Annual Market Assessment Report

26 November 2018 to 25 November 2019

AUGUST 2020

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

Table of Contents

List of Figures

List of Tables

ANNUAL MARKET ASSESSMENT REPORT

This Annual Market Assessment Report (AMAR) provides an assessment of results of the integrated Luzon and Visayas operations of the Wholesale Electricity Spot Market (WESM) for the period of Cool Dry Season (26 November 2018 to 25 February 2019), Hot Dry Season (26 February to 25 May 2019), and Rainy Season (26 May to 25 November 2019). This report likewise sets out an overview of the results of market performance, trends and drivers which in turn provide the means to assess competition and conditions in the WESM, as well as the bidding behavior of trading participants.

I. Highlights of the Market

A. Cool Dry Season

- Low demand during the holiday season resulted in wide supply margins.
- Highest level of outage was recorded in January and February 2019 billing months in preparation for the May 2019 National and Local Elections.
- Three (3) trading intervals were under Market Intervention:

Table 1. Market Intervention Events, Cool Dry 2019

Number of Market Intervention Events	Reason for Market Intervention
2 MO-initiated System-wide	Unimplementable RTD schedule
1 MO-initiated in Luzon	Unimplementable RTD schedule

B. Hot Dry Season

- A magnitude 6.1 earthquake caused plant outages in the Luzon grid on 22 April 2019.
- Annual observance of the Holy Week resulted in low demand levels on 18 to 21 April 2019.
- The secondary price cap was imposed during the occurrence of sustained high prices in April and May 2019 following its last imposition in September 2014.
- Total registered capacity increased by 5.1 percent, translating into 962.4 MW.
- Forty-two (42) Market Intervention events were noted in this season:

Table 2. Market Intervention Events, Hot Dry 2019

Number of Market Intervention Events	Reason for Market Intervention
33 SO-initiated in Luzon	Insufficient supply leading to manual load dropping
6 SO-initiated in Luzon	Earthquake with a magnitude of 6.1
3 MO-initiated System-wide	Unimplemementable RTD schedule and database error

C. Rainy Season

- Record-breaking events in the WESM as of the 2019 billing year:

Table 3. Record-breaking Events in the WESM since 2015

Billing Month	Record-breaking event
June 2019	Highest monthly average system demand plus reserve requirement at 12,030 MW
June 2019	Highest monthly LWAP at PhP7,7770/MWh
September 2019	Highest recorded average effective supply at 13,894 MW

- Rainy season had more secondary price cap impositions, especially in June 2019, compared to the dry season.
- Power plants that relied on fuel from Malampaya's natural gas production had to shut down following the SPEX Malampaya Maintenance Program in October 2019.
- A total of thirteen (13) tropical cyclones entered the country which influenced the supply and demand level throughout the duration of these weather events.
- Breakdown of the season's sixteen (16) Market Intervention events:

Table 4. Market Intervention Events, Rainy 2019

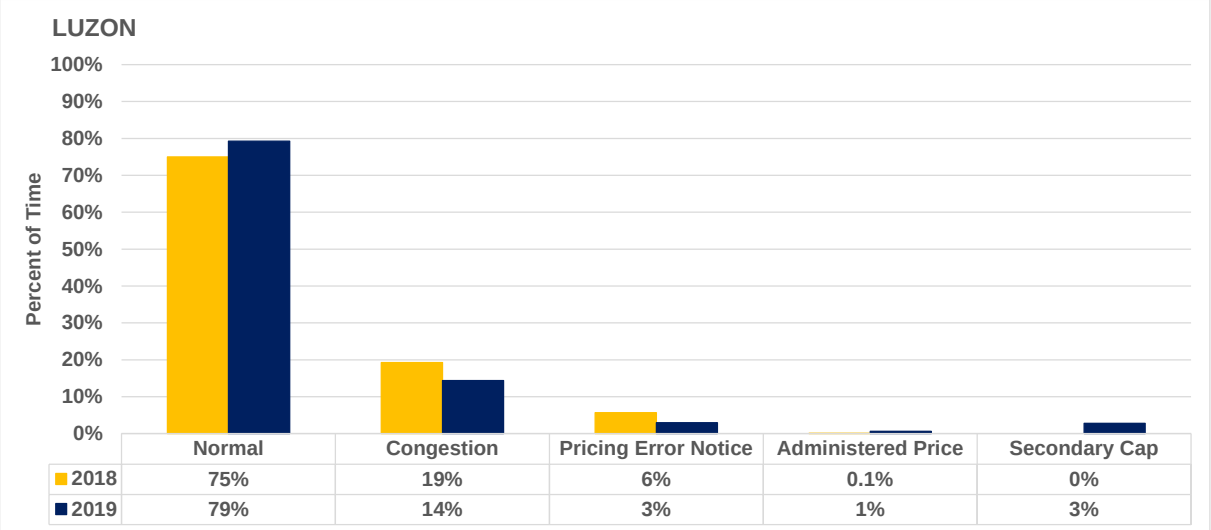
Number of Market Intervention Events	Reason for Market Intervention
10 SO-initiated in Luzon	Insufficient supply leading to manual load dropping
4 SO-initiated in Visayas	
2 MO-initiated System-wide	MMS stoppage

