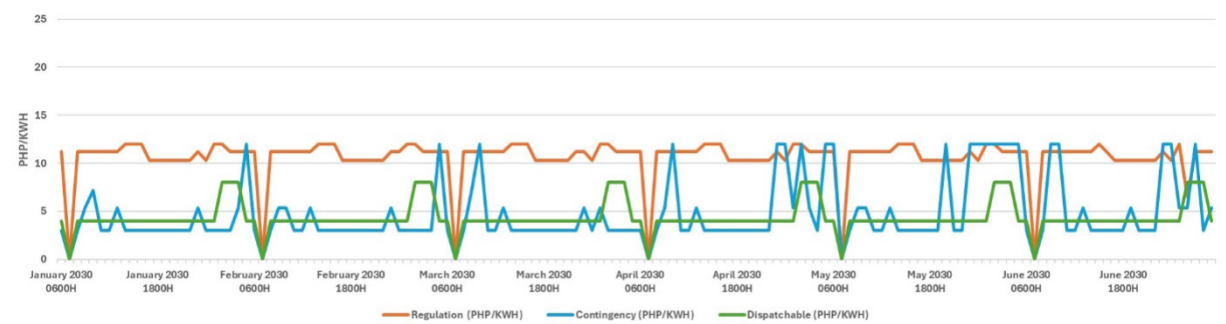


Figure 99. Luzon Reserve Market Projections under Case 1 (July to December 2030)

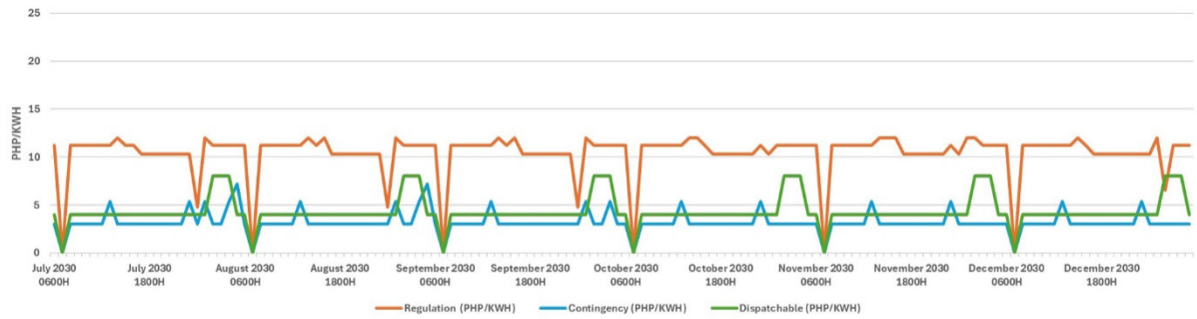


Figure 100. Luzon Reserve Market Projections under Case 2 (July to December 2030)

For Luzon, the projected energy prices in Case 1 ranged from PHP 1.26 to PHP 4.58/kWh. In the reserve market, occasional spikes in the Contingency Reserve costs were observed. These spikes in reserve prices stabilized in Case 2 due to the additional indicative capacities. The projected energy prices also decreased and ranged from PHP 0 to PHP 1.81/kWh. The drop in prices is due to the additional RE capacities coming from the indicative capacities, which can take a much larger role in supplying and can meet the demand during peak hours, resulting in a lesser reliance on conventional generation.

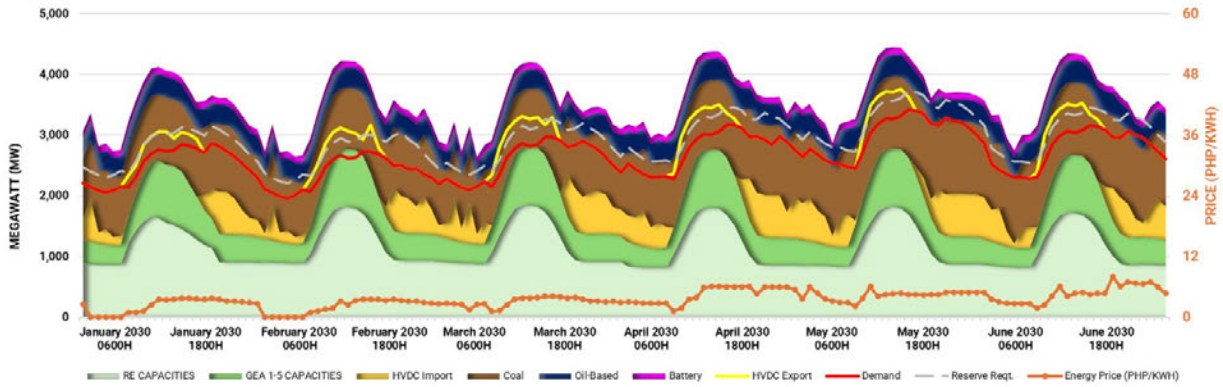


Figure 101. Visayas Energy Market Projections under Case 1 (January to June 2030)

