Annual Market Assessment Report

26 November 2021 to 25 November 2022

This Report is prepared by the
Philippine Electricity Market Corporation –
Market Assessment Group
and approved by the
Market Surveillance Committee

17 AUGUST 2023

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ANNUAL MARKET ASSESSMENT REPORT

This Annual Market Assessment Report (AMAR) provides an assessment of the results on the integrated Luzon and Visayas operations of the Wholesale Electricity Spot Market (WESM) for the covered period (26 November 2021 to 25 November 2022). This includes an overview on the results of the market performance, trends, and the corresponding drivers which in turn provide the means to assess competition and conditions in the WESM, as well as the bidding behavior of trading participants. The report is sectionalized into three (3) seasons such as the Cool Dry Season (26 November 2021 to 25 February 2022), Hot Dry Season (26 February to 25 May 2022), and Rainy Season (26 May to 25 November 2022).

I. Highlights of Market Assessment

A. Cool Dry Season

- Damaged transmission lines in Visayas region brought about by the onslaught of Typhoon Odette.
- ERC declared Market Suspension in Visayas region on 1945h of 16 December 2021 due to the impact of Typhoon Odette and was eventually lifted on 1000h of 17 January 2022 except for the Bohol Island which was only reconnected to the grid on 10 February 2022 (please refer to Table 2).
- High level of capacities on outage was noted due to forced and maintenance outages attributed to the technical issues of the generating units aggravated by the restriction of supply for natural gas from the SPEX Malampaya. Moreover, outages during the latter part of the billing year were mainly attributable to the scheduled planned outages as approved in the Grid Operating Maintenance Program (GOMP) of the National Grid Corporation of the Philippines (NGCP).
- Unusual high level of market prices persisted driven by narrow supply margin attributed to high level of capacities on outage and ramp limited capacities.
- Significant increase in the frequency of issuance of secondary price cap in the Luzon region, from 1,765 total intervals last year to 23,142 total intervals this year.

B. Hot Dry Season

- High levels of capacities on outage persisted during the onset of the summer season.
- Decreased supply margin was a result of high level of demand while also noting the lower level of effective supply as affected by the observed high level of capacities on outage which subsequently resulted in high market prices. Table 1 further provides for significant events that occurred during the season.

Table 1: Significant events in WESM

Billing Month	Significant events in WESM
March 2022	Power peak demand of 13,835 MW on 23 March 2022 at 1410H surpassing the recorded all time highest peak demand of 13,676 MW on 28 May 2021
May 2022	All-time highest peak demand recorded on 12 May 2022, 1440H at 14,358 MW

C. Rainy Season

- Tripping of the 230kV Hermosa-BCCPP lines 1 and 2 caused grid disturbances on 18 June 2022, leading to the isolation of various power plants from the Luzon Grid which subsequently led to the placing of the grid under red alert[1] level from 1425h to 1730h due to generation deficiency.
- Unusual increase in the issuance of secondary price cap due to persistent high prices in the market. The rainy season had more secondary price cap issuances compared to the hot and cool-dry seasons. High prices were especially persistent in September and October 2022 which were the result of changes in the offer behavior of the generators due to the effects of the Russia-Ukraine war and other circumstances affecting the said behavior – with Natural gas and Coal having the more notable changes.
- Massive power brownouts hit Negros-Panay Sub Grid due to damaged submarine cables on 06 July 2022 at 0655h, and eventually came back to operation after the restoration of the submarine cable on the same day at 0925h.
- Luzon Transmission Lines were down after the onslaught of Typhoon Karding on 25 September 2022 and went back to operation on 26 September 2022.
- Tripping of the Bolo-Nagsaag 500kV line, which subsequently led for the outages of various power plants, causing the Luzon Grid to be placed under red and yellow alert levels on 12 September 2022.

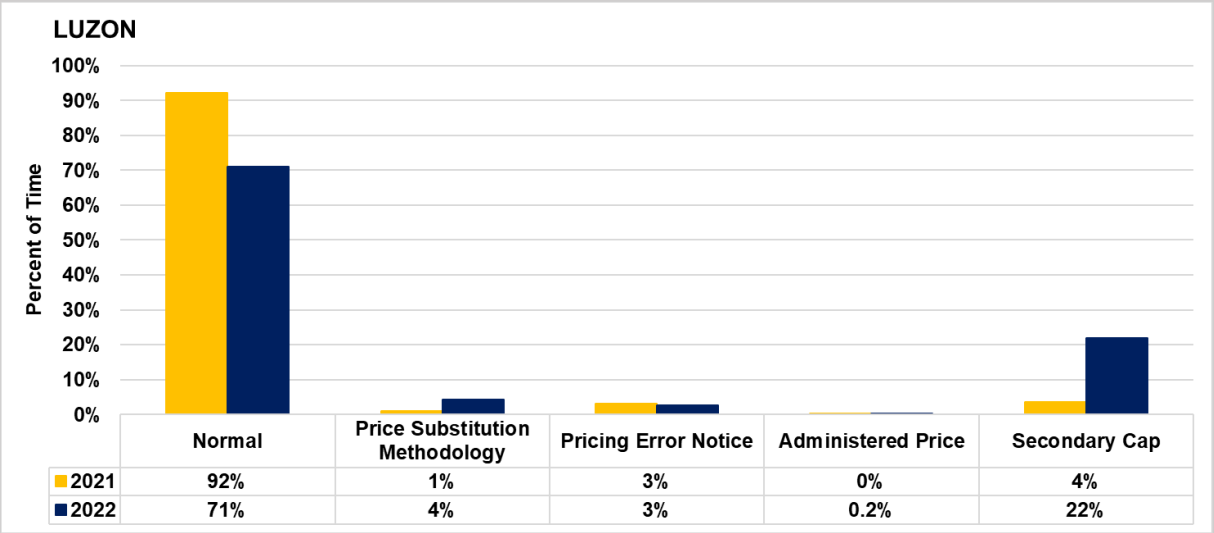
II. Assessment of the Market

- Majority or 65 - 71 percent of the time (74,591 trading intervals for Luzon and 67,971 for Visayas), the market cleared under a normal pricing condition, as shown in Figures 1 and 2 below along with other pricing conditions for the billing year.
    - This was a decrease from last year's 91-92 percent which was mainly attributable to the increase in the issuances of price mitigating measures in the market brought about by significant events that affected the resulting market prices.
- Congestions occurred at 4 - 4.3 percent of the time from 1 percent of the time last year, which triggered the application of Price Substitution Methodology (PSM) to 4,238 trading intervals. Over half of these intervals were due to the frequent congestion in the Samboan-Amlan line connection between the Cebu-Negros islands and Maasin-Ubay line between Leyte-Bohol Islands. PSM was observed during the Rainy Season due to network congestions which coincided with the tripping of various transmission lines resulting from the effects of the typhoons during the season.
- Intervals with pricing error notices remained at around 3 percent of the time for both Luzon (2,671 trading intervals) and Visayas (2,758 trading intervals) mainly accounted as inappropriate input data.
- The issuance of administered prices (AP) resulting from market intervention and/or market suspension events significantly increased in Luzon from 0.04 percent (21 trading intervals) for the 2021 billing period to 0.2 percent (221 trading intervals) this period. At the same time, the Visayas

[1] Red alert was issued when the following conditions exists:
(i) The Primary Reserve is zero;
(ii) The Operating Margin is less than the Load of the largest Synchronized Generating Unit;
(iii) The Available Generating Capacity is less than the Demand; or
(iv) There is Critical Loading or Imminent Overloading of transmission lines or Equipment

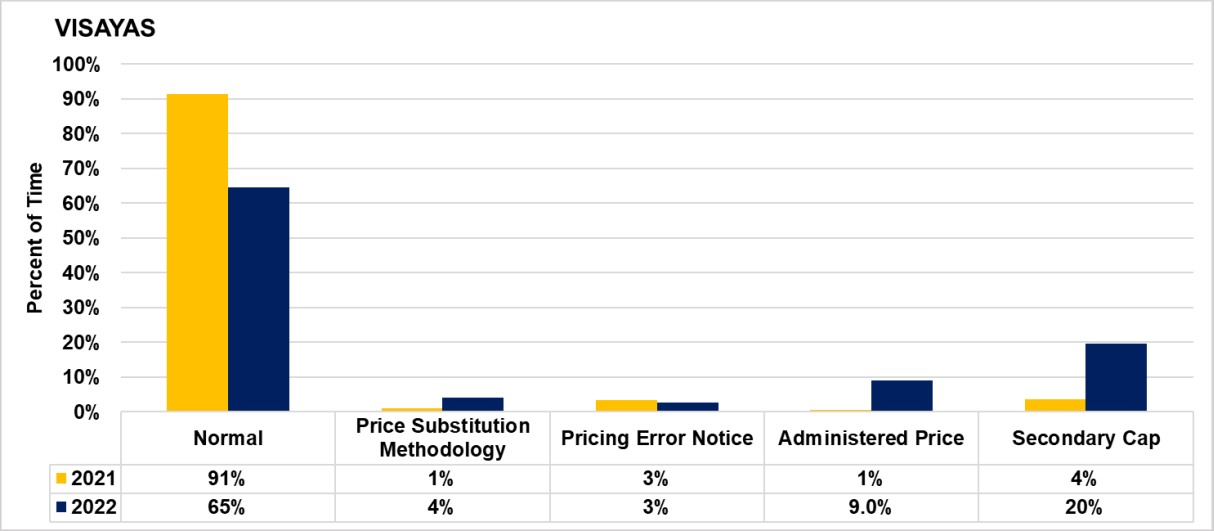
region likewise posted a significant increase, where issuances went up from 0.6 percent to 9 percent (9,493 trading intervals from 295 trading intervals last year).

- Notable increase in the trend of intervals imposed with the secondary price cap was noted. This was more evident during the rainy season. Statistics showed that 20-22 percent of the time, the cumulative price threshold of PHP9,000/MWh was breached using the Generator-Weighted Average Price (GWAP). This is a 16 - 18 percent increase as compared to last year's 4 percent of the time imposition.
- Regional differences of prices between the Luzon and Visayas grids were likewise present as a result of the unavailability of the High-Voltage Direct Current (HVDC) line in a number of instances for the covered period.



	Normal	Price Substitution Methodology	Pricing Error Notice	Administered Price	Secondary Cap
2021	92%	1%	3%	0%	4%
2022	71%	4%	3%	0.2%	22%

Figure 1 Summary of Pricing Conditions in Luzon, 2021 to 2022



	Normal	Price Substitution Methodology	Pricing Error Notice	Administered Price	Secondary Cap
2021	91%	1%	3%	1%	4%
2022	65%	4%	3%	9.0%	20%

Figure 2: Summary of Pricing Conditions in Visayas, 2021 to 2022

- In Luzon, the hot dry season recorded the most share of normal market pricing outcomes while at the same time noting the lowest in terms of imposition of AP and secondary price cap. Meanwhile, for the

Visayas region, intervals imposed with AP posted a significant increase of 9 percent share throughout the year.

- As provided in Table 2 below, intervals under market intervention were due to MMS stoppage, non-generation of RTD schedule, or insufficient supply leading to manual load dropping. On the other hand, market suspension was issued by the ERC in cases of calamities or national and international security emergencies, and in this case the spot market was suspended due to the onslaught of Typhoon Odette.

Table 2: Number of Market Intervention and Market Suspension, 2022

Calendar Year 2022		
Number of Market Interventions/Suspension per Intervals		**Reasons for Market Intervention**
No. of Intervals	Initiated by:	
6	SO initiated in Luzon	Erroneous Real Time Data
192	SO initiated in Visayas	Insufficient supply leading to manual load dropping and threat to the systems security
201	MO initiated System Wide	MMS Workflow Stoppage
4,728	ERC Initiated in Visayas	Grid Disturbance Due to Typhoon Odette
7,044	ERC Initiated in Bohol Region (only)	Grid Disturbance Due to Typhoon Odette

- The breakdown of pricing conditions per season and as discussed above are illustrated in Figures 3 and 4 below.

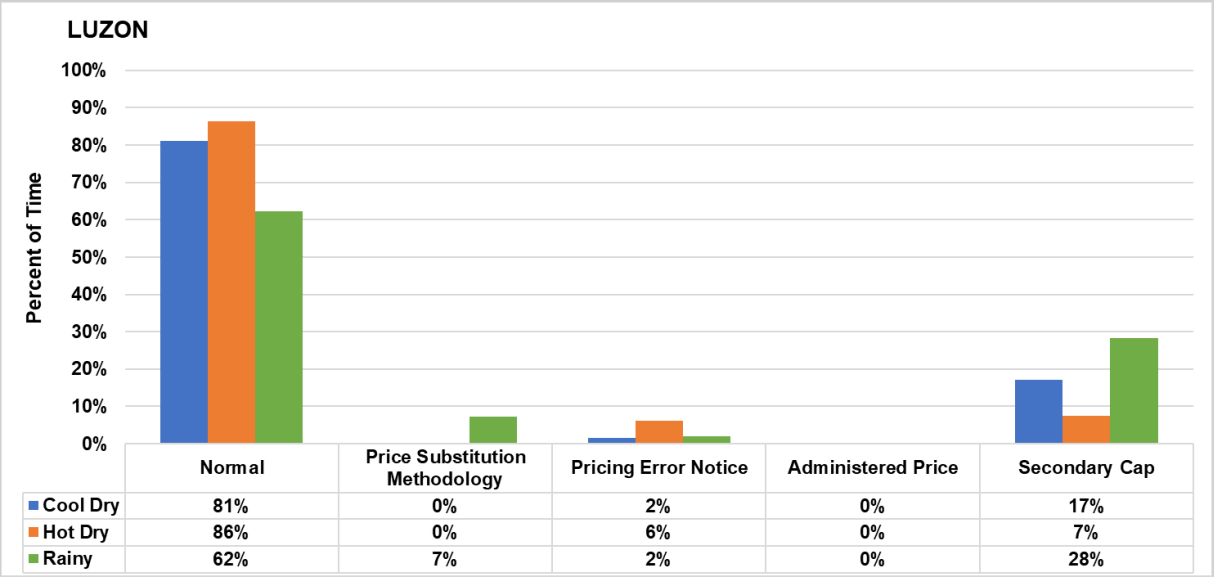
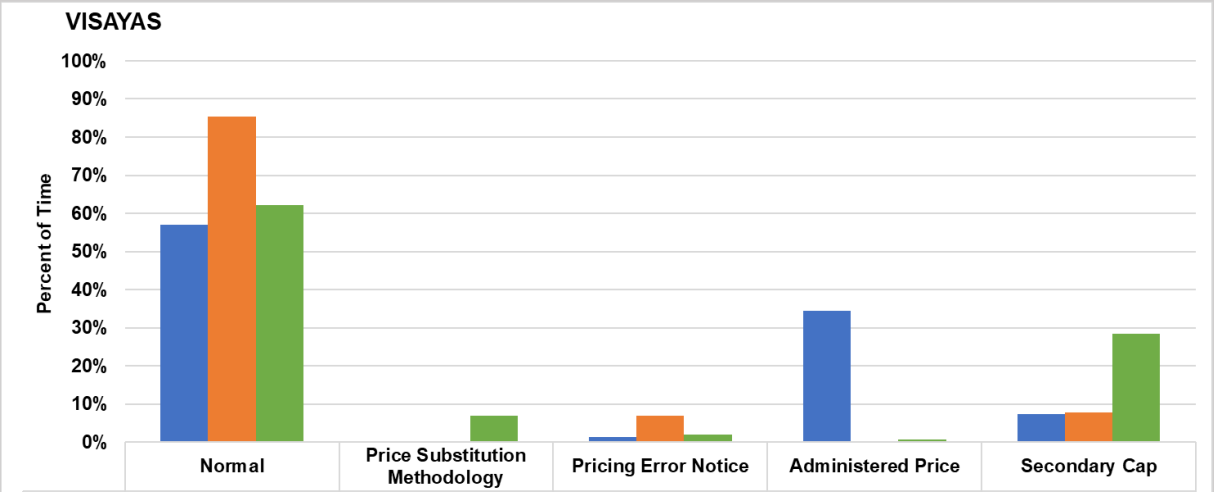


Figure 3: Summary of Pricing Conditions in Luzon, 2022 Seasons



	Normal	Price Substitution Methodology	Pricing Error Notice	Administered Price	Secondary Cap
Cool Dry	57%	0%	1%	34.3%	7%
Hot Dry	85%	0%	7%	0%	8%
Rainy	62%	7%	2%	1%	28%

Figure 4: Summary of Pricing Conditions in Visayas, 2022 Seasons

III. Market Outcome

A. Price

i. Price and Supply Margin

- The year-on-year Load-Weighted Average Price (LWAP) increased and posted a significant change by an average of 47.1 percent, from PHP5,266/MWh in 2021 to PHP7,746/MWh in 2022. The drastic increase was driven by, among others, high level of capacities on outage of the plants, congestions resulting from transmission line outages, and the changes in the offer behavior of the trading participants considering various notable events (i.e., Indonesian Coal Ban, Russia-Ukraine war etc.) which subsequently affected the resulting market prices. Impositions of market interventions likewise contributed to the increased in the price outcome.
- The uptrend in LWAP, as shown in Figure 5, was also shaped by the increase in the level of demand that caused for the decreased supply margin.
- The increase in ramp limited capacities likewise contributed to this reduced supply in the grid. Ramping limitation arises when generator power output is restricted from delivering its maximum offered capacity due to the plants' intrinsic ramp rates, as submitted by the generators, and the merit ordering despite having sufficient available capacity offered in the market. This is particularly true when large generating plants with slower ramp rates and relatively cheaper offer prices are unable to quickly generate power to meet the sudden change in demand.
- As a result, slow ramping generators can only be scheduled based on their offered ramp rate, capacities, and offered prices. To accommodate the demand requirement, the next more expensive offer block that can respond to the demand will be scheduled.