II. Assessment of the Market

- Majority of the time or 79 percent (6,944 trading intervals for Luzon and 6,937 trading intervals for Visayas) of the total market price outcomes in 2019 was the result of normal pricing condition.
- As compared to last year's 75~76 percent normal pricing outcomes for Luzon and Visayas, this was an increase that can be attributed to the decline in intervals that required other forms of pricing methodologies:
    - An improvement in the congestion situation was observed as Price Substitution Methodology (PSM) was applied to only 14~15 percent (1,258 trading intervals for Luzon and 1,293 trading intervals for Visayas) of the outcomes from last year's 19 percent. Around 63 percent of the intervals under PSM was due to the frequent congestion of the Samboan-Amlan line connection between the Cebu-Negros islands.
    - Prices with pricing error occurred around 3 percent of the time both for Luzon (258 trading intervals) and Visayas (245 trading intervals) which was majorly caused by inappropriate input data affecting Luzon and Visayas prices and

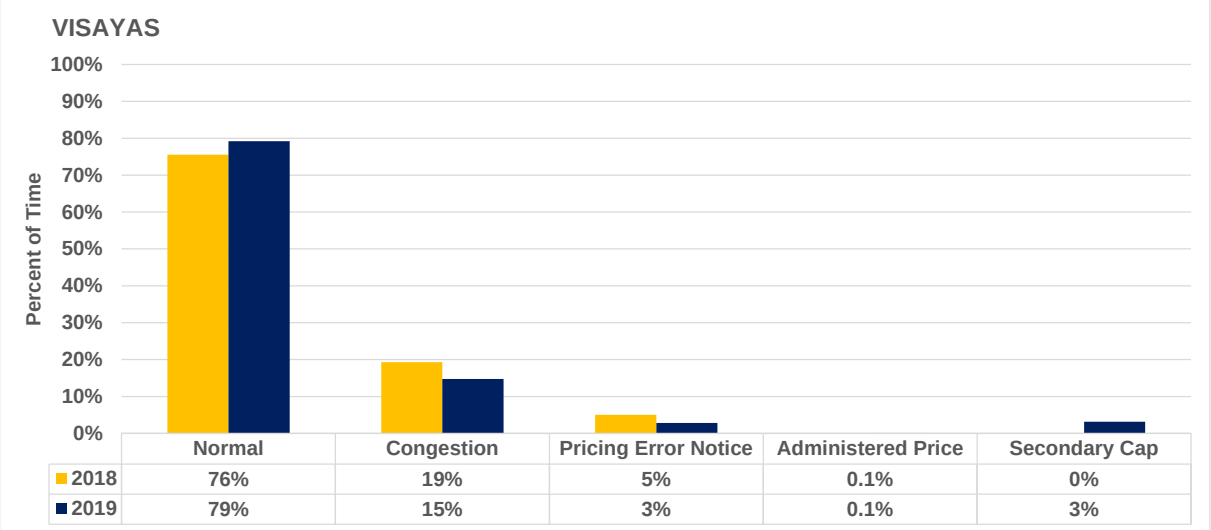
schedules at around 75 percent (193 trading intervals) and 66 percent (161 trading intervals) of the time for Luzon and Visayas, respectively.