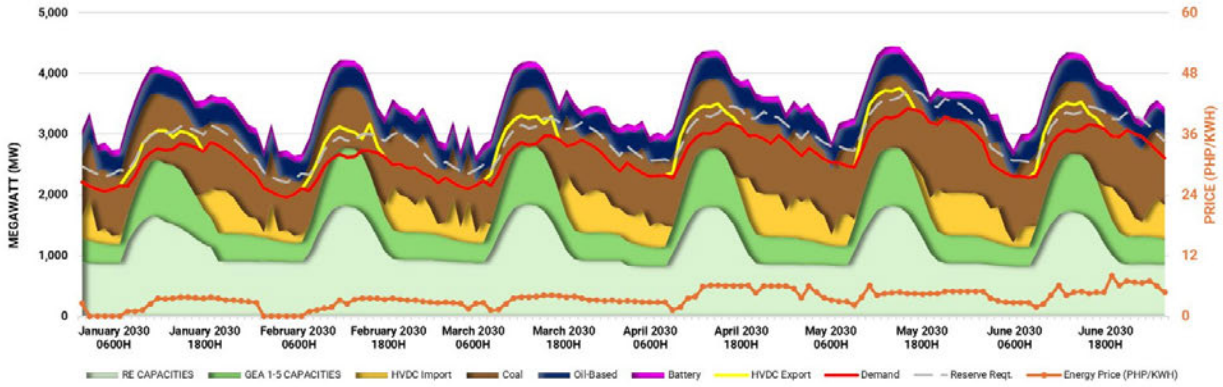


Figure 102. Visayas Energy Market Projections under Case 2 (January to June 2030)

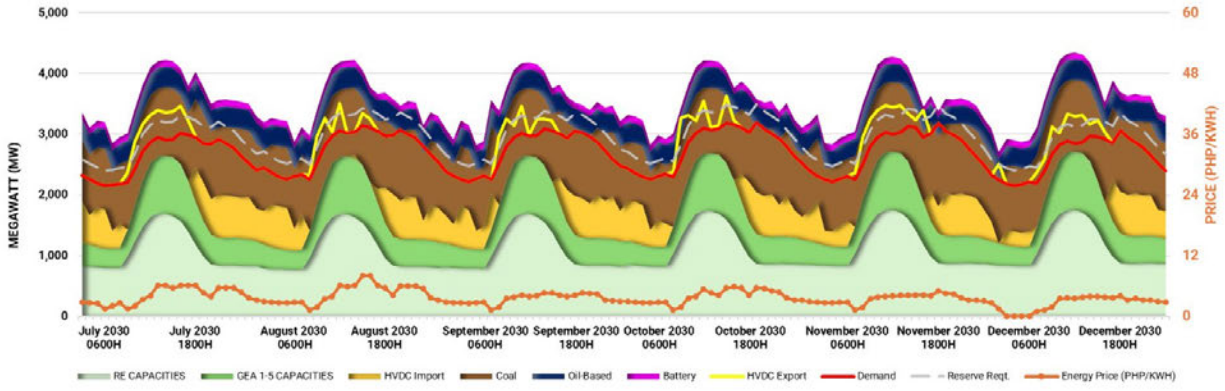


Figure 103. Visayas Energy Market Projections under Case 1 (July to December 2030)

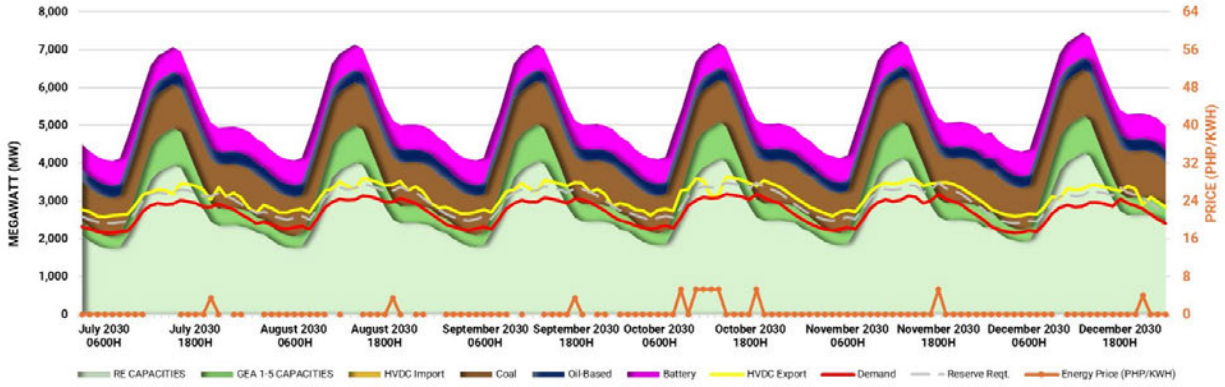


Figure 104. Visayas Energy Market Projections under Case 2 (July to December 2030)

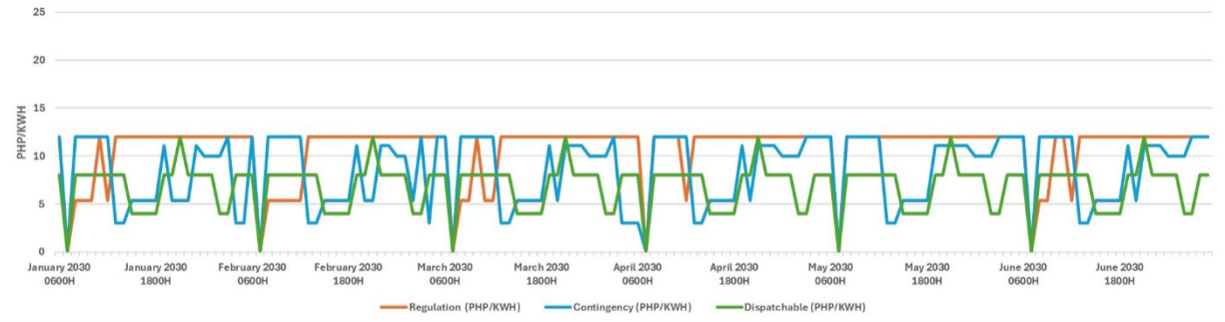


Figure 105. Visayas Reserve Market Projections under Case 1 (January to June 2030)