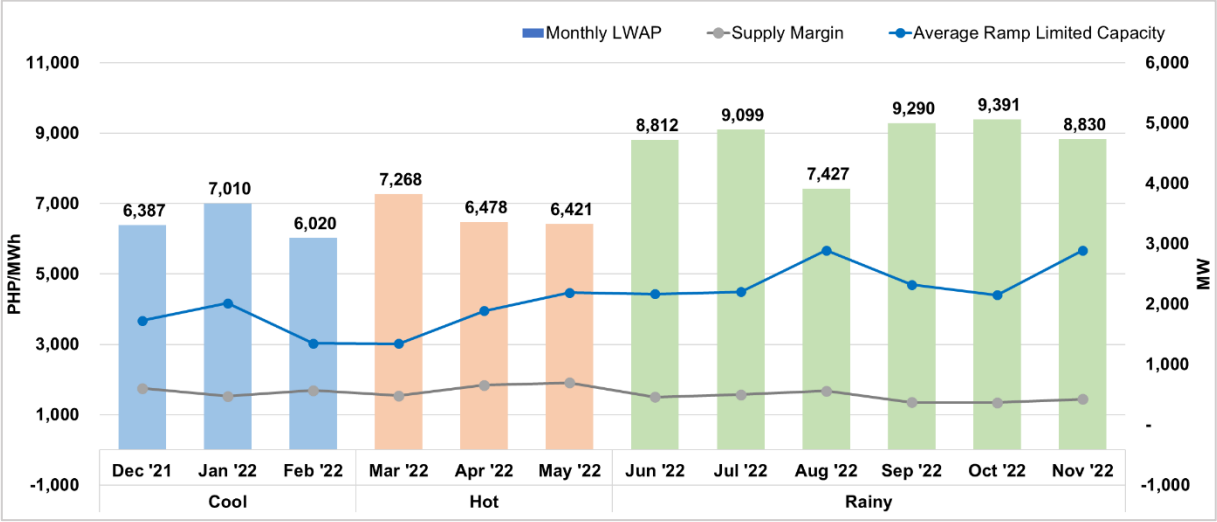


Figure 5: Monthly System LWAP and Hourly Supply Margin, Dec 2021 to Nov 2022

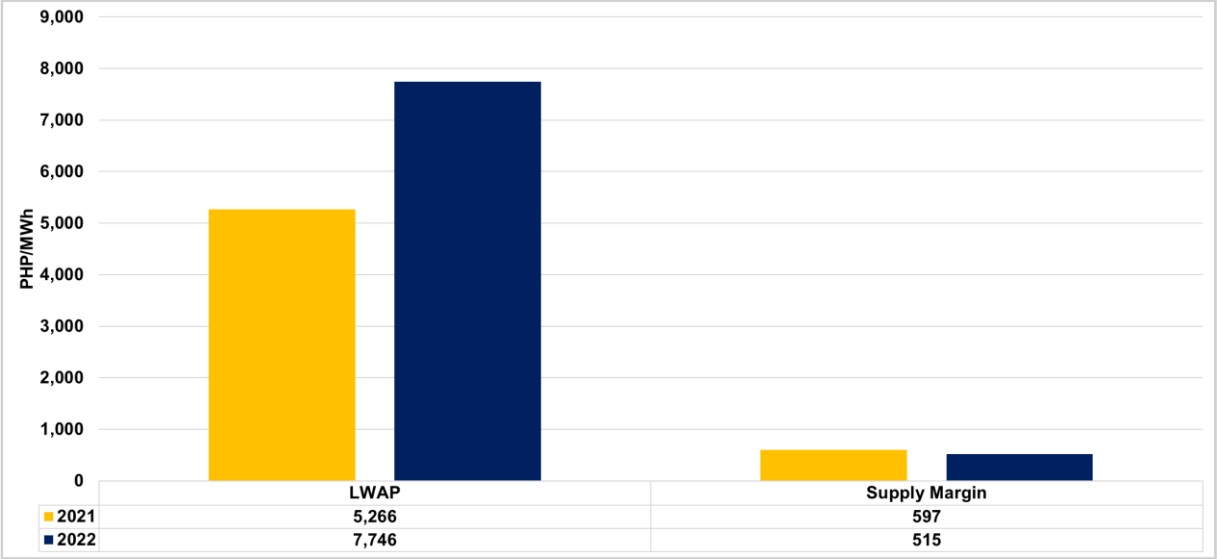


Figure 6: System LWAP and Average Supply Margin, 2021 vs 2022

- Average prices per season posted higher level of average LWAP experiencing notable changes come the 2022 billing period:

Season	Average LWAP 2021	Average LWAP 2022	Percent Change
Cool Dry	PHP2,395/MWh	PHP6,451/MWh	169%
Hot Dry	PHP5,585/MWh	PHP6,703/MWh	20%
Rainy	PHP5,376/MWh	PHP8,810/MWh	64%

- The trend of the price is the inverse trend of the average supply margin as depicted in the table below:

Season	Average Supply Margin 2021	Average Supply Margin 2022	Percent Change
Cool Dry	2,415 MW	550 MW	(77%)
Hot Dry	1,503 MW	609 MW	(61%)
Rainy	462 MW	452 MW	(2.2%)

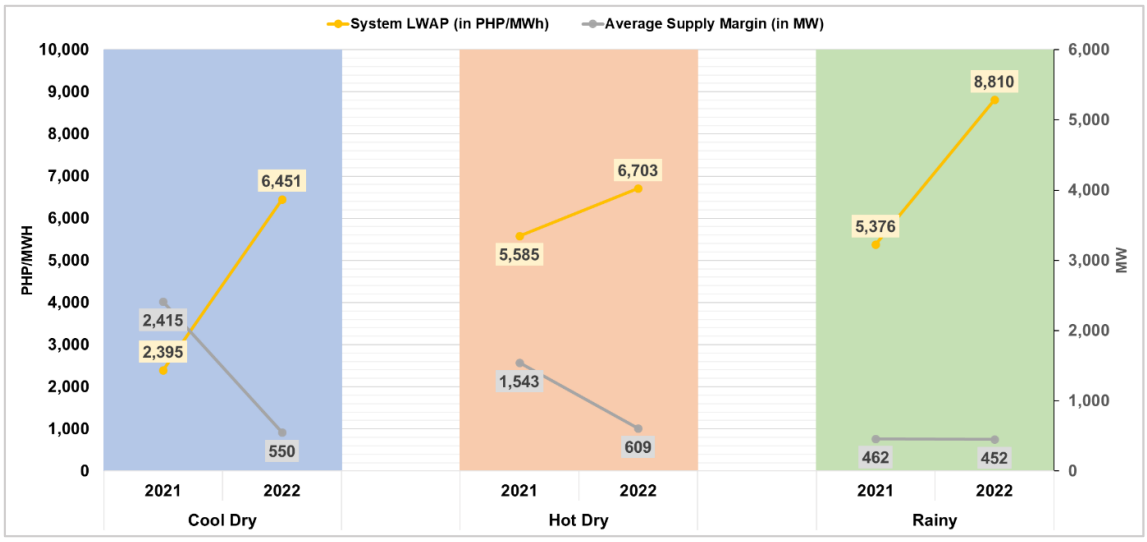


Figure 7: System LWAP and Average Supply Margin, 2021 vs 2022 Seasons

- As shown in Figure 8, average price of peak hours during the rainy season saw the greatest increase at around 168 percent attributed to the upward movement of demand due to the continuous growth as forecasted by the Department of Energy in its Philippine Energy Plan. Furthermore, the increase in peak prices for the rainy season was a result of the plummeting supply margin, due to higher level of capacities on outages and the unavailability of some generators due to ramp limited capacities.
- Average off-peak prices in all seasons of 2022 likewise posted increase of 179, 41, and 67 percent.

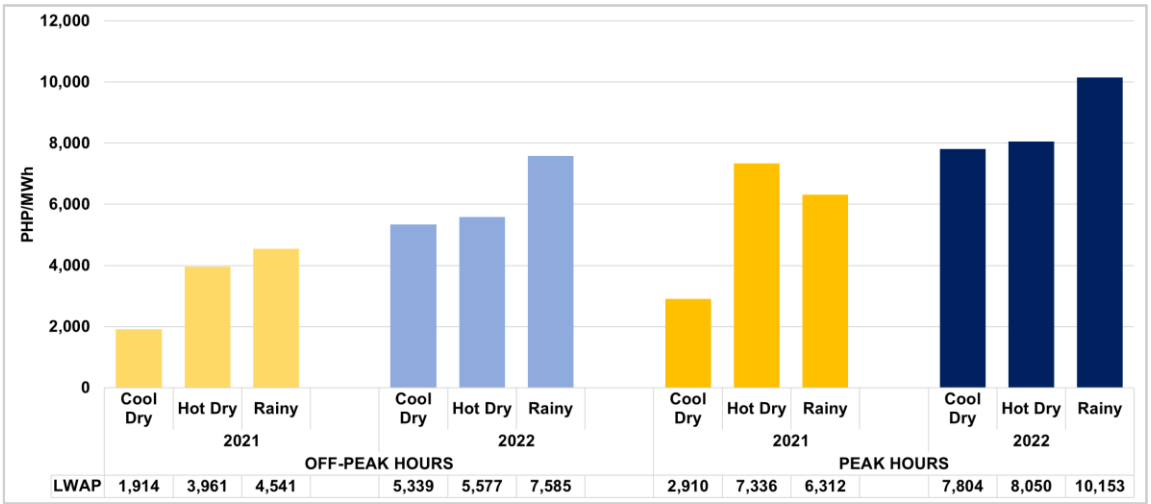
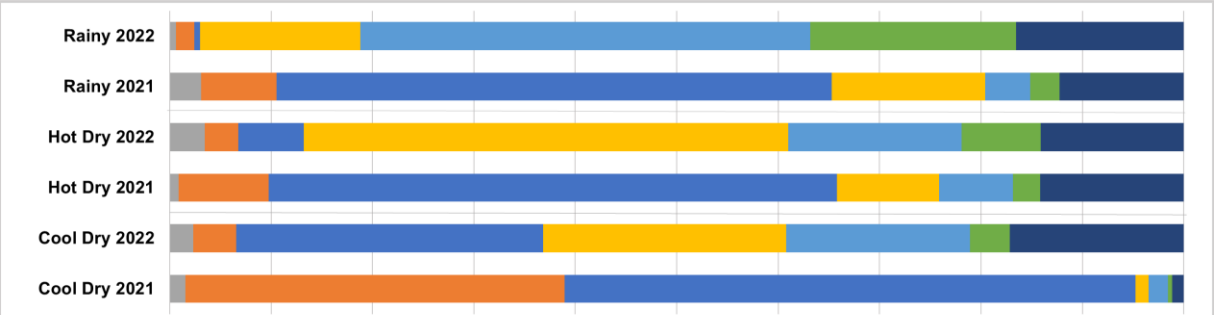


Figure 8: System LWAP Based on Hour Type, 2021 to 2022 Seasons

ii. Price Distribution

- Majority of the prices in 2022 lie within the PHP4,000/MWh to PHP6,000/MWh range as compared to last year when most were within the PHP2,000/MWh to PHP4,000/MWh range.
- Interestingly, the rainy season recorded the highest percentage of prices above PHP6,000/MWh, among other seasons of the year.



	Cool Dry 2021	Cool Dry 2022	Hot Dry 2021	Hot Dry 2022	Rainy 2021	Rainy 2022
0 & below	2%	2%	1%	3%	3%	1%
0 to 2,000	37%	4%	9%	3%	7%	2%
2,000 to 4,000	56%	30%	56%	6%	55%	1%
4,000 to 6,000	1%	24%	10%	48%	15%	16%
6,000 to 8,000	2%	18%	7%	17%	4%	44%
8,000 to 10,000	0%	4%	3%	8%	3%	20%
More than 10,000	1%	17%	14%	14%	12%	17%

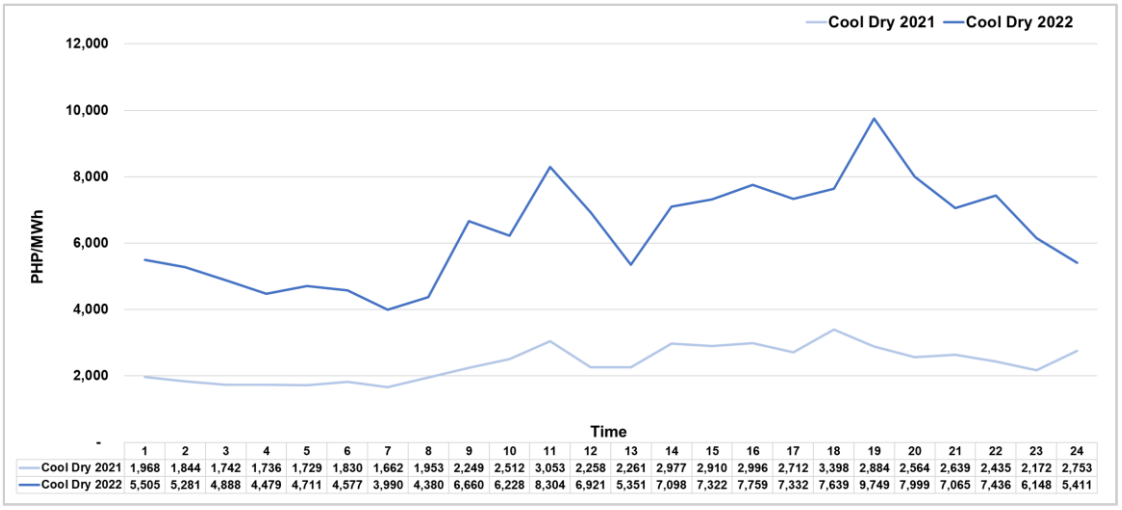
Figure 9: System LWAP Frequency Distribution, 2021 & 2022 Seasons

iii. Hourly Price Profile

- In a per 5-minute resolution[2], the 2022 price patterns for Cool and Rainy seasons show a significant increase from last year, mostly across the peak hours.
- Among all seasons, the cool dry and rainy periods experienced the most drastic change in price movement and volatile pattern owing to high system demand that contributed in the decreased supply margin during this period, as observed in Figures 10, 11, and 12.
- Even with the onset of the rainy season, average system demand remained relatively high, posting almost the same with that of the hot dry season while average effective supply dipped, resulting in price increase by almost half, as compared to its seasonal counterpart in 2021.
- Throughout the different seasons in 2022, market prices peaked at different trading intervals, indicating different patterns of interplay between the supply and demand. High prices were noted during the following season and intervals:

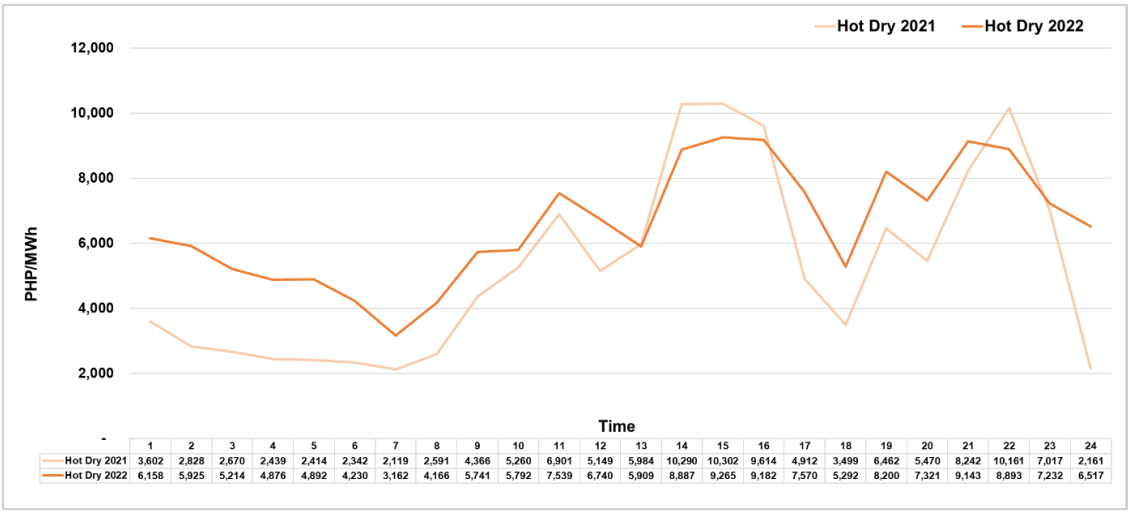
Season	2021	2022
Cool Dry	evening at 1800h	evening at 2000h
Hot Dry	afternoon at 1500h	
Rainy	evening at 2200h	evening at 1900h

[2] The prices are computed on a per interval resolution to reflect the bona fide price outcome.