- The higher number of Market intervention events that occurred this year resulted to the imposition of administered prices (AP) corresponding to the slight increase in its share in Luzon from 0.1 percent (9 trading intervals) in 2018 to 1 percent (57 trading intervals) in 2019 while retaining its Visayas share at 0.1 percent (11 trading intervals) in 2019.
- Secondary price caps at PhP6,245/MWh were likewise evident this year due to the level of the rolling average market prices breaching the PhP9,000/MWh threshold for 120 consecutive trading intervals. This constituted 3 percent (243 trading intervals in Luzon and 274 trading intervals in Visayas) of the total trading intervals for the 2019 billing year.
- The difference in the number of trading intervals between Luzon and Visayas regions with imposition of secondary price cap was due to the regional application of Administered Pricing in several intervals in Luzon as the System Operator (SO) implemented manual load dropping to address the insufficiency of supply.



	Normal	Congestion	Pricing Error Notice	Administered Price	Secondary Cap
2018	75%	19%	6%	0.1%	0%
2019	79%	14%	3%	1%	3%

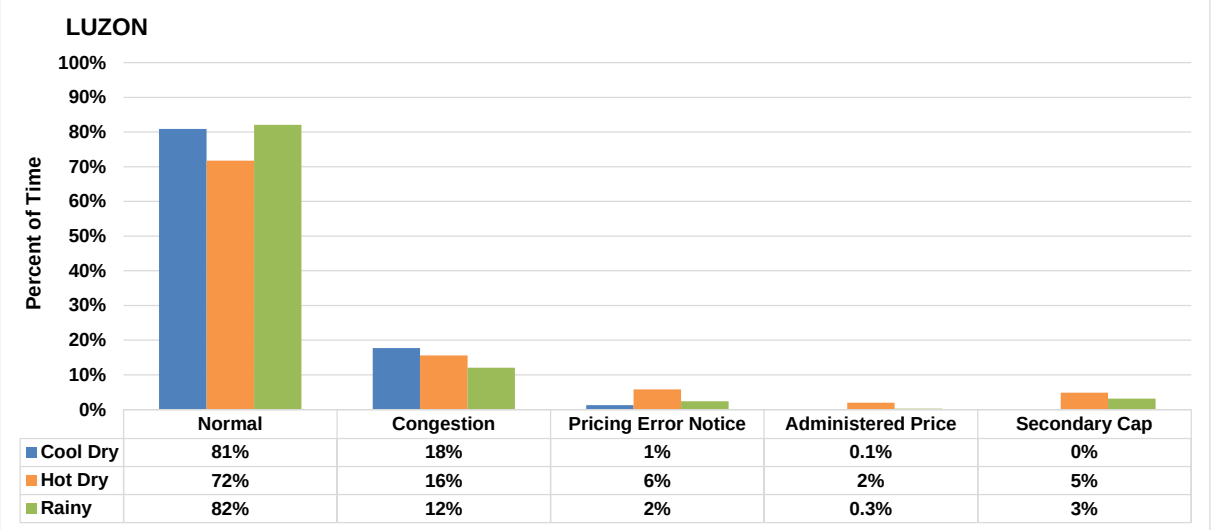
Figure 1. Summary of Pricing Conditions (Ex-ante) in Luzon, 2018 to 2019



	Normal	Congestion	Pricing Error Notice	Administered Price	Secondary Cap
2018	76%	19%	5%	0.1%	0%
2019	79%	15%	3%	0.1%	3%