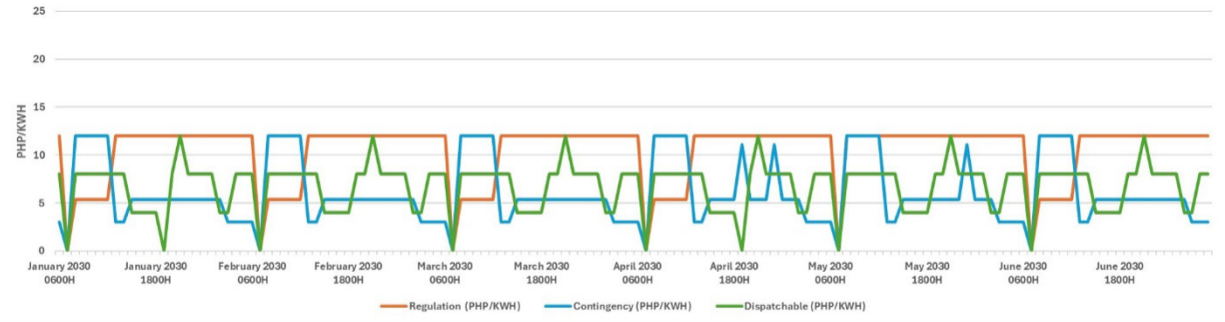


Figure 106. Visayas Reserve Market Projections under Case 2 (January to June 2030)

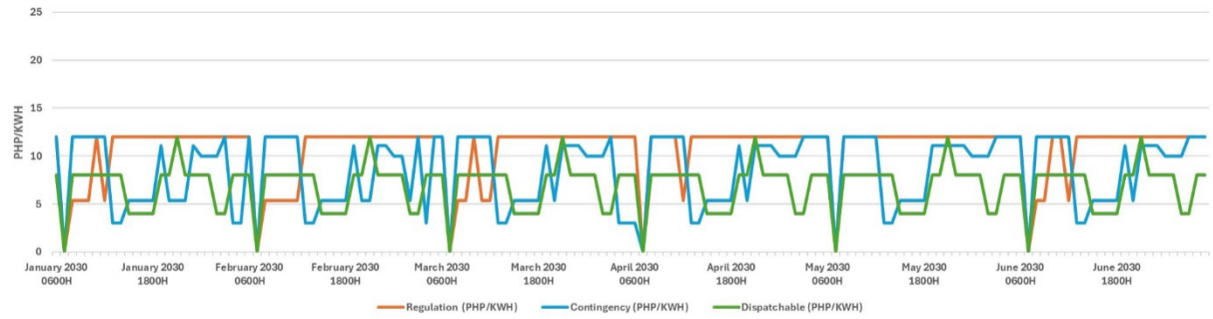


Figure 107. Visayas Reserve Market Projections under Case 1 (July to December 2030)

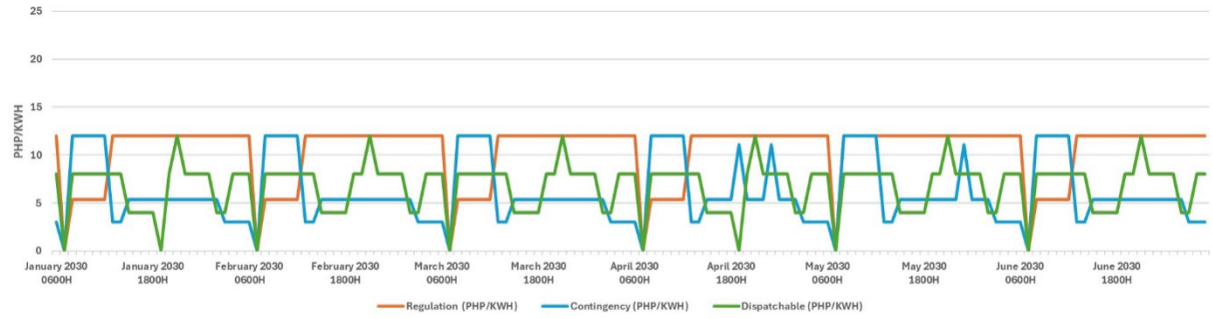


Figure 108. Visayas Reserve Market Projections under Case 2 (July to December 2030)

In Visayas, the projected energy prices in Case 1 ranged from PHP 2.07 to PHP 4.64/kWh. In the reserve market, occasional spikes in both the Contingency Reserve and Dispatchable Reserve costs were observed. The spikes were addressed in Case 2, the Contingency Reserve costs were minimized, and the Dispatchable Reserve costs were stabilized. Case 2 also lowered the projected energy prices which range from PHP 0 to PHP 1.32/kWh. During peak hours in Case 1, the HVDC flow is directed towards Mindanao and is reversed during off-peak hours. In Case 2, however, the HVDC flow is purely towards Mindanao during both peak and off-peak hours which is attributed to the additional and affordable RE capacities in Luzon and Visayas.