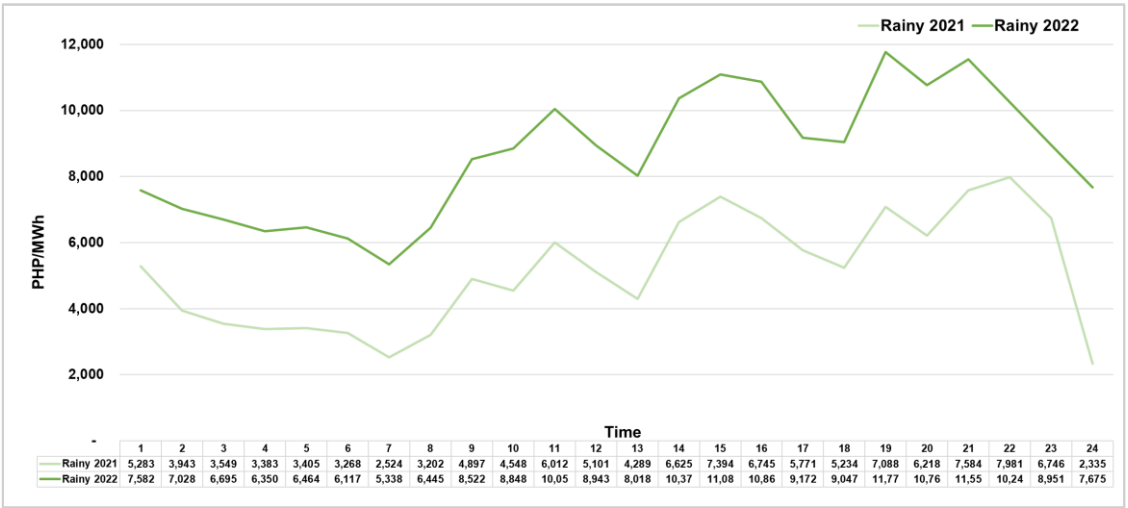
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Cool Dry 2021	1,968	1,844	1,742	1,736	1,729	1,830	1,662	1,953	2,249	2,512	3,053	2,258	2,261	2,977	2,910	2,996	2,712	3,398	2,884	2,564	2,639	2,435	2,172	2,753
Cool Dry 2022	5,505	5,281	4,888	4,479	4,711	4,577	3,990	4,380	6,660	6,228	8,304	6,921	5,351	7,098	7,322	7,759	7,332	7,639	9,749	7,999	7,065	7,436	6,148	5,411

Figure 10: System LWAP Hourly Curve, 2021 vs 2022 Cool Dry Season



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Hot Dry 2021	3,602	2,828	2,670	2,439	2,414	2,342	2,119	2,591	4,366	5,260	6,901	5,149	5,984	10,290	10,302	9,614	4,912	3,499	6,462	5,470	8,242	10,161	7,017	2,161
Hot Dry 2022	6,158	5,925	5,214	4,876	4,892	4,230	3,162	4,166	5,741	5,792	7,539	6,740	5,909	8,887	9,265	9,182	7,570	5,292	8,200	7,321	9,143	8,893	7,232	6,517

Figure 11: System LWAP Hourly Curve, 2021 vs 2022 Hot Dry Season



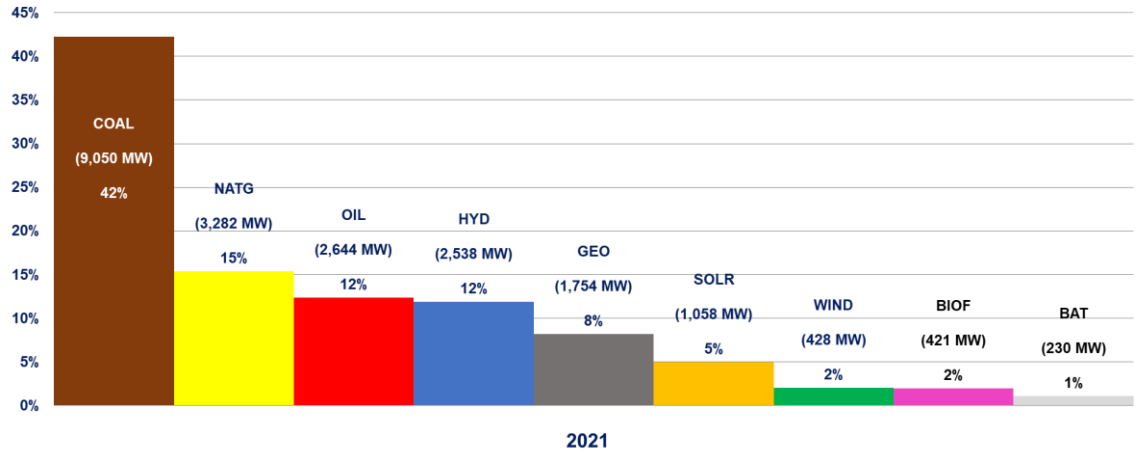
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Rainy 2021	5,283	3,943	3,549	3,383	3,405	3,268	2,524	3,202	4,897	4,548	6,012	5,101	4,289	6,625	7,394	6,745	5,771	5,234	7,088	6,218	7,584	7,981	6,746	2,335
Rainy 2022	7,582	7,028	6,695	6,350	6,464	6,117	5,338	6,445	8,522	8,848	10,05	8,943	8,018	10,37	11,08	10,86	9,172	9,047	11,77	10,76	11,55	10,24	8,951	7,675

Figure 12: System LWAP Hourly Curve, 2021 vs 2022 Rainy Season

B. Supply

i. Registered Capacity

- A net increase[3] of 393 MW was accounted in the total registered capacity from 2021 to 2022 billing periods.
- Of the newly registered power plants in the WESM, about 74 percent or 668 MW was attributed to the entry of Coal plants.
- Updates and changes to the capacity of various existing plants accounted for 19.1 MW increase and 397.6 MW derating of plants' capacities.
- One (1) Battery and seven (7) Oil-based power plants disaggregated their capacities.
- A total capacity of 85 MW ceased[4] registration from the WESM which was attributed to one (1) Oil-based power plant.
- Two (2) Oil power plant with a total capacity of 50 MW deregistered[5] in the WESM.
- In terms of resource types, Coal power plants continued to dominate the spot market, holding the largest share of about 44 percent of the total registered capacity.
- The entry of GN Power Dinginin Coal-Fired Thermal Power Plant unit 2 (668 MW) increased the market share of coal plants by 2 percent for the billing year.
- All other plant types, except for Biomass, Geothermal, and Oil-based plants, recorded minimal increases in registered capacities with Solar power plants holding the second resource which had additional capacities, effectively adding 150.1 MW to the system.
- Contrary to the growth in registered capacities of majority of the different resource types, Biomass, Geothermal, and Oil-based plants capacities noted 28.9MW, 102.8MW, and 357.1MW of net decrease in the registered capacities, respectively.



[3] Net increase is the remaining capacities after the noted changes in the registered capacity.
[4] Ceased WESM member can no longer re-register using the same information in the market.
[5] Deregistered WESM members can re-apply or register again in the market.

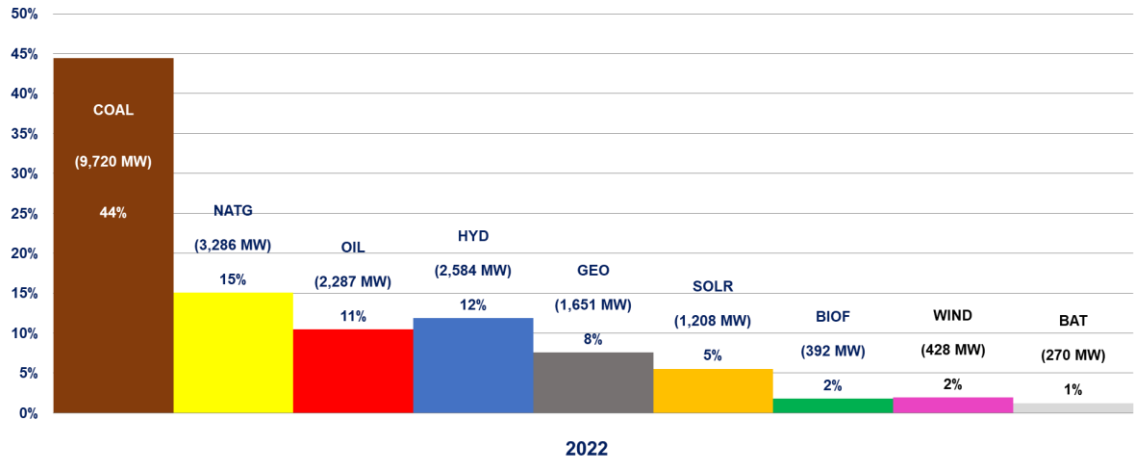


Figure 13: Capacity Mix, 2021 vs 2022

- Based on the age of power plants, 216 out of 307 generator resources were within the age range of 0 - 20 years having an aggregate capacity of 10,635 MW and have continued to comprise 49 percent of the total WESM registered capacity as of 2022.
- Despite the entry of new plants this year, thereby increasing the total registered capacity by 393 MW when compared to the 2021 billing period, generators beyond 20 years of age holds 51 percent of the total registered capacity from 46 percent last year.

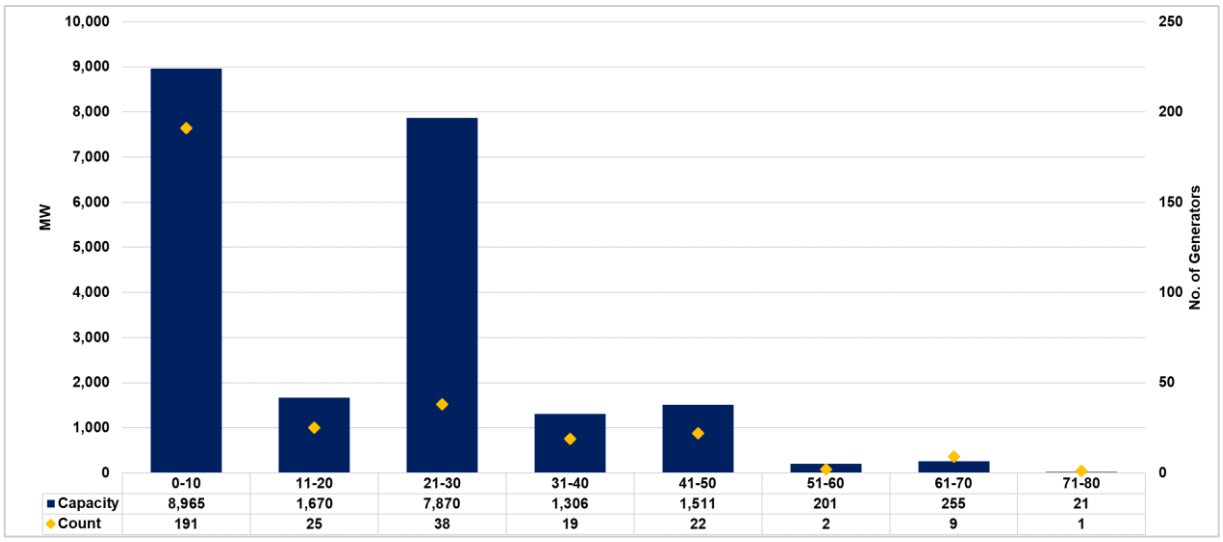
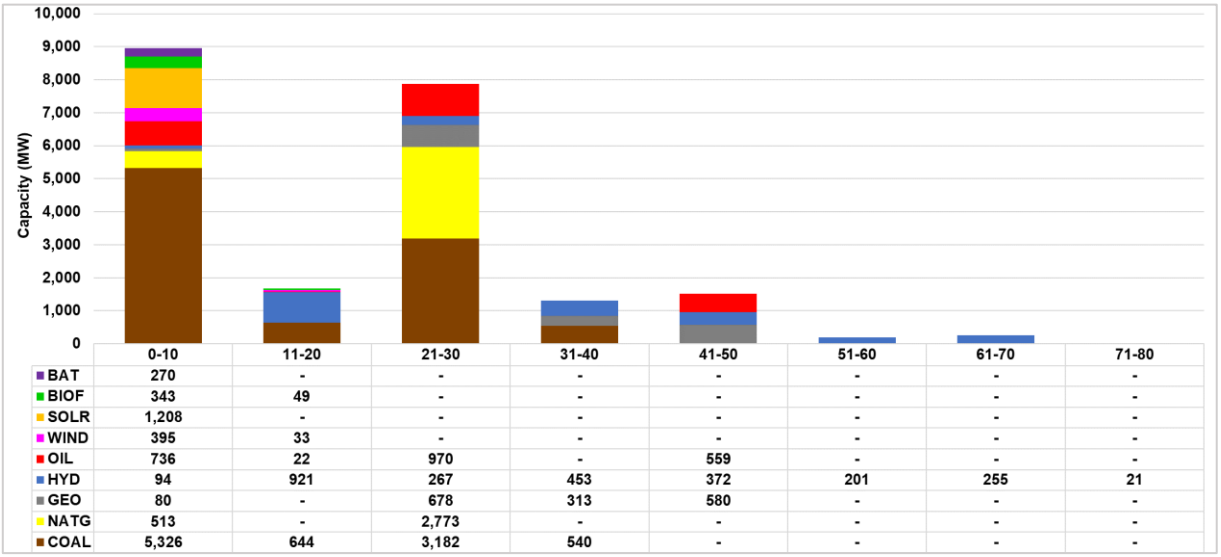


Figure 14: Capacity Profile by Age of Plants, 2022

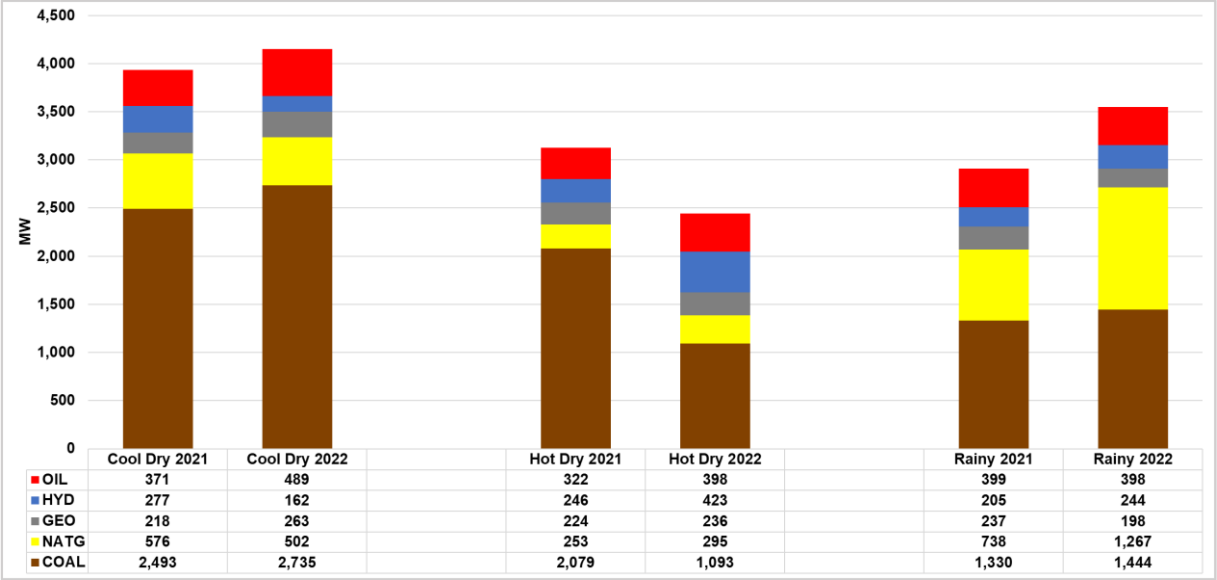


	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
BAT	270	-	-	-	-	-	-	-
BIOF	343	49	-	-	-	-	-	-
SOLR	1,208	-	-	-	-	-	-	-
WIND	395	33	-	-	-	-	-	-
OIL	736	22	970	-	559	-	-	-
HYD	94	921	267	453	372	201	255	21
GEO	80	-	678	313	580	-	-	-
NATG	513	-	2,773	-	-	-	-	-
COAL	5,326	644	3,182	540	-	-	-	-

Figure 15: Capacity Profile by Age of Plants by Resource Type, 2022

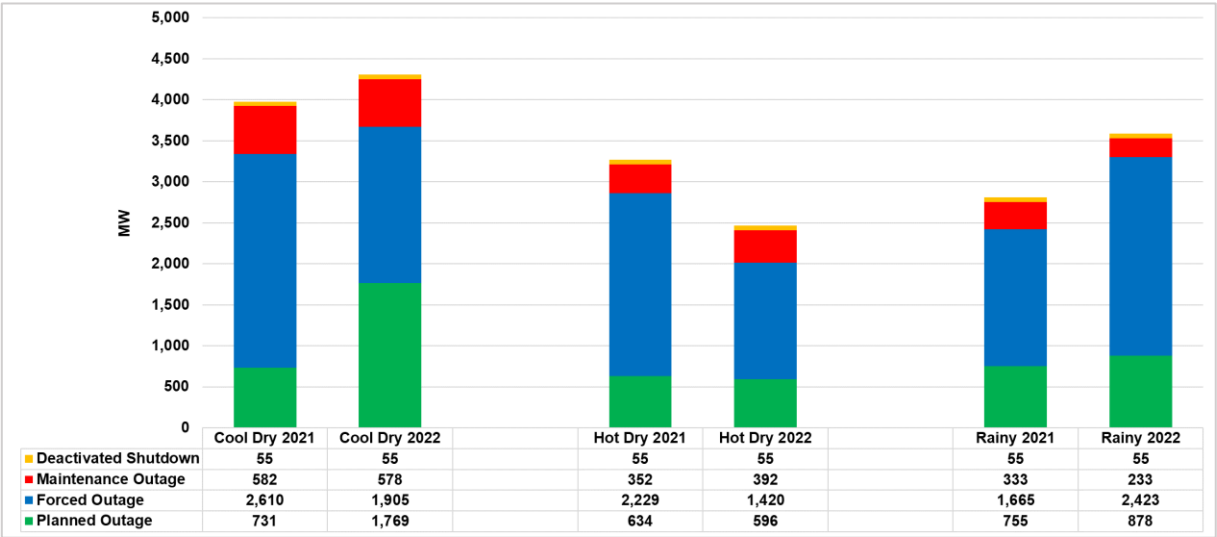
ii. Capacities on Outage

- The annual average capacity on outage has been generally observed to have increased from the previous year.
- The onslaught of various tropical storms resulted in the significant forced outages from the generators over the course of the billing year. The onslaught of Typhoon Odette, for instance, rendered several plants to be on outage in December 2021 until January 2022 due to the unavailability of transmission systems coupled with other damages to the system affecting the operations of the generators.
- Coal plants consistently dominated the outage mix heavily affecting the grid's power supply.
- As anticipated, planned outages increased during the Cool dry season of 2022 owing to the effects of the devastation of typhoon Odette.
- Moreover, forced outages accounted for the largest share of plant outages for the whole year.
- Each season recorded the following average level of outage:
  - Cool Dry – 4,307 MW; Hot Dry – 2,464 MW; Rainy – 3,589 MW



	Cool Dry 2021	Cool Dry 2022	Hot Dry 2021	Hot Dry 2022	Rainy 2021	Rainy 2022
OIL	371	489	322	398	399	398
HYD	277	162	246	423	205	244
GEO	218	263	224	236	237	198
NATG	576	502	253	295	738	1,267
COAL	2,493	2,735	2,079	1,093	1,330	1,444

Figure 16: Capacity on Outage by Plant Type, 2022 Seasons



	Cool Dry 2021	Cool Dry 2022	Hot Dry 2021	Hot Dry 2022	Rainy 2021	Rainy 2022
Deactivated Shutdown	55	55	55	55	55	55
Maintenance Outage	582	578	352	392	333	233
Forced Outage	2,610	1,905	2,229	1,420	1,665	2,423
Planned Outage	731	1,769	634	596	755	878

Figure 17: Capacity on Outage by Category, 2022 Seasons

- On the list of major power plants (> 100 MW) with total outage duration of more than a month, 27 out of 41 occurrences were caused by Coal-fired thermal power plants with forced outage as the main reason for the same, as shown in Table 3.
- About 40 percent came from power plants with less than 10 years of age.
- Annex A provides for the detailed major plant outages during the entire billing year.