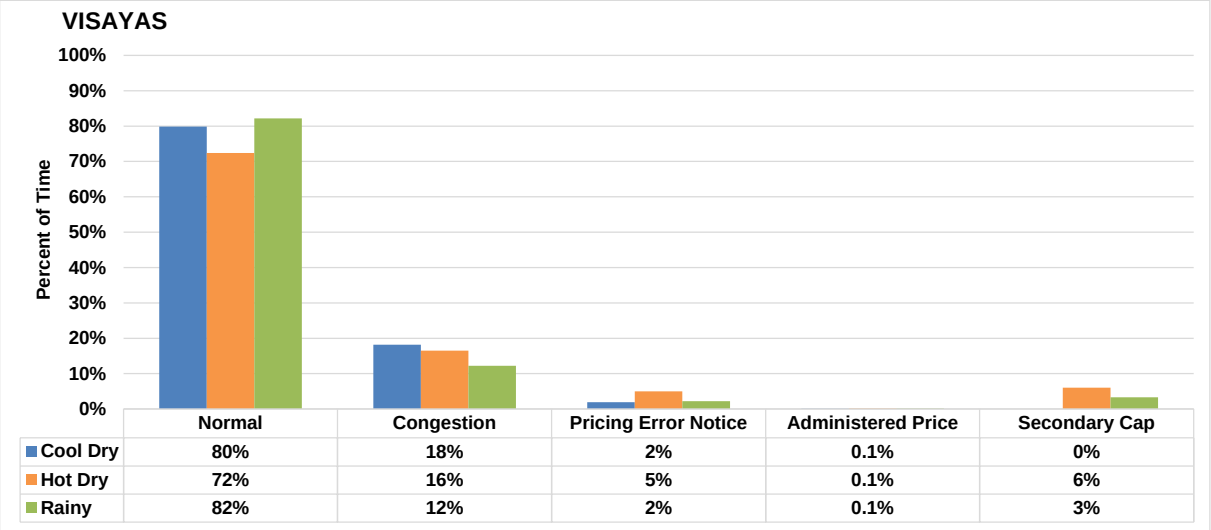
Figure 2. Summary of Pricing Conditions (Ex-ante) in Visayas, 2018 to 2019

- Rainy season had the most frequency of normal market pricing outcomes.
- It was in the hot dry season where the market recorded the lowest percentage of normal pricing condition due to the observance of trading intervals with market intervention and secondary price caps.
- Administered prices (57 trading intervals in Luzon and 11 trading intervals in Visayas) were evident across all seasons as a result of the Market Operator- and System Operator-initiated market intervention events.
- Roughly around 69 percent of the market intervention events in 2019 (47 trading intervals) was the result of the insufficiency of supply to satisfy the high level of demand that led to a number of alert warnings and implementation of manual load dropping of the System Operator.
- Several intervals were found to have breached the threshold of the secondary price cap.
- Prior this, the last recorded imposition of the secondary price cap was in September 2014.
- Market intervention and secondary price cap events persisted on the onset of the rainy season.



	Normal	Congestion	Pricing Error Notice	Administered Price	Secondary Cap
Cool Dry	81%	18%	1%	0.1%	0%
Hot Dry	72%	16%	6%	2%	5%
Rainy	82%	12%	2%	0.3%	3%

Figure 3. Summary of Pricing Conditions (Ex-ante) in Luzon, 2019 Seasons



	Normal	Congestion	Pricing Error Notice	Administered Price	Secondary Cap
Cool Dry	80%	18%	2%	0.1%	0%
Hot Dry	72%	16%	5%	0.1%	6%
Rainy	82%	12%	2%	0.1%	3%

Figure 4. Summary of Pricing Conditions (Ex-ante) in Visayas, 2019 Seasons

III. Market Outcome[1]

A. Price

i. Price and Supply Margin

[1] The market prices were represented by the following: (i) ex-ante load weighted average price (LWAP) for trading intervals without pricing error during ex-ante, (ii) ex-post LWAP for trading intervals with pricing error during ex-ante but without pricing error during ex-post, (iii) LWAP based on the market re-run result for trading intervals with pricing error both during ex-ante and ex-post, and (iv) estimated load reference price (ELRP) for trading intervals where the ERC-approved Price Substitution Mechanism (PSM) was applied.

- The year-on-year load-weighted average price (LWAP) grew by 37 percent from PhP3,562/MWh in 2018 to PhP4,894/MWh in 2019.
- The increase in yearly average market price factored in the 14 percent decline in the average yearly supply margin.
- The 2019 billing year recorded the highest yearly average LWAP since 2015.