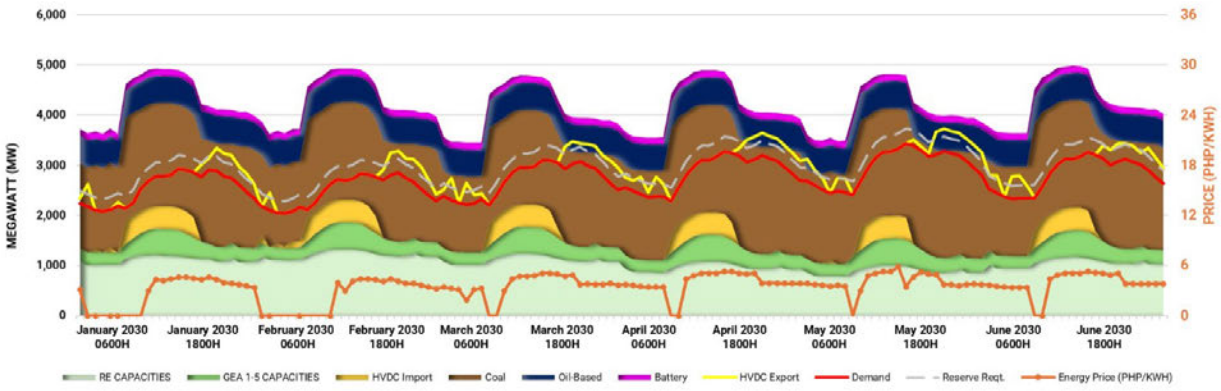


Figure 109. Mindanao Energy Market Projections under Case 1 (January to June 2030)

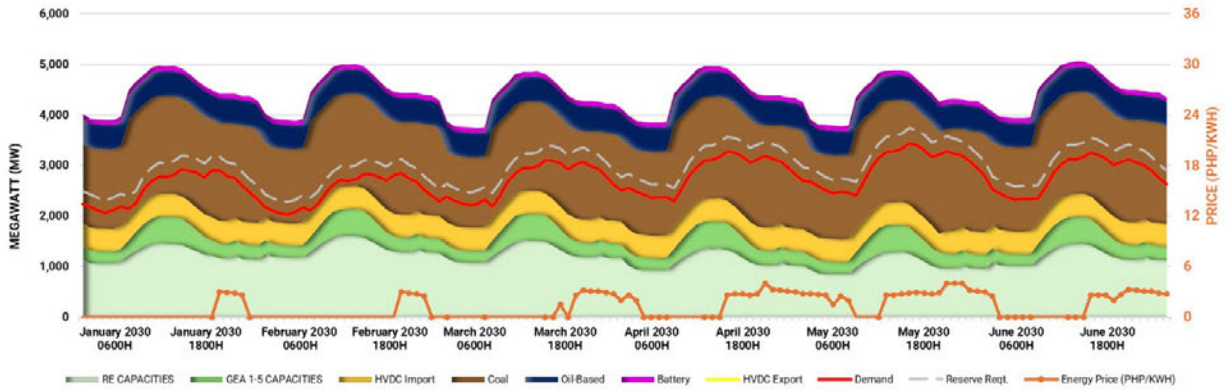


Figure 110. Mindanao Energy Market Projections under Case 2 (January to June 2030)

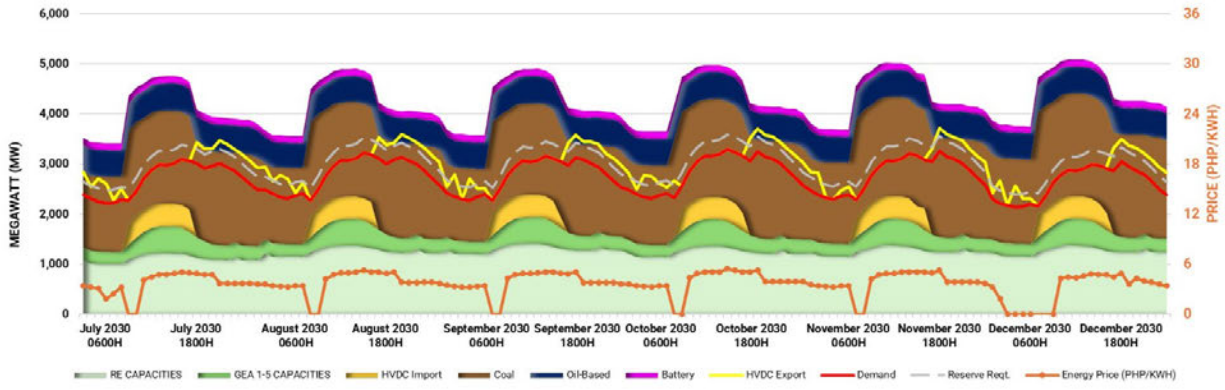


Figure 111. Mindanao Energy Market Projections under Case 1 (July to December 2030)

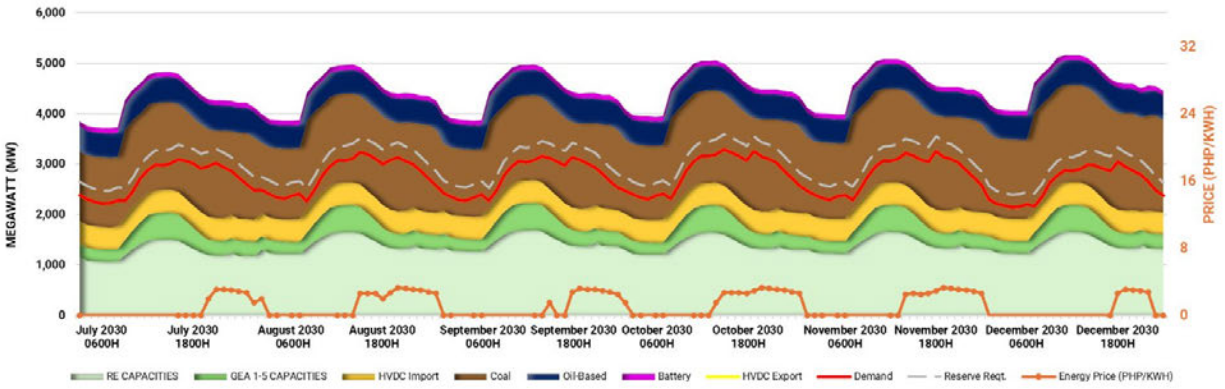


Figure 112. Mindanao Energy Market Projections under Case 2 (July to December 2030)