Table 3: Total Outage Days of Major Power Plants (> 30 days), as of 2022

Plant/Unit Name	Plant Type	MPG	Capacity (MW)	Age	Total No. of Outage Days			Total
					Forced	Maintenance	Planned	
Calaca 1	COAL	DMCI	240	39	13.6		54.8	68.4
Calaca 2	COAL	DMCI	300	39	317.8			317.8
GN Power 1	COAL	AC	316	10	68.8			68.8
GN Power 2	COAL	AC	316	10	62.4		41.0	103.4
GNP Dinginin 1	COAL	AP	668	3	14.9	86.1		100.9
Ilijan A1	NATG	SMC	190	21	190.1			190.1
Ilijan A2	NATG	SMC	190	21	180.3	4.7		185.0
* Ilijan B1	NATG	SMC	190	21	420.1		2.8	422.9
* Ilijan B2	NATG	SMC	190	21	413.3			413.3
* Ilijan B3	NATG	SMC	220	21	347.5		2.7	350.2
Kepco Salcon 1	COAL	KPHI	103	13	30.8		23.3	54.1
Kepco Salcon 2	COAL	KPHI	103	12	35.0		17.2	52.2
* Malaya 1	OIL	BPC	300	48	728.0			728.0
Masinloc 3	COAL	SMC	335	4	15.5		26.2	41.8
Pagbilao 1	COAL	AP	382	27	9.1		27.3	36.4
Pagbilao 2	COAL	AP	382	27	4.0	3.4	29.5	36.9
Pagbilao 3	COAL	AP	420	6	3.3		34.5	37.8
PALM 1	COAL	JNRI	135	7	46.0			46.0
PEDC 3	COAL	GBPC	150	7	74.9		30.6	105.6
QPPL	COAL	QPPL	460	23	9.1	2.4	42.3	53.8
San Gabriel	NATG	FGC	420	7	12.4	3.0	21.5	36.9
San Lorenzo 1	NATG	FGC	265	21	199.2	29.4	2.2	230.7
San Lorenzo 2	NATG	FGC	265	21	114.9		40.2	155.1
San Roque 1	HYD	SMC	145	20			169.0	169.0
SBPL	COAL	SBPLC	455	4	1.4		49.2	50.5
SLPGC 1	COAL	SLPGC	150	8	38.4		113.7	152.1
SLPGC 2	COAL	SLPGC	150	8	12.2	5.1	55.8	73.0
SLTEC 1	COAL	AC	122	9	46.1	14.9	43.7	104.7
SLTEC 2	COAL	AC	124	8	30.2			30.2
SLTEC 2	COAL	AC	122.9	8	277.9		61.0	338.8
SMC 3	COAL	SMC	150	6	38.0			38.0
Sta. Rita 1	NATG	FGC	257.3	23	1.0	0.3	34.6	35.8
Sta. Rita 4	NATG	FGC	264	22	17.6		16.8	34.3
Sual 1	COAL	SMC	647	24	2.7	3.5	97.3	103.5
Sual 2	COAL	SMC	647	24	12.5	11.8	37.9	62.1
THVI 1	COAL	AP	169	6	39.8		103.8	143.6
THVI 2	COAL	AP	169	6	293.0	5.5	13.1	311.6
GNP Dinginin 2	COAL	AP	668	2	39.3	21.5	4.9	65.7
SMC 1	COAL	SMC	150	7	37.3			37.3
Ilijan A3	NATG	SMC	220	21	174.2	4.5		178.7
Malaya 2	OIL	BPC	130	44	0.1		92.2	92.3

*Note: Plants on red font and with an " * " in their name are the plants that were on outage prior to the subject billing year.*

- Generating units with age of 21 - 50 years were observed to have had long average forced outage days for the billing year.
- Plants aged 31 - 40 and 71 - 80 years have had somewhat similar performance as opposed to the previous billing year, at an average length of around 126 days or about 4 months due to, among others, technical-related issues.
- Older generating units (51 - 80 years) all from hydro plants – Ambuklao HEPP, Binga HEPP, Angat HEPP, and Botocan HEPP – recorded very short average forced outage days from a

range of 0.1 to 5 days. However, Unit 3 of Ambuklao HEPP was noted to be on forced outage for about 30 days due to low water level. It should also be noted that these plants have undergone rehabilitation after their respective privatizations.

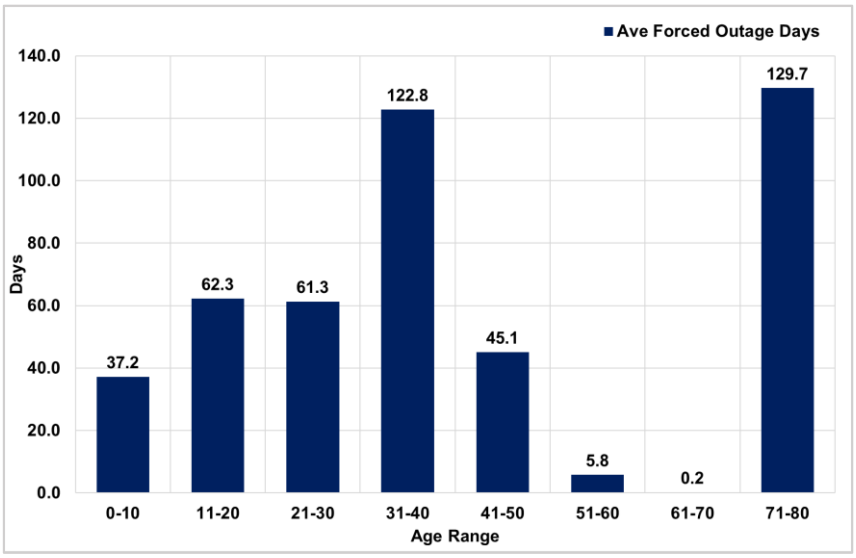


Figure 18: Average Forced Outage Days per Age Range of Generator Units, 2022

- Based on the size of plants, large plants (> 100 MW) have had longer average outage days averaging at 113.5 days than small plants (< 100 MW) with an average of 61.4 days.
- Considering all generator outages, the following information were concluded:
  - For every 1 day of maintenance outage, there is approximately 82 days of forced outage.
  - For every 1 day of planned outage, there is approximately 4 days of forced outages.

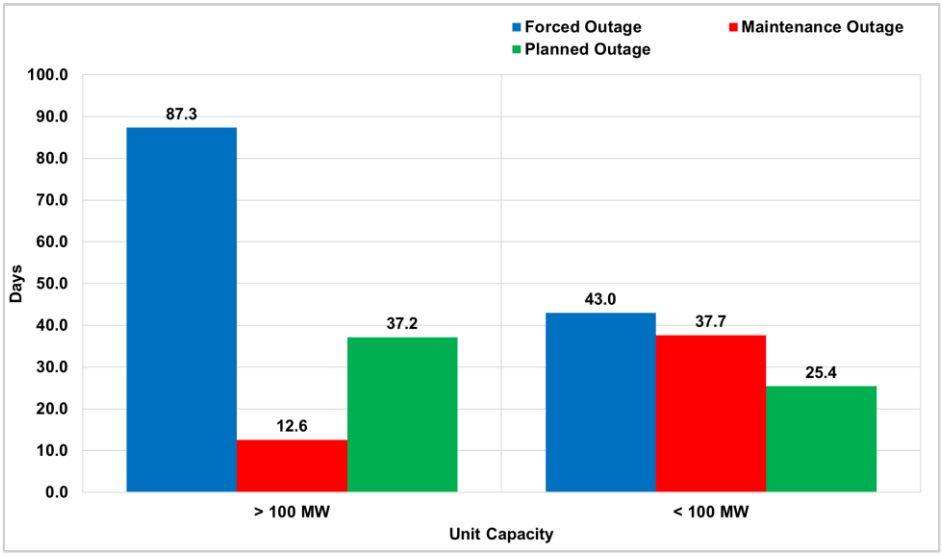
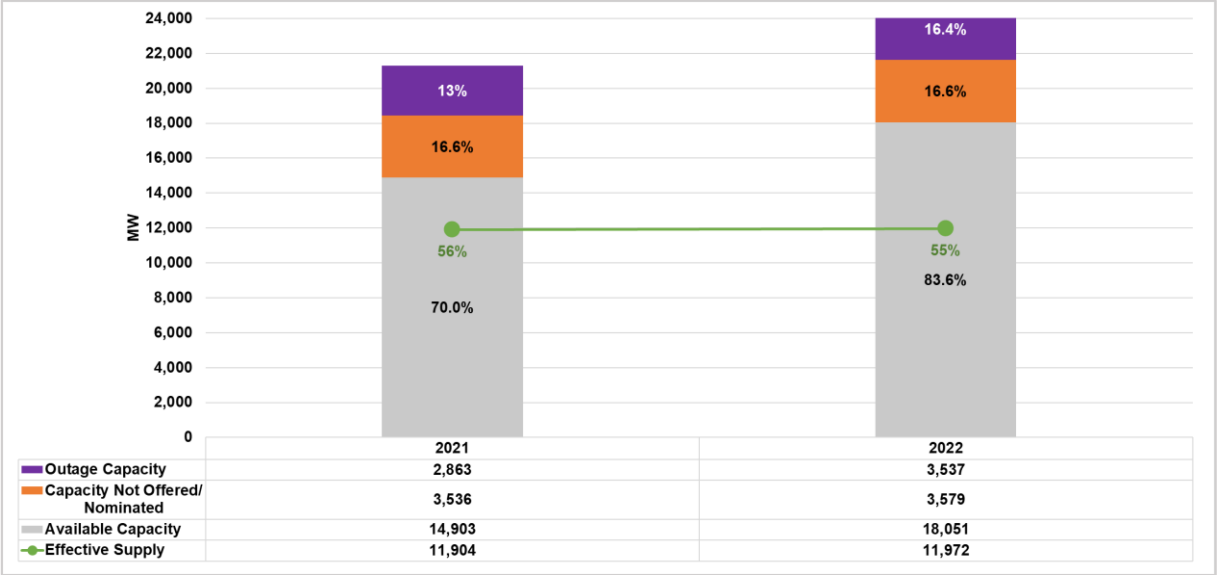


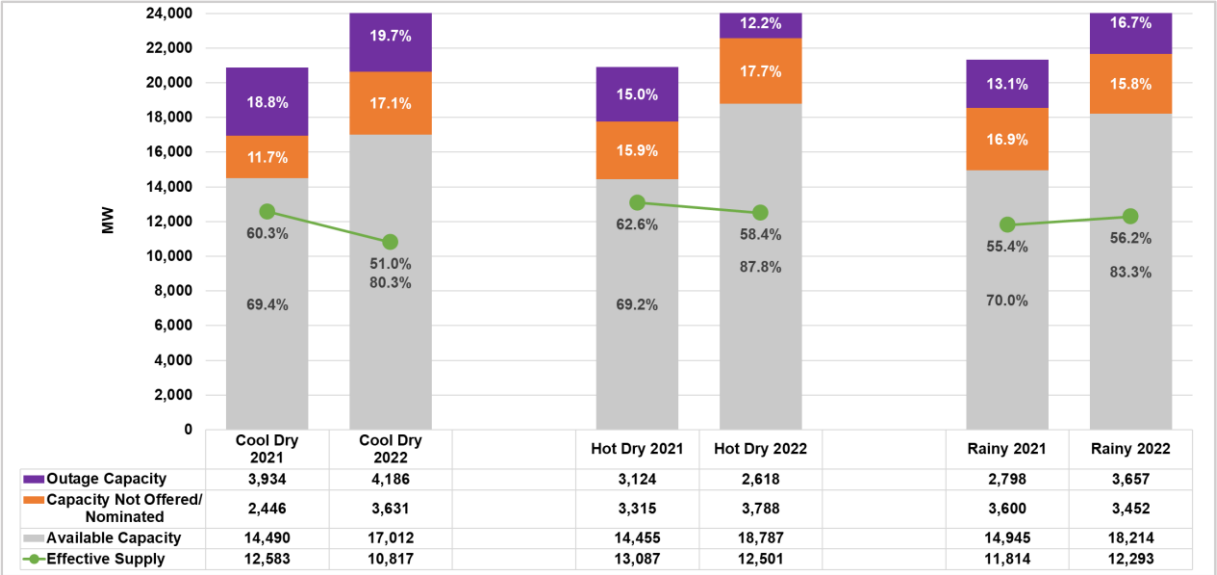
Figure 19: Average Outage Days Based on Unit Capacity, 2022



	2021	2022
Outage Capacity	2,863	3,537
Capacity Not Offered/ Nominated	3,536	3,579
Available Capacity	14,903	18,051
Effective Supply	11,904	11,972

Figure 20: Capacity Profile by Component - Yearly, 2021 vs 2022

- Capacities on outage were consistently the highest during the cool dry season taking advantage of a generally low demand during the billing periods for December 2021 to February 2022.
- As a result of limited water supply during the onset of summer months, Hydro power plants became unavailable which contributed to the high level of capacities not offered/nominated during the hot dry season.
- Subsequently, Coal and Natural gas power plants contributed to the increase in the capacities not offered nor nominated due to continuous high level of capacities on outage of these plants all throughout the season.



	Cool Dry 2021	Cool Dry 2022	Hot Dry 2021	Hot Dry 2022	Rainy 2021	Rainy 2022
Outage Capacity	3,934	4,186	3,124	2,618	2,798	3,657
Capacity Not Offered/ Nominated	2,446	3,631	3,315	3,788	3,600	3,452
Available Capacity	14,490	17,012	14,455	18,787	14,945	18,214
Effective Supply	12,583	10,817	13,087	12,501	11,814	12,293

Figure 21: Capacity Profile by Component, 2021 to 2022 Seasons

iii. Generation Mix

- Coal plants in the Luzon region comprised more than half of the entire generation mix in the grid despite having only around 44 percent share in registered capacity.
- A similar reliance was observed for Natural gas plants where the share in generation mix was generally observed to have increased as compared to the capacity mix.
- The opposite trend was manifested by Hydro plants as majority of these capacities were offered at the higher price spectrum and were likewise dependent on the availability of water. Additionally, it is noteworthy that most of the large Hydro power plants are scheduled for reserve and may thereby dispatched or not, as the case may be.

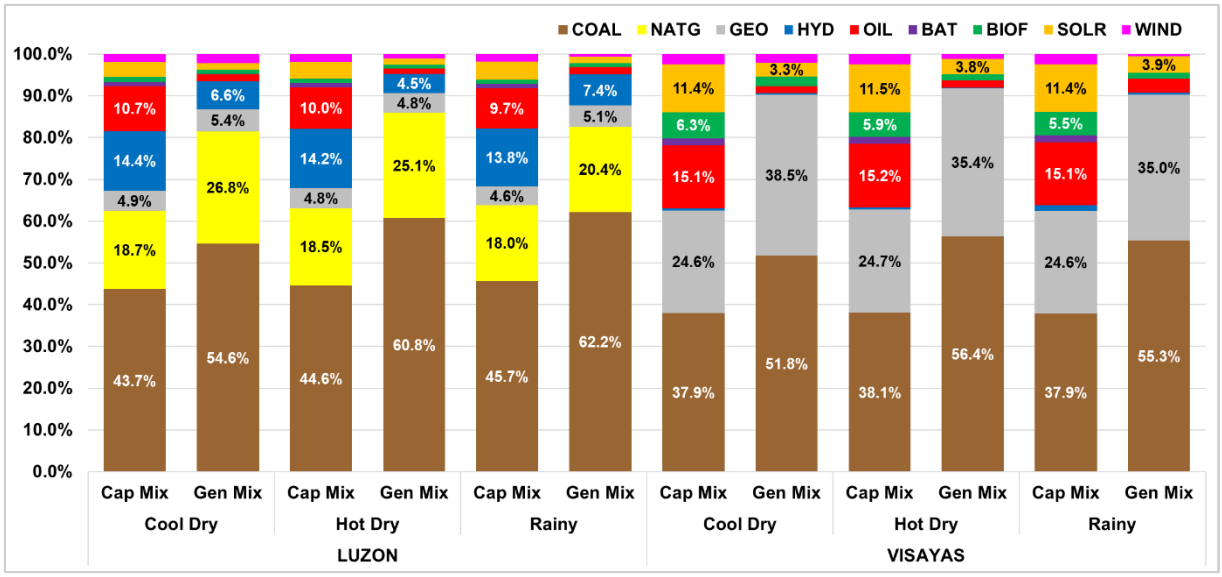


Figure 22: Capacity Mix vs Generation Mix - Luzon, 2022 Seasons

iv. Capacity Profile

- Available capacity[6], with respect to the total registered capacity experienced an increase coming from a 70 percent share to 83.6 percent. One of the attributable instances is the addition of the new power plants in the overall registered capacity.
- Capacities on outage increased to an average of 3,537 MW from 2,863 MW for the 2021 billing period, comprising 16.4 percent of the total registered capacity.