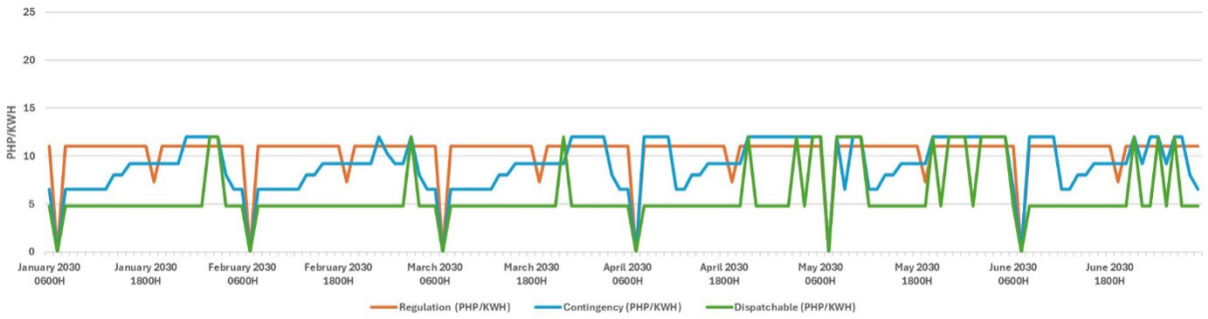


Figure 113. Mindanao Reserve Market Projections under Case 1 (January to June 2030)

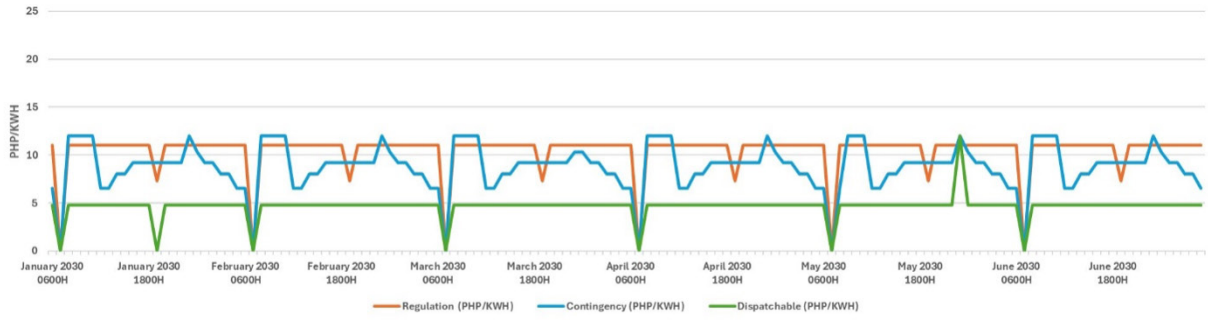


Figure 114. Mindanao Reserve Market Projections under Case 2 (January to June 2030)

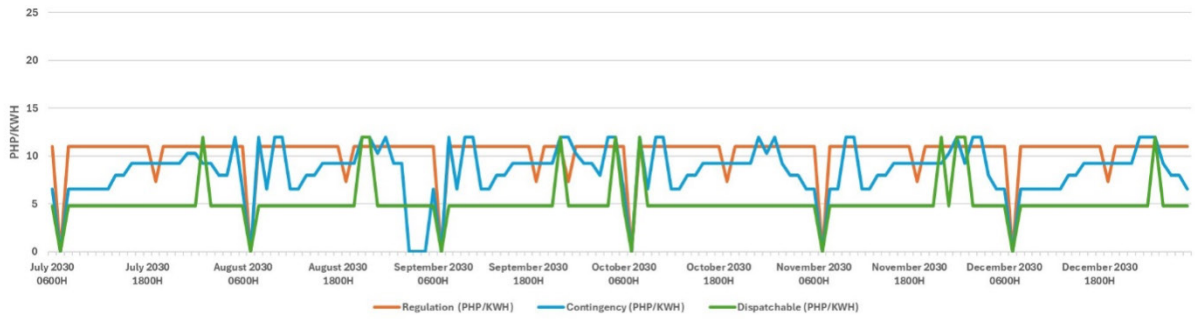


Figure 115. Mindanao Reserve Market Projections under Case 1 (July to December 2030)

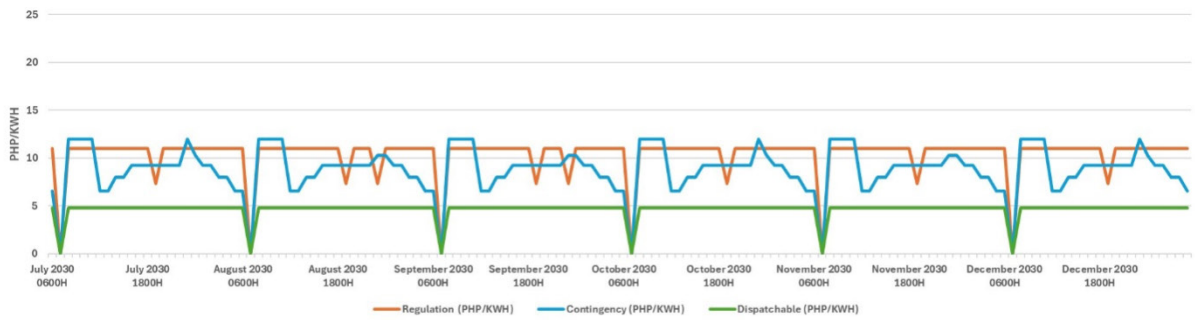


Figure 116. Mindanao Reserve Market Projections under Case 2 (July to December 2030)