[6] Available capacity refers to the aggregate of Capacity Offered/Nominated, Malaya Capacity for MRU, and Capacity of Plants on Testing and Commissioning

Table 4: Plants with Increase/Decrease Capacity, 2021 vs 2022

Plant Type	Capacity		
	2021	2022	Change
New Registered Plants			
BAT		40	40
COAL		668	668
HYDRO		669	37.8
SOLR		670	161
SUB-TOTAL:			**906.8**
Plants that Increased Capacity			
COAL	243.9	246	2.1
HYDRO	124.2	132.3	8.1
NATG	526.6	530	3.4
OIL	100	104.7	4.7
SOLR	12.6	13.4	0.8
SUB-TOTAL:			**19.1**
Plants that Decreased Capacity			
BIOF	109.4	80.5	-28.9
COAL	202	174.6	-27.4
GEO	362.8	260	-102.8
OIL	614.3	387.5	-226.8
SOLR	178	166.3	-11.7
SUB-TOTAL:			**-397.6**
Ceased Registration			
OIL	85		-85
SUB-TOTAL:			**-85.0**
Deregistered			
OIL	50		-50
SUB-TOTAL:			**-50.0**
GRAND TOTAL:			**393.3**

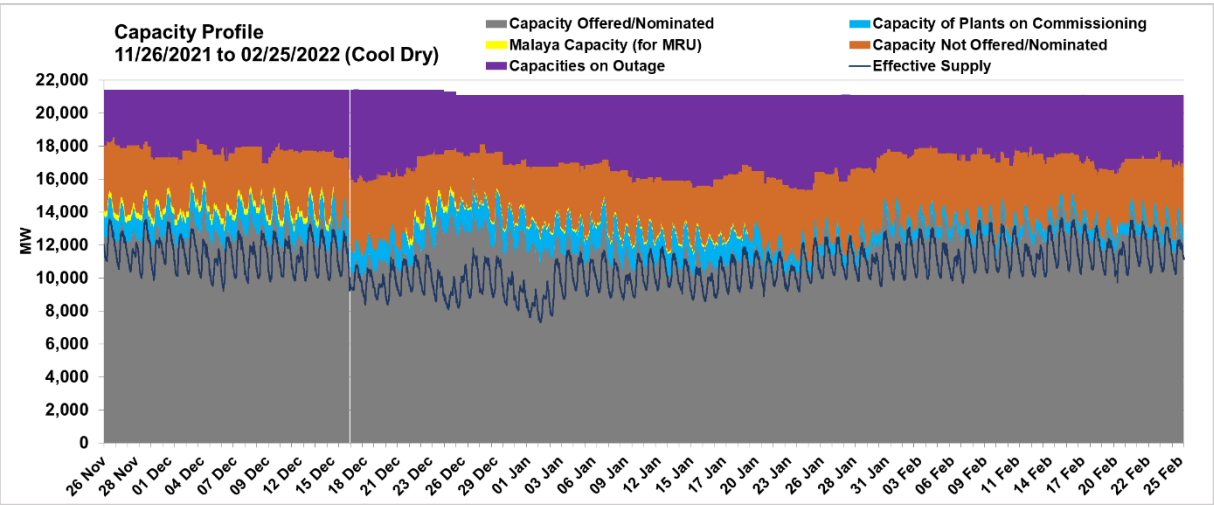


Figure 23: Capacity Profile by Component – Cool Dry 2022

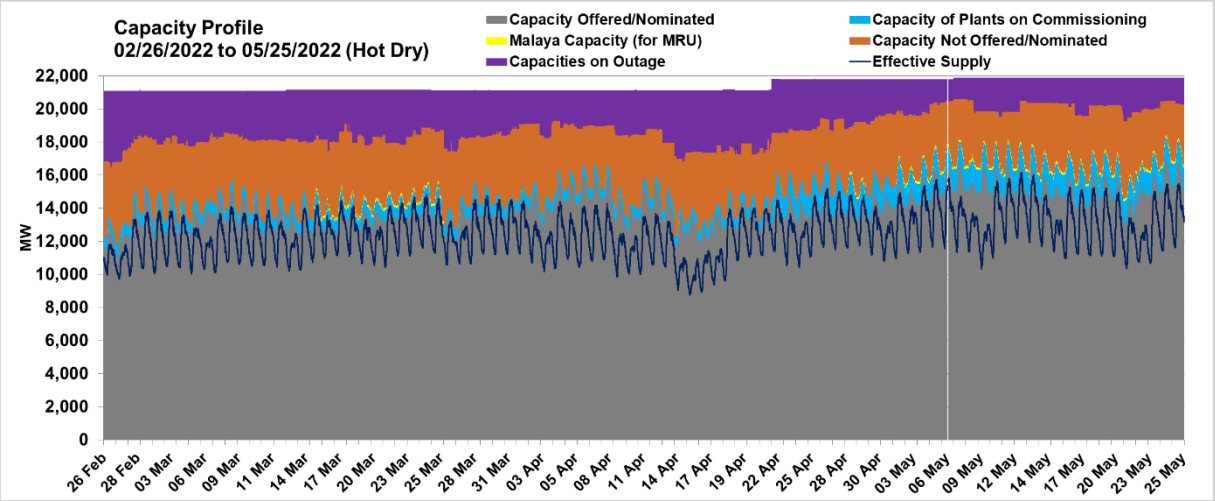


Figure 24: Capacity Profile by Component – Hot Dry 2022

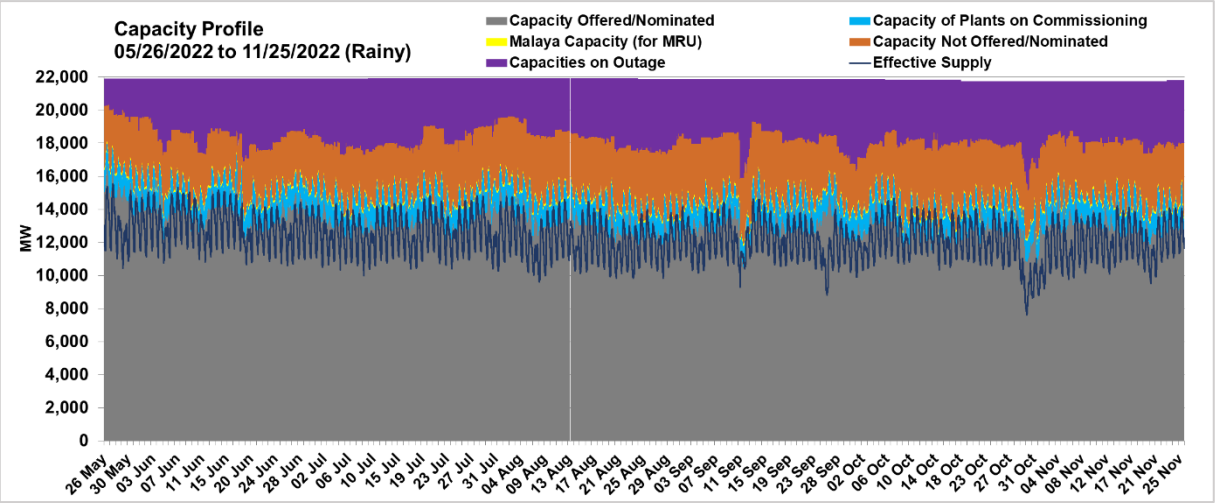


Figure 25: Capacity Profile by Component – Rainy Dry 2022

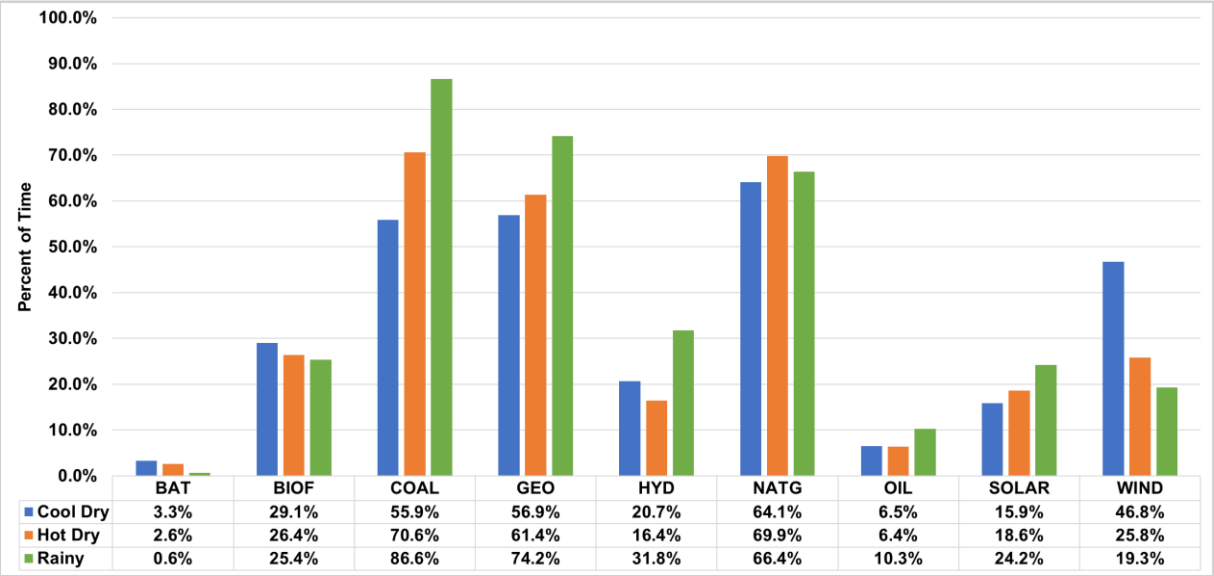
v. Dispatch Factor[7]

- Dispatch factors measure the instances when a generator is dispatched at certain levels of capacities vis-à-vis its registered capacities. Due to the baseload capabilities of the following plants, here are some observations during the billing year:
    - Coal power plants, which topped the rank in terms of capacity and generation mix, likewise dominated almost all seasons in terms of the computed dispatch factor resulting in values around 56 - 87 percent, indicating that more than half their total capacities were being dispatched for the entire billing year.
    - Geothermal plants had a similar trend with Coal, with a dispatch factor of 57 - 74 percent all throughout the season.

[7] Dispatch factor is the ratio between the total metered quantity and the total registered capacity.

- This was followed by Natural gas, which consistently posted a dispatch factor of more than 60 percent all throughout the seasons, consistent with their based load characteristics.

- Meanwhile, and as anticipated, hydro plants experienced low dispatch factors during the hot dry season due to the decrease in water supplies from rivers and reservoirs. Solar, wind, and biomass power plants, on the other hand, were able to take advantage of this situation and increase their output.
- Similar to last year, wind power plants regularly displayed high dispatch factor during the cool dry season.



	BAT	BIOF	COAL	GEO	HYD	NATG	OIL	SOLAR	WIND
Cool Dry	3.3%	29.1%	55.9%	56.9%	20.7%	64.1%	6.5%	15.9%	46.8%
Hot Dry	2.6%	26.4%	70.6%	61.4%	16.4%	69.9%	6.4%	18.6%	25.8%
Rainy	0.6%	25.4%	86.6%	74.2%	31.8%	66.4%	10.3%	24.2%	19.3%

Figure 26: Dispatch Factor by Plant Type, 2022 Seasons

C. Demand

- The demand forecast was expected to increase for the billing year, notwithstanding the continuous observance of COVID-19 pandemic protocols implemented by the National Government, and corresponded to a 7 percent annual increase from 10,292 MW in 2021 to 10,519 MW in 2022.

Season	Demand 2021	Demand 2022	Percent Change
Cool Dry	9,058 MW	9,350 MW	3.2% increase
Hot Dry	10,441 MW	10,954 MW (Peak demand at 15,687 MW on 12 May 2022)	4.9% increase
Rainy	10,345 MW	10, 893 MW (Peak demand at 14,992 MW on 27 May 2022)	5.3% increase

- Correlating the foregoing with the similar increase in Gross Domestic Product (GDP)[8] of 7.8 percent, it is estimated that each 1 MWh of energy produced and consumed amounts to roughly PHP167,796 of economic value in 2022.
- Similar for the 2021 billing year, the hot-dry season for the billing year 2022 recorded the highest average demand. Nevertheless, the rainy season demand level came very close to the hot-dry season which is quite unusual as this season is expected to have lower demand due to the cooler temperature during the said season.

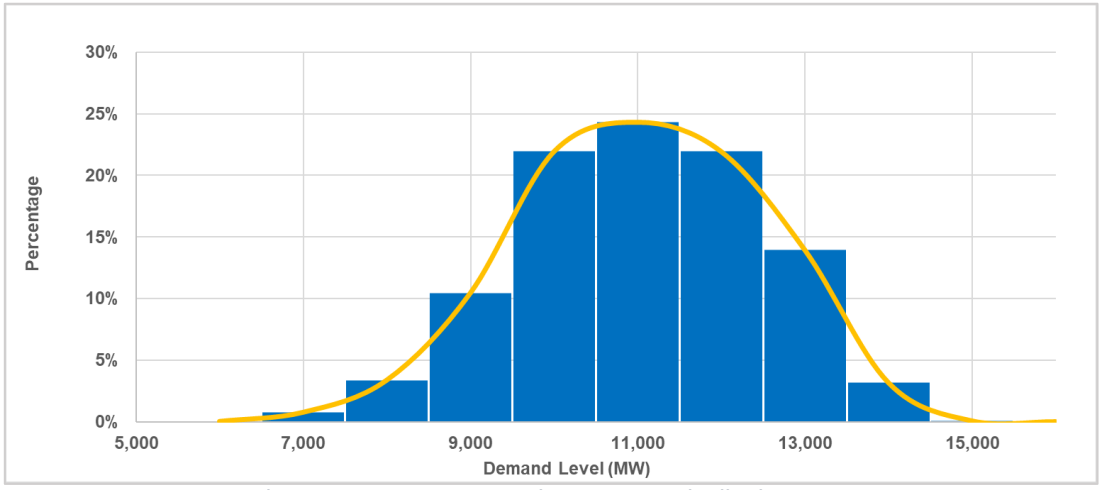


Figure 27: System Demand Frequency Distribution, 2022

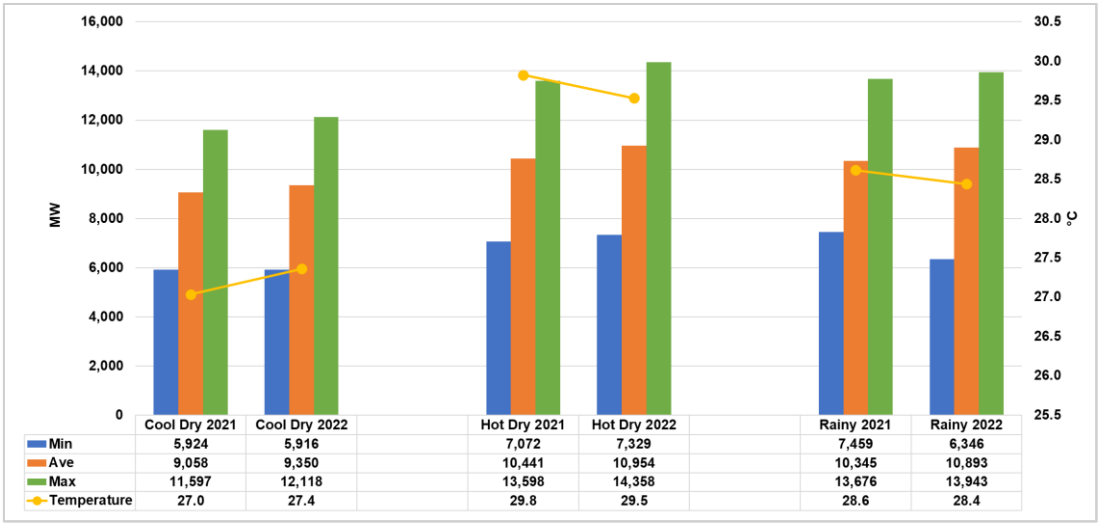
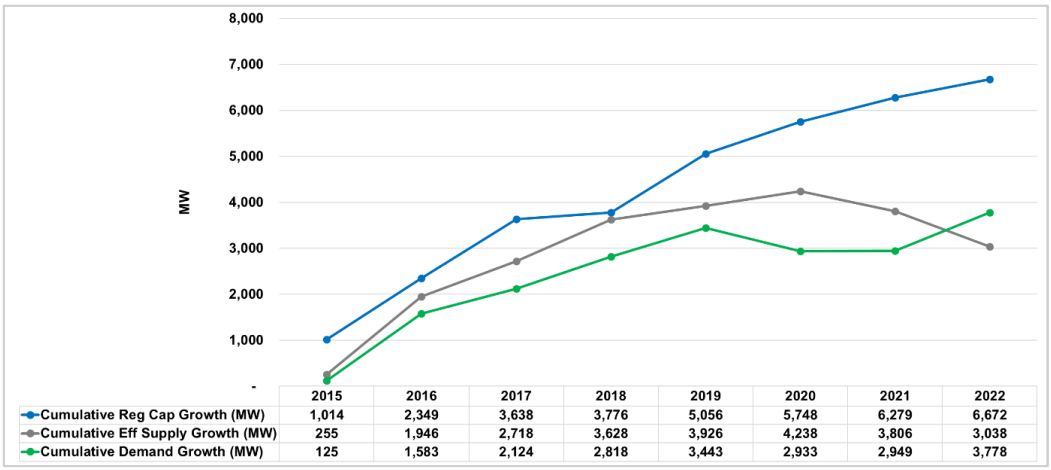


Figure 28: Demand and Temperature, 2021 to 2022 Seasons

- Using 2015 as the baseline, market data shows that there is sufficient margin between registered capacity and system demand across the 6-year horizon. However, for the billing year 2022, the effective supply cannot accommodate the increasing levels of demand as it considers other technical limitations of the generators in the system.

[8] Based on the Philippine Statistics Authority's (PSA) Annual National Accounts Data (2020-2022) at constant 2018 prices as of January 2022

- Effective supply declined due to the increase in both the capacities on outage and the ramp limited capacities.
- Together with the increasing demand, the foregoing resulted in the notable decrease in the supply margin this billing year.



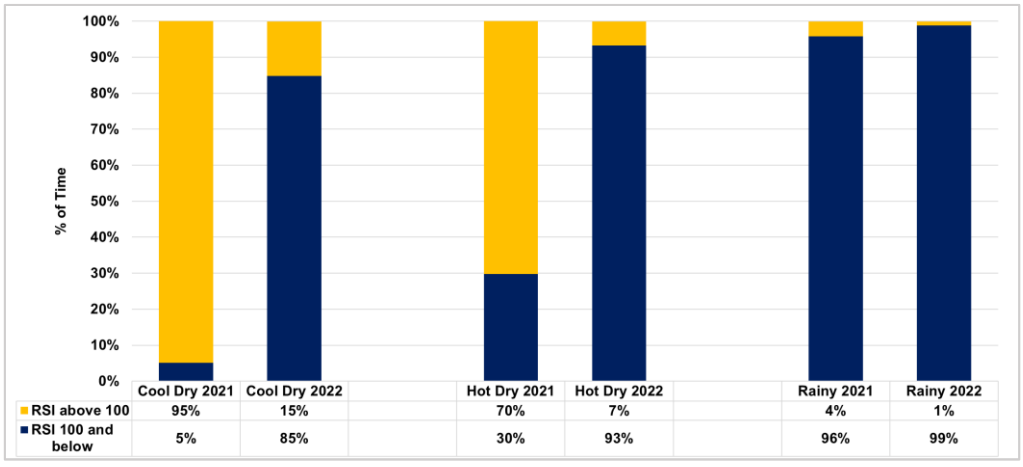
	2015	2016	2017	2018	2019	2020	2021	2022
Cumulative Reg Cap Growth (MW)	1,014	2,349	3,638	3,776	5,056	5,748	6,279	6,672
Cumulative Eff Supply Growth (MW)	255	1,946	2,718	3,628	3,926	4,238	3,806	3,038
Cumulative Demand Growth (MW)	125	1,583	2,124	2,818	3,443	2,933	2,949	3,778

Figure 29: Cumulative Growth Trend of Supply and Demand, 2015-2022

IV. Competitiveness Analysis

A. Residual Supply Index (RSI)[9]

- In 2022 billing year, percentage of RSIs above 100 significantly went down to 7 percent during the hot dry season and only 1 percent during the rainy season, further establishing the relationship of high market prices during instances when low RSIs were observed.
- The average market prices for intervals with RSI below 100% was PHP7,992/MWh while it was PHP3,364/MWh for the intervals with RSI above 100% for the billing year.



	Cool Dry 2021	Cool Dry 2022	Hot Dry 2021	Hot Dry 2022	Rainy 2021	Rainy 2022
RSI above 100	95%	15%	70%	7%	4%	1%
RSI 100 and below	5%	85%	30%	93%	96%	99%

Figure 30: Market RSI, 2021 vs 2022 Seasons

[9] The Residual Supply Index (RSI) is a dynamic continuous index measured as the ratio of the available generation without that generator to the total generation required to supply the demand. The Market RSI is measured as the lowest RSI among all generators in the market. A Market RSI less than 100% indicates the presence of pivotal generator/s or supplier/s.

B. Pivotal Suppliers

- A total of 174 power plants were pivotal during the 2022 billing period with 119 coming from Luzon and 55 from Visayas.
- With the high level of system demand and low supply levels during the period, this translated to a high number of pivotal suppliers.

Table 5: Pivotal Supplies Old and New market regime

2022			
Plant	Major Participant Group	Frequency	% of Time
STA RITA NGPP	FGC	91,967	87.5%
MASINLOC CFTPP	SMC	88,555	84.2%
SUAL CFTPP	SMC	80,419	76.5%
GNP DINGININ CFTPP	AP	69,492	66.1%
PAGBILAO CFTPP	AP	52,880	50.3%
SMC LIMAY CFTPP	SMC	51,804	49.3%
SAN LORENZO NGPP	FGC	42,055	40.0%
ILIJAN NGPP	SMC	37,824	36.0%
MARIVELES CFTPP	AP	35,911	34.2%
SBPLC CFTPP	SBPLC	26,146	24.9%

C. Market Share and Herfindahl-Hirschman Index (HHI)[10]

- Across all seasons, the WESM remained to be dominated by the five (5) major participant groupings based on registered capacity: San Miguel Corporation (SMC), Aboitiz Power Corporation (AP), First Gen Corporation (FGC), Meralco PowerGen Corporation (MGEN), and Power Sector Assets and Liabilities Management Corporation (PSALM).
- The combined shares of all five major firms comprised almost 75% of the system's registered, offered, and actual generation.

[10] The HHI measures the degree of market concentration, considering the relative size and distribution of participants in the monitored market. It is calculated as the sum of squares of the participant's market share. The following are the widely used HHI screening numbers: the HHI approaches zero when the market has very large number of participants with each having a relatively small market share. In contrary, the HHI increases as the number of participants in the market decreases, and the disparity in the market shares among the participants increases. The following are the widely used HHI screening numbers: (1) when HHI is less than 1,000 the market is not concentrated; (2) in the range of 1,000 to 1,800 the market is moderately concentrated; (3) greater than 1,800 to 2,500 the market is concentrated; and (4) greater than 2,500 the market is highly concentrated and signals lack of competition in the market.

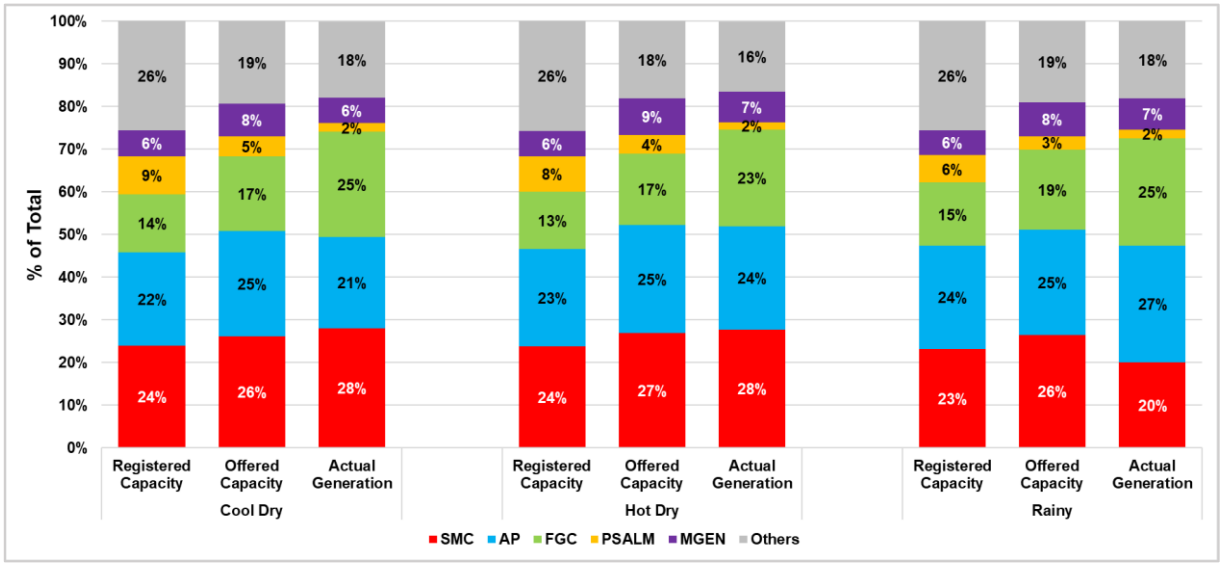


Figure 31: Market Share, 2022 Seasons

- Correspondingly, the HHIs per dispatch interval, indicated a moderately concentrated market based on registered capacities for all hours in 2022.

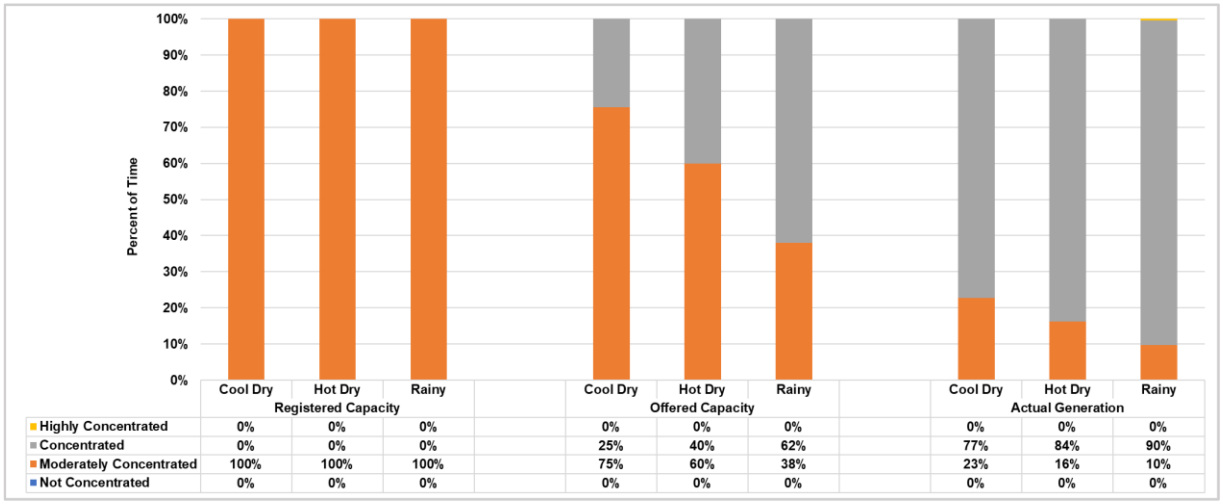


Figure 32: Herfindahl-Hirschman Index, 2022 Seasons

V. Generator Trading Behavior

- The trading behavior of WESM participants highly affects the resulting market price outcomes in the WESM, in the current absence of any input information from customers/end-users which should have been considered in market optimization.
- In this report, the offer prices of the generators for each trading intervals were directly used to determine whether there had been changes in the behavior of WESM trading participants when compared to the previous billing year.

- Consistent with the previous billing year, Geothermal plants were one of the cheapest of all resource types along with Coal offering all its capacities in the market at an average price below PHP0/MWh for the year.
- On the contrary, it was observed that for the three (3) seasons, Hydro and Oil-based plants were the most expensive to supply power to the grid due to higher fuel costs.
- Noting the cheaper offered prices of Coal and Natural gas, the grid relied on this baseload power plants, causing them to be dispatched more frequently. Notwithstanding the relatively cheaper price of Coal power plants, the onset of Ukraine-Russia war, when the prices of most commodities, including the Coal, affected the behavior of these plants causing for the increase in the offered prices during rainy season.
- On another note, it can be observed that offered prices of Natural gas power plants increased during the rainy season noting the gas supply restriction from the SPEX Malampaya.

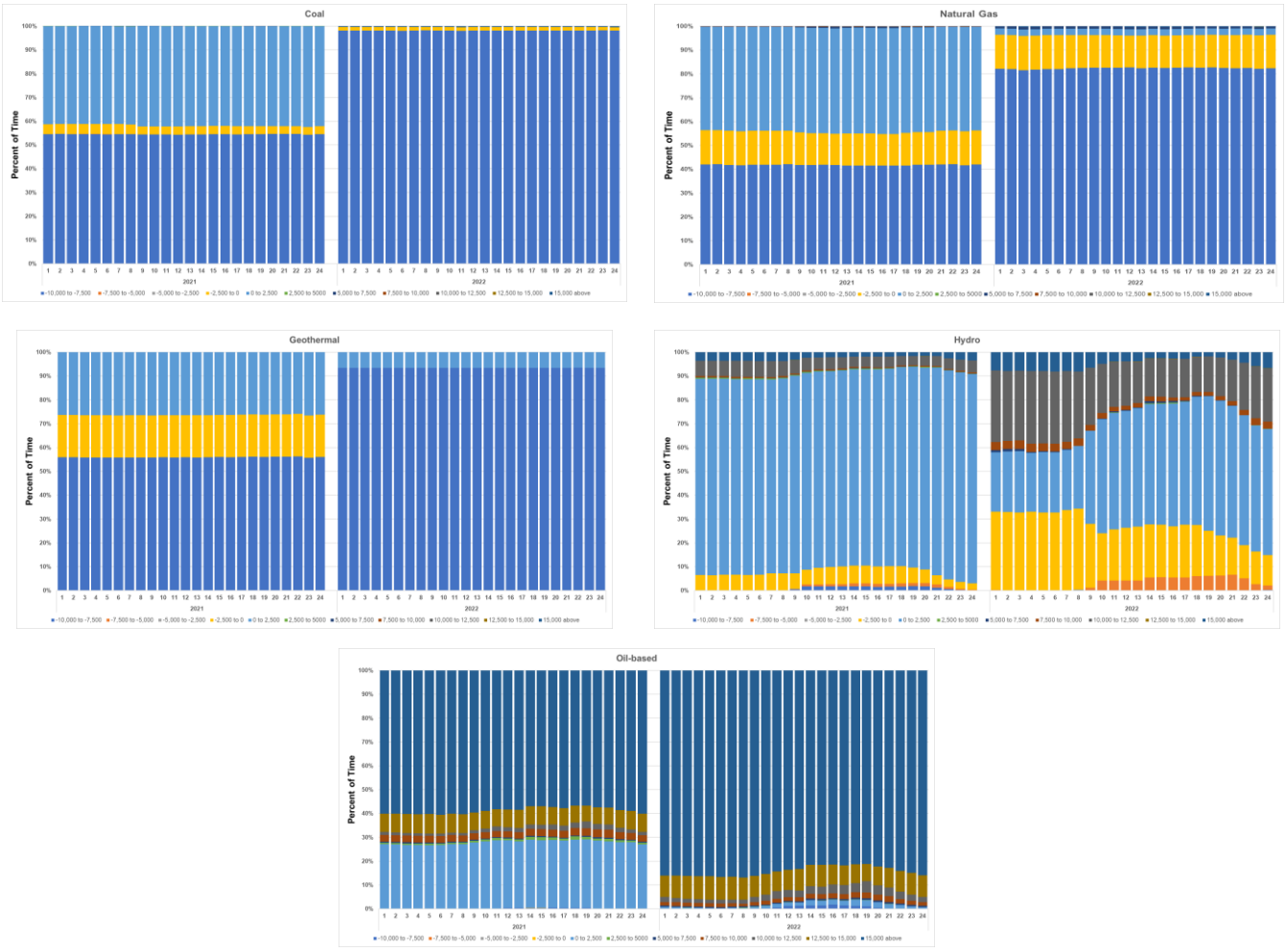


Figure 33: Average Offer Prices Based on Plant Type, 2021 and 2022 Cool Dry Season

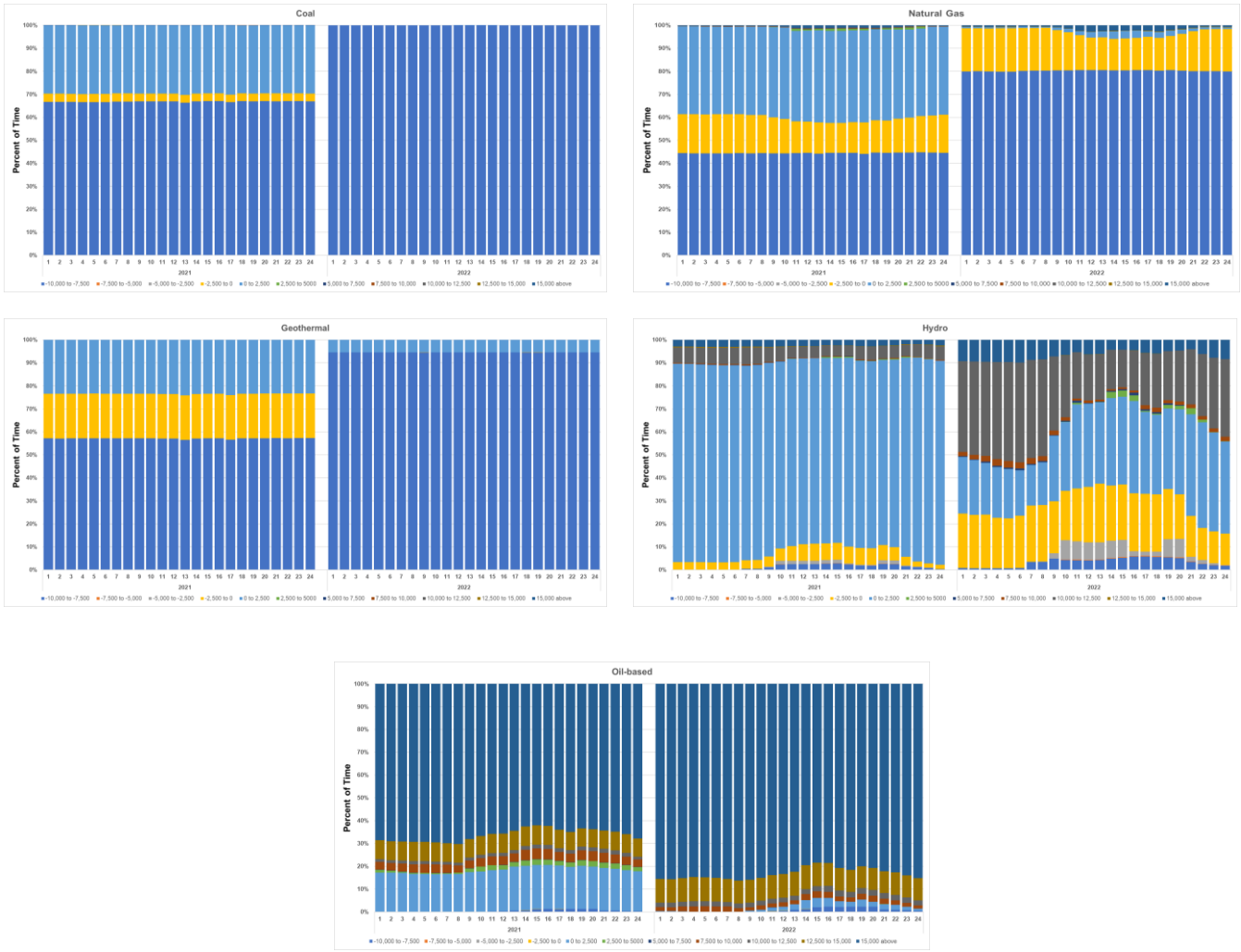


Figure 34: Average Offer Prices Based on Plant Type, 2021 and 2022 Hot Dry Season

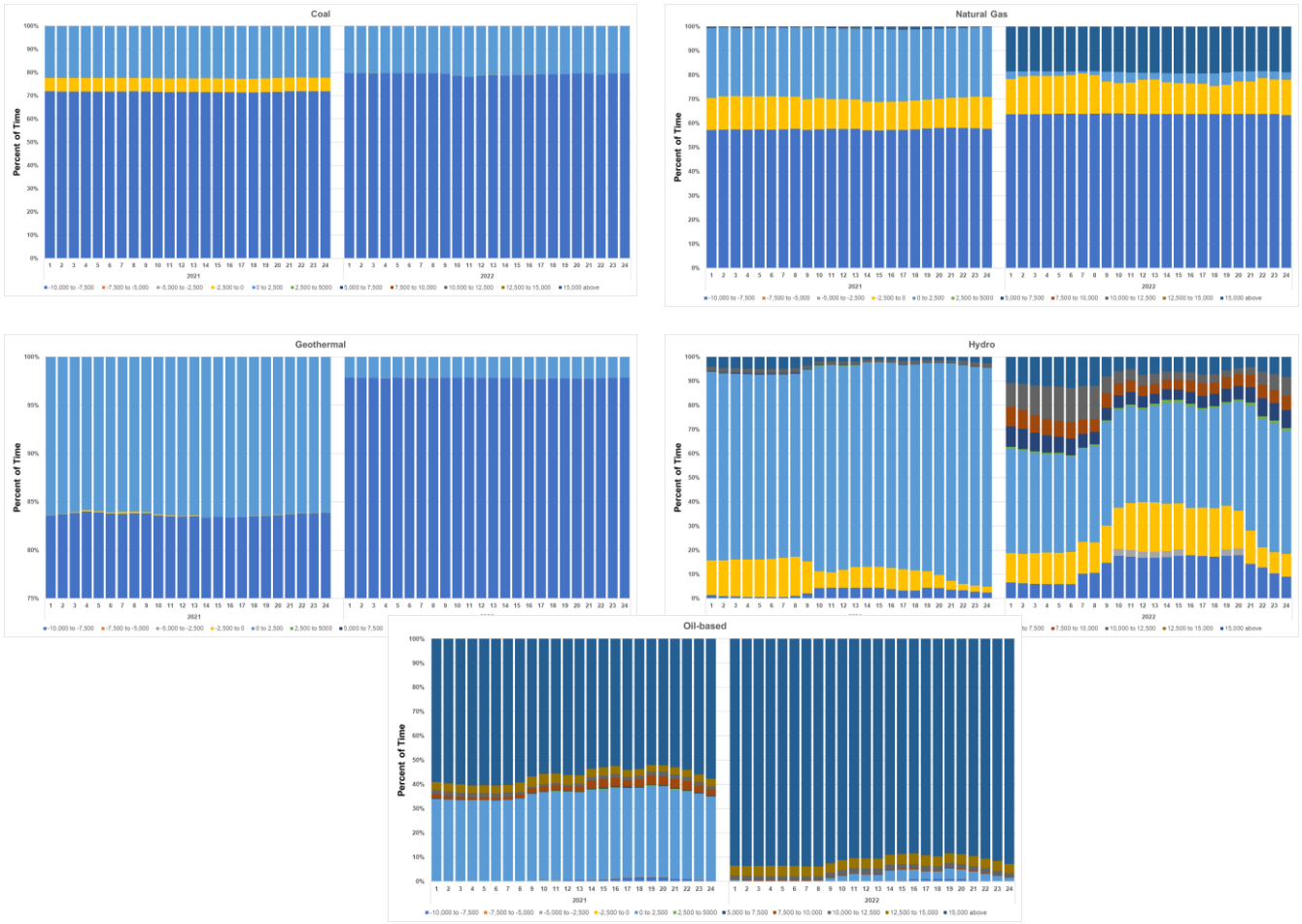


Figure 35: Average Offer Prices Based on Plant Type, 2021 and 2022 Rainy Season

VI. Spot Market Transactions

A. Spot Exposure

- Total energy transactions (in MWh) increased by 14 percent following the increasing level of demand, but the seasonal composition of spot and bilateral contract quantities remained and relatively unchanged when compared to the 2021 billing period.
- The spot market transaction of trading participants during the billing period was noted at 13 percent, a slight decline from last year's 14 percent indicating higher demand capacities covered by bilateral contracts.
- Logically, majority of the energy transactions in the grid are still entered into by bilateral contracts.