In Mindanao, the projected energy prices in Case 1 ranged from PHP 2.28 to PHP 4.03/kWh. The reserve market behaved similarly to Visayas with occasional spikes in the Contingency and Dispatchable Reserve costs for Case 1. The spikes were similarly addressed in Case 2 upon considering the additional indicative capacities. Similar to Luzon and Visayas, Case 2 significantly reduced the projected energy prices, which ranged from PHP 0.46 to PHP 2.4/kWh. Aside from the increase in RE capacity, the decrease in prices can also be attributed to the extra supply coming from Visayas due to the HVDC flow.

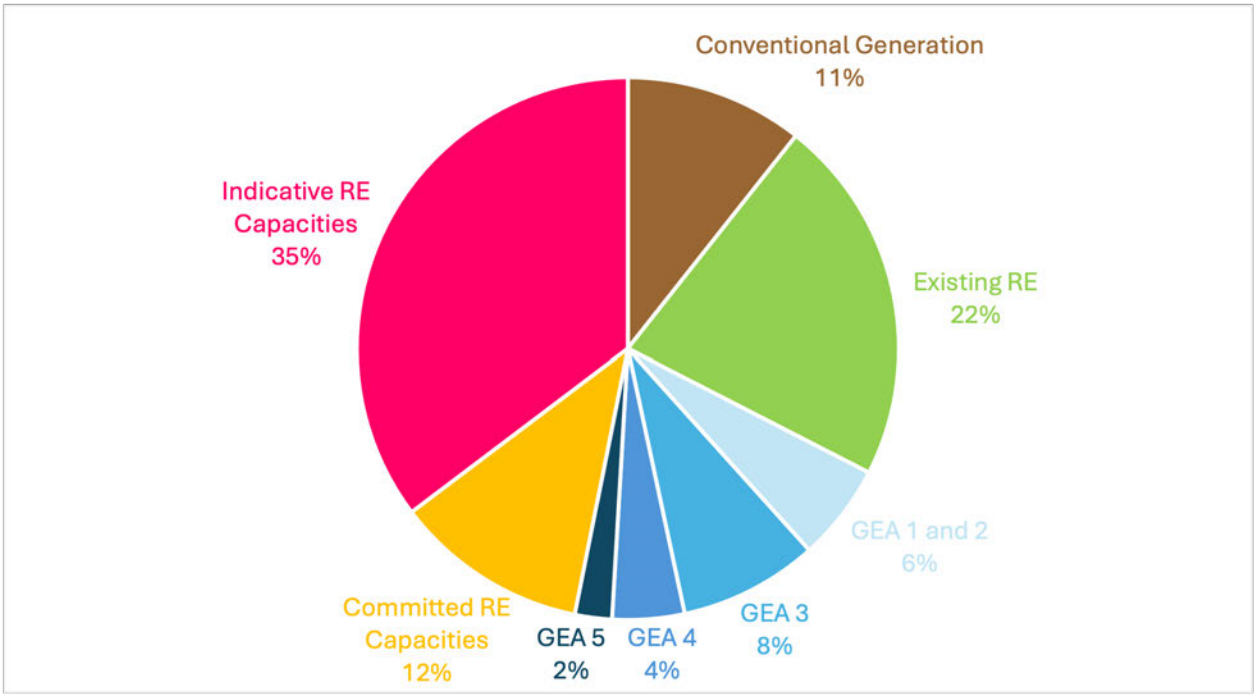


Figure 117. Projected Energy Mix for 2030

Based on the results of the study, the integration of the committed, indicative, and GEA capacities to energy and reserve also has an impact on the energy mix of the country. For the projected demand of 2030, the RE mix is expected to reach 37% with the inclusion of GEA 1-3 capacities and 44% with GEA 1-5. The overall RE share is expected to reach 54% upon the integration of the committed capacities combined with the GEA 1-5 capacities. The addition of committed, indicative, and GEA capacities have significantly observable effects on the prices with the co-optimization of the energy and reserve markets. Despite this effect, the study's findings emphasize the co-optimized market model and its requirement to overcompensate for the intermittency to be experienced due to the increasing potential RE generation. This issue can be addressed by incentivizing flexible generation and storage providers which will ensure market stability. The proper integration of these capacities shall secure and stabilize the market. The addition of committed, indicative, and GEA capacities have significantly observable effects on the prices with the co-optimization of the energy and reserve markets. Despite this effect, the study's findings emphasize the co-optimized market model and its requirement to overcompensate for the intermittency to be experienced due to the increasing potential RE generation. This issue can be addressed by incentivizing flexible generation and storage providers which will ensure market stability. The proper integration of these capacities shall secure and stabilize the market and shall realize the country's goal of reaching 35% RE share by 2030.