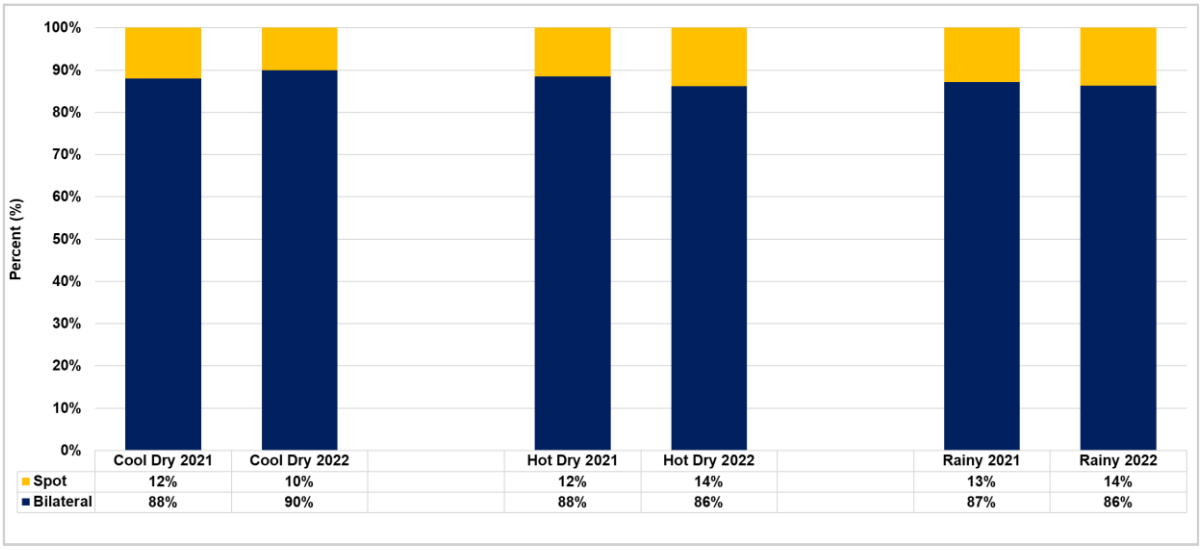


Figure 36: Spot Market Exposure, 2021 to 2022 Seasons

- Spot exposure was lower in peak hours, indicating that consumers were more assured of fixed prices brought by bilateral contracts which reduced the risk of exposure in volatile prices during peak hours.
- The hot dry season posted the season with the highest spot exposure across all hours despite having high prices this year.

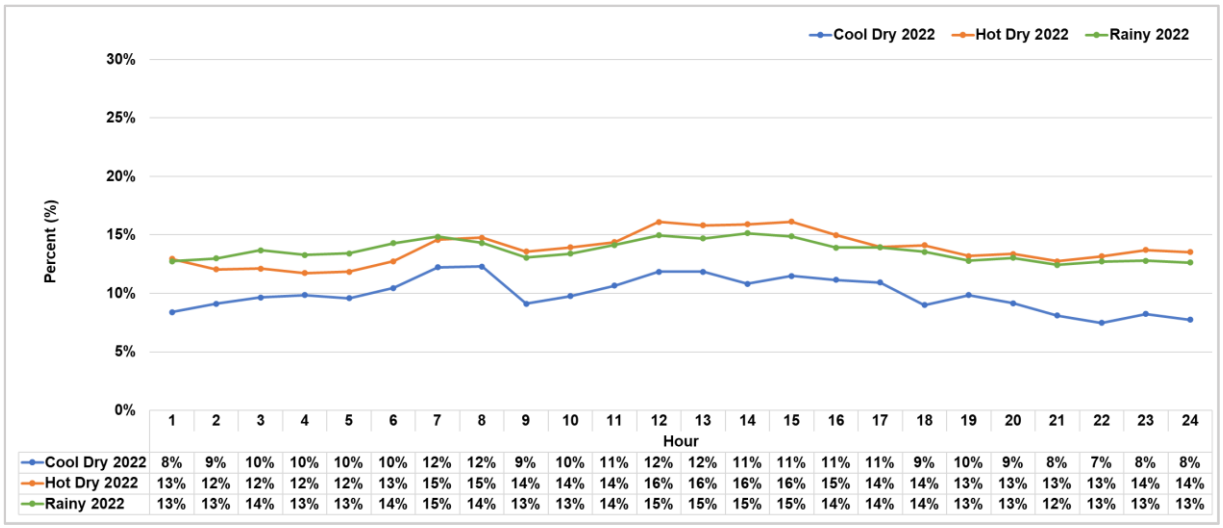


Figure 37: Hourly Generator Spot Market Exposure, 2022 Seasons

B. Energy Trading Amount (ETA)[11] Share

[11] The Energy Trading Amount refers to the amount of revenue from spot market transactions excluding quantities that are declared by the generators as covered by bilateral power supply contracts, which are settled outside the WESM. The ETA share of a major participant group is measured as a percentage of its ETA over the ETA of all participants during the period.

- AP held the top spot in terms of ETA at a high of 37 percent share with a corresponding 38 percent spot exposure and likewise dominated the market in terms of overall registered capacity.
- Similarly, Semirara Mining and Power Corporation (SMPC) incurred high ETA percentages despite having a low share in registered capacity, as most of its capacities were sold in the market.
- On the other hand, San Miguel Corporation (SMC) recorded high actual generation percentages, but effectively had lower spot exposures which led to low ETA shares, as these plants are highly covered by BCQ.
- Millennium Energy, Inc. (MEI) had only 1 percent of actual generation share but resulted in a 5 percent ETA share given that the portfolio consists of relatively more expensive oil-based plants.

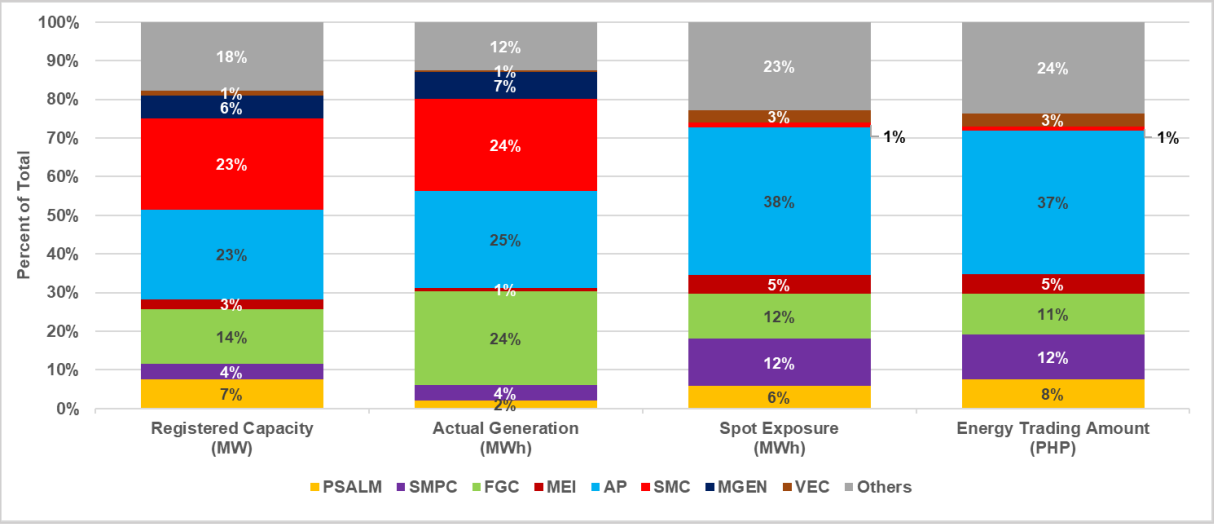


Figure 38: Energy Trading Amount and Spot Exposure, 2022

Annex A. Major Plant Outages

Region	Plant Type	Plant/ Unit Name	Capacity (MW)	Date Out	Date In	Duration (Days)	Outage Type	Remarks	Date Commissioned/ Commerical Operation	Total No. of Trading Intervals
LUZON										
LUZON	BIOF	GIFT 2	6	03-Jan-22	11-Mar-22	67.13	Forced Outage	Furnace trouble.	07 December, 2019	19,045
LUZON	COAL	SLTEC 1	122	20-Oct-22		35.33	Forced Outage	Tripped due to high vibration of primary air fan B.	01 April, 2015	1,536
LUZON	COAL	GN Power 2	316	15-Oct-22		40.99	Planned Outage	General maintenance outage.	01 May, 2013	12,093
LUZON	COAL	Sual 1	647	07-Oct-22		48.02	Planned Outage	Planned Outage until November 7 2022.	01 October, 1999	5,190
LUZON	COAL	Calaca 1	240	01-Oct-22		54.80	Planned Outage	Planned Outage Correction of burner and replacement of boiler tube	01 September, 1984	16,071
LUZON	COAL	SMC 3	150	28-Sep-22	28-Oct-22	30.28	Forced Outage	Suspected tube leak.	01 March, 2018	8,721
LUZON	COAL	Calaca 2	300	01-Sep-22	03-Oct-22	31.62	Forced Outage	Emergency shutdown due to high generator vibration.	01 September, 1984	9,107
LUZON	COAL	SLPGC 1	150	31-Aug-22		85.00	Planned Outage	Planned Outage until September 30. 2022	01 July, 2016	7,202
LUZON	COAL	SLTEC 1	122	11-Aug-22	24-Sep-22	43.72	Planned Outage	Maintenance Outage until September 20. 2022	01 April, 2015	12,593
LUZON	COAL	GNP Dinginin 2	668	10-Jun-22	19-Jul-22	38.46	Forced Outage	Manual turbine trip due to condenser tube leak	#N/A	11,077
LUZON	COAL	SLTEC 2	124	01-Mar-22	01-Apr-22	30.20	Forced Outage	Tripped due to high pressure relative expansion.(RECLASSIFIED FROM FORCE. OMC OUTAGE)	01 February, 2016	2,064
LUZON	COAL	SLTEC 2	122.9	01-Mar-22		268.03	Forced Outage	Tripped due to high pressure relative expansion.(RECLASSIFIED FROM FORCE. OMC OUTAGE)	01 February, 2016	6,633
LUZON	COAL	QPPL	460	04-Feb-22	18-Mar-22	41.96	Planned Outage	Planned outage from Feb 5 - Mar 21 2022	01 May, 2000	11,795
LUZON	COAL	Pagbilao 3	420	08-Jan-22	11-Feb-22	34.51	Planned Outage	Planned Outage from 08 January - 06 February 2022(RECLASSIFIED FROM FORCE. OMC OUTAGE)	01 March, 2018	9,938
LUZON	COAL	SLPGC 2	150	30-Dec-21	23-Feb-22	55.78	Planned Outage	On Planned Outage from 30 Dec 2021 to 23 Feb 2022.	01 July, 2016	15,776
LUZON	COAL	Sual 2	647	29-Dec-21	30-Jan-22	31.85	Planned Outage	On Planned Outage from 30 Dec 2021 to 12 Feb 2022(RECLASSIFIED FROM FORCE. OMC OUTAGE)	01 October, 1999	9,172
LUZON	COAL	SLTEC 2	122.9	17-Dec-21	16-Feb-22	60.99	Planned Outage	Preventive Maintenance	01 February, 2016	17,567
LUZON	COAL	SBPL	455	11-Dec-21	19-Jan-22	39.37	Planned Outage	Planned outage up to 19 Jan 2022.	01 October, 2019	11,339
LUZON	COAL	GNP Dinginin 1	668	29-Nov-21	25-Jan-22	56.54	Maintenance Outage	Performance instrument calibration.	21 January, 2022	16,283
LUZON	COAL	Calaca 2	300	18-Nov-21	28-Aug-22	275.60	Forced Outage	Tripped due to generator stator ground fault	01 September, 1984	79,085
LUZON	COAL	BT2020 2	25	07-Oct-21	04-May-22	159.86	Forced Outage	Affected by the tripping of BT2020COGEN.	#N/A	45,752
LUZON	GEO	Makban 6	55	11-Apr-13		364.00	Deactivated Shutdown	Conducted Gas compressor test.	01 April, 1979	8,928
LUZON	GEO	Makban 2	63.2	12-Oct-22		43.79	Planned Outage	Planned Outage.	01 April, 1979	3,971
LUZON	GEO	Makban 10	20	16-Aug-22		100.28	Forced Outage	Triiped due to actuation of generator bearing vibration very high	01 April, 1979	8,703
LUZON	GEO	Makban 4	63.2	13-Aug-22	21-Sep-22	38.48	Planned Outage	Maintenance Outage until September 25. 2022	01 April, 1979	11,083
LUZON	GEO	Tiwi 1	60	30-Nov-21		359.23	Forced Outage	Steam supply diverted to Unit 2.	01 January, 1979	103,458
LUZON	GEO	Makban 6	55	11-Apr-13		364.00	Deactivated Shutdown	Conducted gas compressor test	01 April, 1979	95,904
LUZON	GEO	Makban 1	63.2	02-Nov-21	30-Dec-21	34.99	Planned Outage	Shutdown requested by APRI to facilitate Makban Plant A Unit 1 retrofitting and other maintenance activities.	01 April, 1979	10,076
LUZON	HYD	Caliraya 2	14	03-Oct-22	21-Nov-22	49.83	Planned Outage	Planned shutdown to facilitate major overhauling.	01 October, 2002	7,727
LUZON	HYD	Angat M 4	50	14-Feb-22		284.00	Planned Outage	Planned outage.	01 October, 1967	8,928
LUZON	HYD	Angat A 1	6	22-Aug-22		94.67	Planned Outage	Planned Outage until April 21 2023	01 June, 1986	8,928
LUZON	HYD	Ambuklao 3	35	25-Oct-22		30.50	Forced Outage	Declared unavailable due to low water level.	01 December, 1956	144
LUZON	HYD	Angat A 2	6	10-Oct-22		45.37	Forced Outage	Tripped due to high temperature at thrust bearing	01 June, 1986	4,427
LUZON	HYD	Angat A 1	6	22-Aug-22		94.67	Planned Outage	Planned Outage until April 21. 2023	01 June, 1986	18,624
LUZON	HYD	Caliraya 1	14	02-Aug-22	17-Sep-22	46.53	Planned Outage	Planned Outage	01 October, 2002	13,399
LUZON	HYD	Magat 2	97	25-Mar-22	06-May-22	42.56	Planned Outage	Annual preventive maintenance outage.	01 August, 1983	12,256
LUZON	HYD	Magat 1	97	25-Mar-22	04-May-22	40.46	Planned Outage	Annual preventive maintenance outage.	01 August, 1983	11,652
LUZON	HYD	San Roque 1	145	14-Mar-22	30-Aug-22	169.00	Planned Outage	Plammed outage from 14 March--09 September 2022.	01 May, 2003	48,672
LUZON	HYD	Magat 4	97	01-Mar-22	25-Apr-22	55.52	Planned Outage	On Planned Outage until 04 May 2022	01 October, 1983	15,991
LUZON	HYD	Angat M 4	50	14-Feb-22		284.00	Planned Outage	Planned Outage	01 October, 1967	72,864
LUZON	HYD	Magat 4	97	10-Jan-22		318.34	Forced Outage	Emergency shutdown due to critical high elevation of Maris.	01 October, 1983	387
LUZON	HYD	Magat 3	97	20-Dec-21		339.58	Forced Outage	Critical high water level of Maris dam.	01 October, 1983	1,319
LUZON	HYD	Magat 2	97	20-Dec-21		339.58	Forced Outage	Critical high water level of Maris dam.	01 August, 1983	1,319
LUZON	HYD	Magat 1	97	20-Dec-21		339.58	Forced Outage	Critical high water level of Maris dam.	01 August, 1983	1,319
LUZON	HYD	Angat M 3	50	02-Nov-21		364.00	Forced Outage	Draw-out of Main Unit 3 generator breaker.	01 October, 1967	104,832
LUZON	NATG	Ilijan B3	220	05-Jun-22		173.00	Forced Outage	End of Cooperation Period of Ilijan NGPP.	01 June, 2002	8,928
LUZON	NATG	Ilijan B2	190	05-Jun-22		173.00	Forced Outage	End of Cooperation Period of Ilijan NGPP.	01 June, 2002	8,928
LUZON	NATG	Ilijan B1	190	02-May-22		206.16	Forced Outage	End of Cooperation Period of Ilijan NGPP.	01 June, 2002	8,928
LUZON	NATG	San Lorenzo 2	265	04-Aug-22		112.34	Forced Outage	Emergency shutdown due to trouble during fuel changeover from gas to oil.	01 September, 2002	8,881
LUZON	NATG	Ilijan B3	220	05-Jun-22		173.00	Forced Outage	End of Cooperation Period of Ilijan NGPP.	01 June, 2002	41,184
LUZON	NATG	Ilijan B2	190	05-Jun-22		173.00	Forced Outage	End of Cooperation Period of Ilijan NGPP.	01 June, 2002	41,184
LUZON	NATG	Ilijan A1	190	04-Jun-22		173.05	Forced Outage	End of Cooperation Period of Ilijan NGPP.	01 June, 2002	50,126
LUZON	NATG	Ilijan A3	220	04-Jun-22		173.05	Forced Outage	End of Cooperation Period of Ilijan NGPP.	01 June, 2002	50,128
LUZON	NATG	Ilijan A2	190	04-Jun-22		173.18	Forced Outage	End of Cooperation Period of Ilijan NGPP.	01 June, 2002	50,163
LUZON	NATG	San Lorenzo 1	265	10-May-22		198.27	Forced Outage	Tripped w 166MW load due to possible defective float switch on deluxe pump	01 September, 2002	78
LUZON	NATG	Ilijan B1	190	02-May-22		206.16	Forced Outage	Malampaya Natural Gas Supply Restriction	01 June, 2002	50,735
LUZON	NATG	San Lorenzo 2	265	20-Jan-22	25-Feb-22	36.33	Planned Outage	Maintenance Outage until 23 February 2022	01 September, 2002	10,175
LUZON	NATG	Ilijan B2	190	05-Jan-22	11-Feb-22	36.53	Forced Outage	Affected by the Malampaya gas supply restriction.	01 June, 2002	10,519
LUZON	NATG	Avion 1	47.2	10-Dec-21	06-Feb-22	58.16	Forced Outage	Thorough inspection.	01 August, 2016	16,750
LUZON	OIL	SLPGC 4	25	10-Feb-22		287.25	Forced Outage	Due to low turbine lube oil supply. IEMOP deregistration effective on August 25 2022.	01 March, 2018	8,928
LUZON	OIL	SLPGC 3	25	22-Jan-22		306.10	Forced Outage	Declared unavailable due to turbine lube oil sump metal chips detected. IEMOP deregistration effective on August 25 2022.	01 March, 2018	8,928
LUZON	OIL	MGTPP	85	29-Sep-21		364.00	Forced Outage	Tripped from 14MW due to turbine bearing shaft vibration. IEMOP deregistration effective December 25 2021.	01 January, 1993	8,928
LUZON	OIL	Malaya 1	300	03-May-19		364.00	Forced Outage	Declared unavailable due to motorization of unit generator caused by the non-opening of phase B of PCB 8-05CB08MAL	01 August, 1975	8,928
LUZON	OIL	Limay 4	87	24-Oct-22	24-Nov-22	31.60	Planned Outage	Minor overhauling of steam turbine.	01 May, 1993	9,101
LUZON	OIL	Ingrid 6	28	14-Oct-22		41.95	Planned Outage	Planned Outage	04 October, 2021	3,441
LUZON	OIL	Ingrid 5	22	14-Oct-22		41.95	Planned Outage	Planned Outage	04 October, 2021	3,441
LUZON	OIL	Ingrid 4	28	14-Oct-22		41.95	Planned Outage	Planned Outage	04 October, 2021	3,441
LUZON	OIL	Ingrid 3	22	14-Oct-22		41.95	Planned Outage	Planned Outage	04 October, 2021	3,441
LUZON	OIL	Ingrid 2	22	14-Oct-22		41.95	Planned Outage	Planned Outage	04 October, 2021	3,441
LUZON	OIL	Ingrid 1	28	14-Oct-22		41.95	Planned Outage	Planned Outage	04 October, 2021	3,441
LUZON	OIL	Limay 1	60	11-Jul-22	22-Aug-22	42.49	Planned Outage	Planned outage.	01 May, 1993	12,236
LUZON	OIL	Malaya 2	130	23-Mar-22	28-Apr-22	35.35	Planned Outage	on commisssioning test.	01 April, 1979	9,579
LUZON	OIL	SLPGC 4	25	10-Feb-22		287.25	Forced Outage	Emergency shutdown due to low bearing lube oil pressure.	01 March, 2018	64,583
LUZON	OIL	Limay 7	60	01-Feb-22	04-Mar-22	30.88	Forced Outage	Tripped due to loss of excitation.	01 December, 1994	8,605
LUZON	OIL	SLPGC 3	25	22-Jan-22		306.10	Forced Outage	Declared unavailable due to turbine lube oil sump metal chips detected	01 March, 2018	70,013
LUZON	OIL	Malaya 2	130	19-Jan-22	15-Mar-22	54.46	Planned Outage	Commissioning test	01 April, 1979	15,397
LUZON	OIL	Limay 5	60	10-Jan-22	27-Feb-22	48.62	Planned Outage	Planned outage is until 23 Feb 2022. PANASIA to conduct inspection of Gas Turbine or Generator and Heat Recovery Steam Generator and carry out other pending wor	01 December, 1994	13,715
LUZON	OIL	Limay 5	60	09-Jan-22		319.25	Forced Outage	Due to fuel system problem.	01 December, 1994	71
LUZON	OIL	MGTPP	85	29-Sep-21		364.00	Forced Outage	Tripped from 14MW due to turbine bearing shaft vibration	01 January, 1993	95,904
LUZON	OIL	Malaya 1	300	03-May-19		364.00	Forced Outage	Declared unavailable due to motorization of unit generator caused by the non-opening of phase B of PCB 8-05CB08MAL	01 August, 1975	95,904
VISAYAS										
VISAYAS	BIOF	South Negros	25	11-Oct-22	21-Nov-22	40.86	Forced Outage	Emergency offline due to poor fuel(bagasse) quality.	12 September, 2019	7,595
VISAYAS	BIOF	San Carlos Bio	20	27-Jun-22	01-Nov-22	127.51	Forced Outage	Emergency offline due to poor fuel quality.	01 February, 2009	1,880
VISAYAS	BIOF	South Negros	25	11-Aug-22	26-Sep-22	46.37	Forced Outage	Emergency offline due to poor fuel quality.	12 September, 2019	108
VISAYAS	COAL	THVI 1	169	10-Oct-22	20-Nov-22	41.91	Planned Outage	UNIT 1 MANUALLY SHUTDOWN FOR APMS FROM OCT 10 TO NOV 03 2022	01 April, 2019	7,463
VISAYAS	COAL	THVI 2	169	05-Apr-22	25-May-22	49.51	Forced Outage	Auto-tripped due to induced draft fan vibration high	01 September, 2019	14,260
VISAYAS	COAL	PALM 1	135	27-Mar-22	28-Apr-22	32.62	Forced Outage	Offline due to Low Boiler Excess Oxygen caused by Pre-Heater Leak.	01 August, 2016	9,395
VISAYAS	COAL	CEDC 3	82	02-Feb-22	24-Mar-22	50.54	Forced Outage	INSTRUMENT AIR PRESSURE LOW(AFFECTED BY THE TRIPPING OF UNIT 1)	01 January, 2011	14,266
VISAYAS	COAL	PEDC 3	150	01-Jan-22	31-Jan-22	30.65	Planned Outage	APMS	01 December, 2016	8,826
VISAYAS	COAL	CEDC 1	82	16-Dec-21	18-Jan-22	32.19	Forced Outage	Tripped while house load. Typhoon odette	01 April, 2010	9,270
VISAYAS	COAL	PEDC 1	83.7	16-Dec-21	28-Mar-22	101.66	Forced Outage	Autotripped	01 November, 2010	28,990
VISAYAS	COAL	THVI 2	169	16-Dec-21	17-Jan-22	31.99	Forced Outage	UNIT TRIPPED AFFECTED BY THE TRIPPING OF DAANLUNGSOD-MAGDUGO 138KV LINE CAUSED BY TYPHOON ODETTE	01 September, 2019	9,214
VISAYAS	COAL	TPC-Sangi 3	40.36	27-Nov-21	15-Jul-22	230.19	Maintenance Outage	BOILER REHAB	01 October, 2015	66,008
VISAYAS	COAL	TPC-Sangi 2	20.38	27-Nov-21	15-Jul-22	230.19	Maintenance Outage	BOILER REHAB	01 October, 2015	66,008
VISAYAS	GEO	Mahanagdong A1	5	02-Oct-22	14-Nov-22	42.63	Forced Outage	Tripped affected by the tripping of 350kV HVDC line.	01 July, 1997	5,517
VISAYAS	GEO	PGPP2 Unit 2	20	18-Sep-22	19-Oct-22	31.47	Planned Outage	Offline to conduct maintenance activity.	01 August, 1983	9,065
VISAYAS	GEO	Malitbog BC	14	13-Aug-22	02-Oct-22	50.03	Forced Outage	Tripped.	01 July, 1997	14,408
VISAYAS	GEO	Mahanagdong A2	5	13-Aug-22	02-Oct-22	50.03	Forced Outage	Tripped.	01 July, 1997	14,408
VISAYAS	GEO	Upper Mahiao 3	32	15-Jun-22	17-Jul-22	31.72	Planned Outage	Part of Plant Testing (Economic Shutdown)	01 July, 1997	9,134
VISAYAS	GEO	Leyte 1	41	18-May-22	17-Jul-22	59.81	Forced Outage	Emergency cut-out to effect repair of steam leak.	01 June, 1983	17,227
VISAYAS	GEO	Mahanagdong A2	5	04-May-22	13-Aug-22	100.76	Forced Outage	Replacement of Transformer Differential Relay	01 July, 1997	29,018
VISAYAS	GEO	Malitbog 1	72	26-Jan-22	30-Apr-22	94.32	Forced Outage	Under assessment	01 July, 1997	26,877
VISAYAS	GEO	Mahanagdong A1	5	11-Jan-22	27-Feb-22	47.71	Planned Outage	35 days scheduled APMS with replacement of cooling tower	01 July, 1997	13,451
VISAYAS	GEO	Upper Mahiao 3	32	22-Jul-20	15-Jun-22	201.93	Maintenance Outage	Trip with Loss of Excitation. Economic Shutdown	01 July, 1997	57,867
VISAYAS	WIND	SLWind	54	08-Mar-22	09-Apr-22	31.36	Forced Outage	Offline to conduct Line Clearing.	01 December, 2014	9,030
VISAYAS	WIND	SLWind	54	16-Dec-21	08-Mar-22	81.77	Forced Outage	Autotriped due to high voltage	01 December, 2014	23,261

Annex B. Plants with Increase/Decrease Capacity, 2021 vs 2022

Plant Type	Market Participant Name	Node ID	Capacity		
			2021	2022	Change
New Registered Plants					
BAT	Universal Power Solutions, Inc.	01MAGAPIT_BAT		40	40
COAL	GNPower Dinginin Ltd. Co.	01GNPD_U02		668	668
HYDRO	Mindoro Grid Corporation	01BUTAO_G01		1.3	1.3
	Bicol Hydropower Corporation	03INARI_G01		1.7	1.7
	Taft Hydroenergy Corporation	04TAFT_G01		15.9	15.9
	Oriental Energy & Power Generation Corp.	08TIMBA_G01		18.9	18.9
SOLR	Greencore Power Solutions 3, Inc.	01ARAYSOL_G01		50	50
	Energy Logics Philippines, Inc.	01PASQSOL_G01		96	96
	RASLAG Corp.	01RASLAG_G03		15	15
				SUB-TOTAL:	**906.8**
Plants that Increased Capacity					
COAL	South Luzon Thermal Energy Corporation	03SLTEC_G01	121	122	1
	South Luzon Thermal Energy Corporation	03SLTEC_G02	122.9	124	1.1
HYDRO	SN Aboitiz Power - Benguet, Inc.	01AMBUK_U03	35	37.5	2.5
	SN Aboitiz Power - Benguet, Inc.	01AMBUK_U01	35	37.5	2.5
	SN Aboitiz Power - Benguet, Inc.	01AMBUK_U02	35	37.5	2.5
	HEDCOR, Inc.	01BINENG_G01	19.2	19.8	0.6
NATG	FGP Corp.	03STA-RI_G05	264.8	265	0.2
	FGP Corp.	03STA-RI_G06	261.8	265	3.2
OIL	Isabel Ancillary Services Co. Ltd.	04IASMOD_G02	10	10.1	0.1
	Isabel Ancillary Services Co. Ltd.	04IASMOD_G03	15	15.1	0.1
	Isabel Ancillary Services Co. Ltd.	04IASMOD_G04	10	10.2	0.2
	Isabel Ancillary Services Co. Ltd.	04IASMOD_G05	15	15.1	0.1
	Isabel Ancillary Services Co. Ltd.	04IASMOD_G06	10	10.2	0.2
	Cebu Private Power Corporation	05CPPC_U01	6	6.5	0.5
	Cebu Private Power Corporation	05CPPC_U02	6	6.5	0.5
	East Asia Utilities Corporation	05EAUC_U03	10.5	11.5	1
	East Asia Utilities Corporation	05EAUC_U04	10.5	11.5	1
	SPC Power Corporation	07TPLPB4_U04	7	8	1
SOLR	YH Green Energy, Incorporated	01YHGRN_G01	12.6	13.4	0.8
				SUB-TOTAL:	**19.1**
Plants that Decreased Capacity					
BIOF	HyperGreen Energy Corporation	01HYPGRN_G01	12	10	-2
	Isabela Biomass Energy Corporation	01IBEC_G01	18.3	18	-0.3
	Hawaiian-Philippine Company	06HPCO_G01	3	2	-1
	Hawaiian-Philippine Company	06HPCO_G02	18.6	9.5	-9.1
	San Carlos Biopower Inc.	06SCBIOP_G01	20	19.5	-0.5
	Victorias Milling Company,Inc.	06VMC_G02	37.5	21.5	-16
COAL	Asia Pacific Energy Corporation	01APEC_G01	52	25	-27
	Southwest Luzon Power Generation Corporatio	03SLPGC_G02	150	150	-0.4
GEO	AP Renewables Inc.	03MKBN_A	126.4	114	-12.4
	AP Renewables Inc.	03MKBN_B	126.4	116	-10.4
	AP Renewables Inc.	03MKBN_C	110	30	-80
OIL	CIP II Power Corporation	01CIP2_G01	21.3	20	-1.3
	Panasia Energy, Inc.	01LIMAY_U04	90	87	-3
	Ingrid Power Holdings, Inc.	03INGRID_GS1	28.3	28	-0.3
	Ingrid Power Holdings, Inc.	03INGRID_GS2	22.9	22	-0.9
	Ingrid Power Holdings, Inc.	03INGRID_GS3	22.5	22	-0.5
	Ingrid Power Holdings, Inc.	03INGRID_GS4	28.4	28	-0.4
	Ingrid Power Holdings, Inc.	03INGRID_GS6	28.4	28	-0.4
	Belgrove Power Corporation	03MALAYA_G02	350	130	-220
	East Asia Utilities Corporation	05EAUC_U01	11.5	11.5	0
	East Asia Utilities Corporation	05EAUC_U02	11	11	0
SOLR	GIGASOL3, Inc.	01GIGSOL_G01	55	50.5	-4.5
	RASLAG Corp.	01RASLAG_G01	9	8.2	-0.8
	RASLAG Corp.	01RASLAG_G02	13.1	10.5	-2.6
	Jobin-SQM Inc.	01SUBSOL_G01	59.3	56.6	-2.7
	Sulu Electric Power and Light (Phils.), Inc.	04SEPSOL_G01	41.6	40.5	-1.1
				SUB-TOTAL:	**-397.5**
Ceased Registration					
OIL	Millennium Energy, Inc.	02MILLEN_G01	85		-85
				SUB-TOTAL:	**-85.0**
Derigistered					
OIL	Southwest Luzon Power Generation Corporatio	03SLPGC_G03	25		-25
	Southwest Luzon Power Generation Corporatio	03SLPGC_G04	25		-25
				SUB-TOTAL:	**-50.0**
				GRAND TOTAL:	**393.3**

DEFINITIONS, REFERENCES, AND INTERPRETATION

- Pricing Error Notice (PEN)
  - A pricing algorithm in the market and are categorized according to cause, as either Network congestion pricing errors or non-congestion pricing errors. Pricing error notice shall be issued only for the market run where the pricing error is determined by the Market Operator to have occurred.

- Secondary Price Cap (SPC)
  - A preventive mitigating measure instituted by the ERC to avoid excessive high market prices through its imposition on succeeding intervals, upon breach of PHP9,000/MWh Rolling Average of the generator-weighted average price (GWAP) for a running period of 3 days or 864 5-minute intervals. In this case, market prices are capped at PHP6,245/MWh.

- Administered Price (AP)
  - Administered price determination methodology which shall be implemented by the Market Operator to impose administered prices on dispatch intervals under market suspension or market intervention.
  - Administered price shall be established by the Market Operator in accordance with guiding principles as set forth by the WESM rules.

- Generator/Producer Surplus
  - Represents the difference between the price a generator receives and their willingness to sell for each quantity.
  - Daily average price of the producer/generator surplus is derived from the daily weighted average price of all the generator trading participants during peak and off-peak hours. Increase and decrease in the daily weighted average price depend on the generator schedule per dispatch interval.

- Pivotal Suppliers
  - The market measures how critical a particular generator is in meeting the total demand at a particular time, taking into consideration the variables that change dynamically, mainly demand (energy withdrawn), required spinning (or operational) reserve and generation availability.

- Residual Supply Index
  - Measures the ratio of the available generation without a Generator to the total generation (including operational reserve) required to supply the demand. It is likewise essential in determining whether there are pivotal suppliers in an interval.

- Price Substitution Methodology (PSM)
  - A pricing algorithm that shall be implemented in all the regions where the WESM is in operation. In cases where a region/s has no interconnection with other regions, or has no exchange of power with other regions, this region/s shall be separately assessed for the application of the price substitution methodology.
  - The price substitution methodology shall apply to a dispatch interval when the trigger factor exceeds the threshold, which shall be set at 0.2, subject to annual review.

- The dispatch schedules arrived at in the original (constrained) market solution for the relevant dispatch interval will stand and will be the basis for dispatch by the System Operator irrespective of the results of the unconstrained solution. Redispatch of generation units will be implemented by the System Operator in accordance with relevant provisions of the WESM Rules and Market Manuals, the Philippine Grid Code and other relevant rules, regulations, issuances, guidelines, and procedures.

- Ramp Limited Capacity
  - Generator restricted capacities due to the plants' intrinsic ramp rates.
  - Ramp rate is essentially the speed at which a generator can increase (ramp up) or decrease (ramp down) generation. Generating units have different characteristics, making some more suited to supplying certain needed functions.

- Energy Trading Amount
  - The energy trading amount for a trading participant and settlement interval shall be determined using the final energy dispatch prices for that node, the gross energy settlement quantities, and bilateral contract quantities for that node in the dispatch intervals within the same settlement interval.