MAJOR EVENTS AND ENGAGEMENTS IN 2024

MARKET PARTICIPANTS UPDATE (MPU) 2024

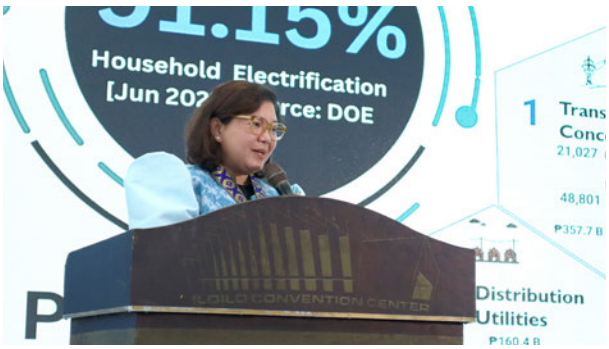
IEMOP conducted the MPU last 4 April 2024 at the Courtyard by Marriott in Iloilo City and apprised the WESM members of the market operations highlights and developments. This activity provided an interactive venue for trading participants to raise their concerns and queries with regard to WESM operations.

PHILIPPINE ELECTRIC POWER INDUSTRY FORUM (PEPIF) 2024

In coordination with the Department of Energy (DOE), the Energy Regulatory Commission (ERC), and in partnership with MORE Electric and Power Corporation, the Independent Electricity Market Operator of the Philippines Inc. (IEMOP) presented the second installment of Philippine Electric Power Industry Forum (PEPIF) last 5 April 2024, at the Iloilo Convention Center (ICON) with the theme, "Powering a Sustainable and Secure Energy Future for the Country". PEPIF aims to bring all sectors of the electric power industry together to discuss vital issues and promote synergy in the industry.

Recognizing the country's goal toward sustainable energy, PEPIF 2024 covered the following topics:

- Philippine Energy Transition Plan – Opportunities and Challenges in the Renewable Sector
- Regulations and Market Mechanisms to Support RE Development
- Achieving 100% Rural Electrification through Renewable Energy
- National Transmission Corporation's (TransCo) Role in a Sustainable Power System Infrastructure
- Transmission Development Plan and Integration of Renewable Energy for a Reliable and Secure Grid
- Achieving RE Mix Targets while Ensuring Reliable Supply for End-Users
- Country's Path Towards Achieving a Sustainable and Secure Energy Future



CAPACITY BUILDING EXCHANGE ON ELECTRICITY MARKETS

This forum held on 11-12 July 2024 was a three-day executive capacity exchange on electricity markets organized by the United States Energy Association (USEA) in collaboration with the Independent Electricity Market Operator of the Philippines, Inc. (IEMOP), the Philippine Department of Energy (DOE), the Energy Regulatory Commission (ERC), other attached agencies, and the rest of the Philippine energy stakeholder groups.

This undertaking is funded by the U.S. Department of State, Bureau of Energy Resources, and Power Sector Program (PSP) in support of the Clean EDGE (Enhancing Development & Growth through Energy) Asia, for USEA to present how U.S. regulators, utilities, companies, and system operators have used competitive energy markets in integrating increasing levels of variable renewable energy (VRE) into the electric power system.

VARIABLE RENEWABLE ENERGY INTEGRATION AND CAPACITY MARKET WORKSHOP

Deloitte, in coordination with IEMOP, spearheaded the recently concluded workshop entitled "Variable Renewable Energy Integration and Capacity Market" which is an undertaking funded by the U.S. Department of State, Bureau of Energy Resources (ENR), in partnership with Deloitte Touche Tohmatsu Limited held last 11-12 July 2024 here in Metro Manila, Philippines.

This workshop aimed to equip the Regulators, Market Operator, System Operator, and other power industry stakeholders with critical insights into capacity market mechanisms and strategies to ensure stable grid operations amidst the increasing integration of renewable energy systems. The two-day workshop also aimed to impart and discuss key lessons on energy transition through wind, solar photovoltaic (PV), and battery energy storage systems (BESS) technologies in other jurisdictions over recent years.

Ultimately, the workshop is expected to develop a high-level road map to outline strategic approaches for achieving desired outcomes in VRE integration, capacity market implementation vis-à-vis demand response participation, and ancillary services markets.

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IEMOP VISITS ALAMINOS SOLAR RENEWABLE ENERGY FROM ACEN IN ALAMINOS, LAGUNA

On 6 September 2024, IEMOP had the privilege to tour the Alaminos Solar Renewable Energy from ACEN in Laguna. With a 120 MW solar farm + 40 MW battery energy storage of installed capacity, this plant powers 41,000 homes with clean energy with an estimated 111,000 MT CO2e avoided annually.

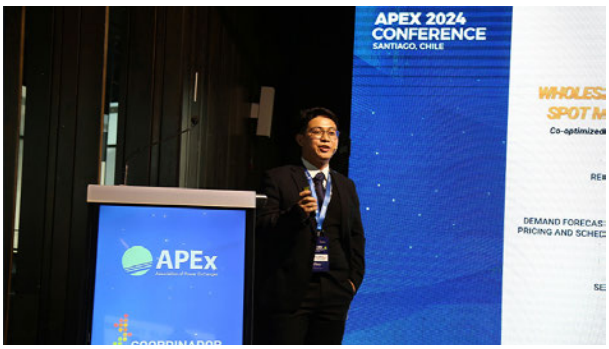
The plant visit included an overview of ACEN's sustainability initiatives, a walkthrough of the Plant Operations Center, and a tour of the solar farm — home to the innovative agrivoltaics program aka "Solar Gulayan" combining solar power generation and agriculture.

Furthermore, ACEN's inspiring circularity efforts have diverted 32,540 kg of plastic from landfills— parts of which were used in the construction of some of their office facilities on the site. Their Tree Nursery project, aiming to grow 120,000 seedlings, and the surrounding Carbon Forest highlight their commitment to biodiversity.

ASSOCIATION OF POWER EXCHANGES (APEX) ANNUAL CONFERENCE IN SANTIAGO, CHILE

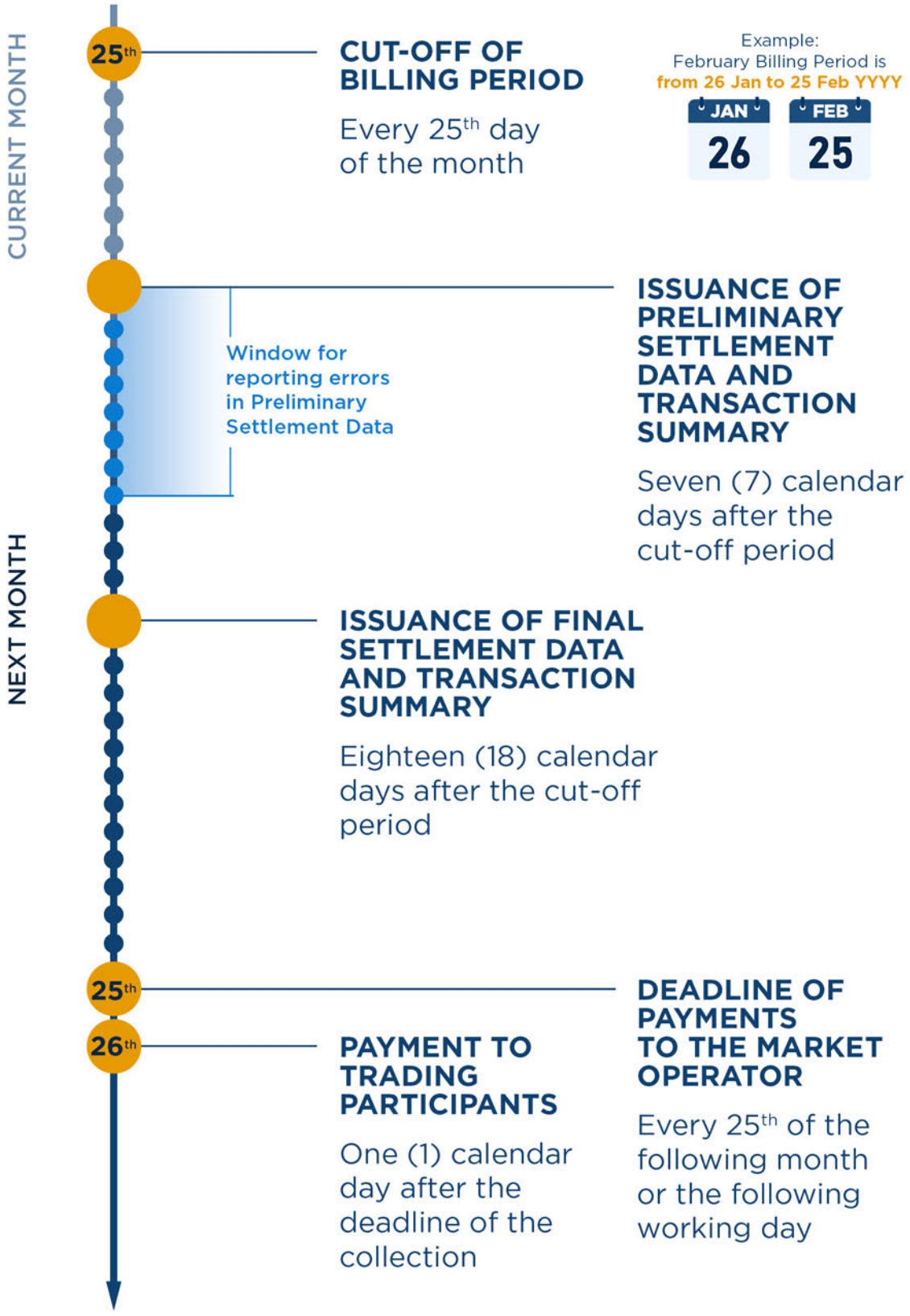
Held in Santiago, Chile, on 28-29 October 2024, IEMOP is proud to have beenrepresented at the APEx 2024 Conference by IEMOP Chief Operating Officer, Engr. Robinson P. Descanzo and Operations Planning and Modeling Manager, Engr. Edsel Y. Evasco. APEx is an international organization uniting Power Exchanges from around the world. APEx was formed to facilitate the development and communication of ideas and practices in the operation of global competitive electricity markets. One of its primary intentions is to provide a platform for sharing of information between its members. This year's summit is hosted by Coordinador Eléctrico Nacional of Chile, the market operator of Chile that began operating in 2017.

Our very own Engr. Chris Warren C. Manalo, Assistant Manager for Market Simulations and Analysis, also took the stage as a presenter, being one of the APEx Bright Sparks Awardees, sharing valuable insights on the Philippine electricity market updates and various market developments. The Association of Power Exchanges (APEx) facilitates the development and communication of ideas and practices in the operation of global competitive electricity markets. In 2015, APEx launched the Bright Sparks Program to support the development of young energy professionals. The program gives three scholarship winners from around the world the opportunity to attend the annual APEx Conference to meet with international thought leaders and experience the local industry and culture. This year, IEMOP is one of the three (3) winners to have been selected for the 2024 installment of this program.



WESM BILLING AND SETTLEMENT

TIMELINE



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