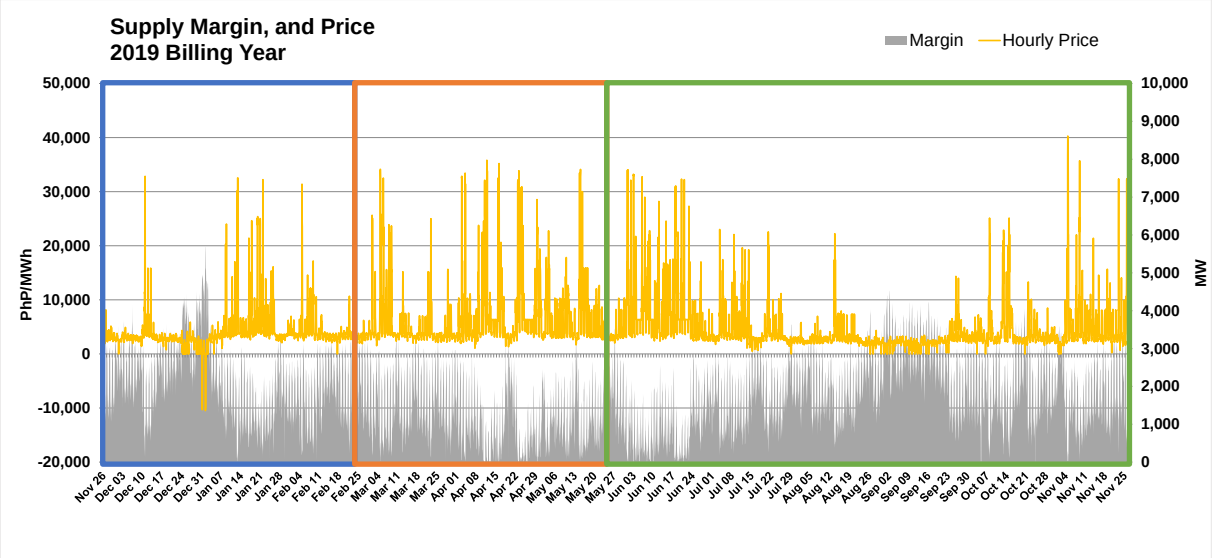


Figure 5. Hourly System LWAP and Hourly Supply Margin, 2018 to 2019

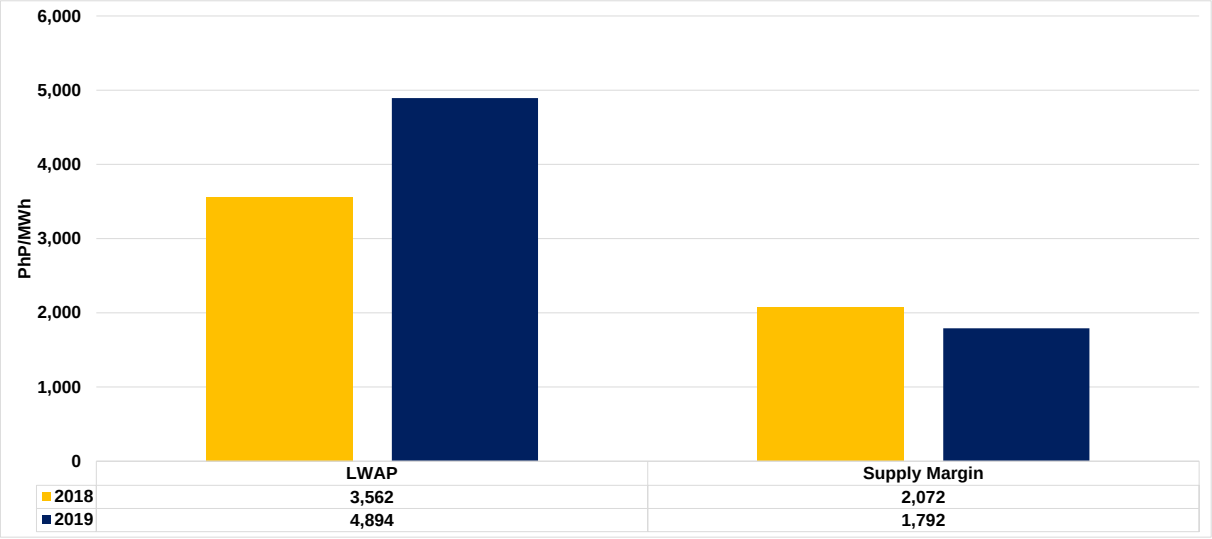


Figure 6. System LWAP and Average Supply Margin, 2018 to 2019

- The scatter plot of supply margin and price showed an inverse relationship wherein an increasing level of supply margin corresponded to a lower resulting price and vice versa.

- Also, prices are more sensitive to upward dispersions in lower levels of supply margin. Intervals, specifically with high demand, often lead to a much higher resulting market price as the slope of the supply curve becomes exponentially steeper at these demand levels.

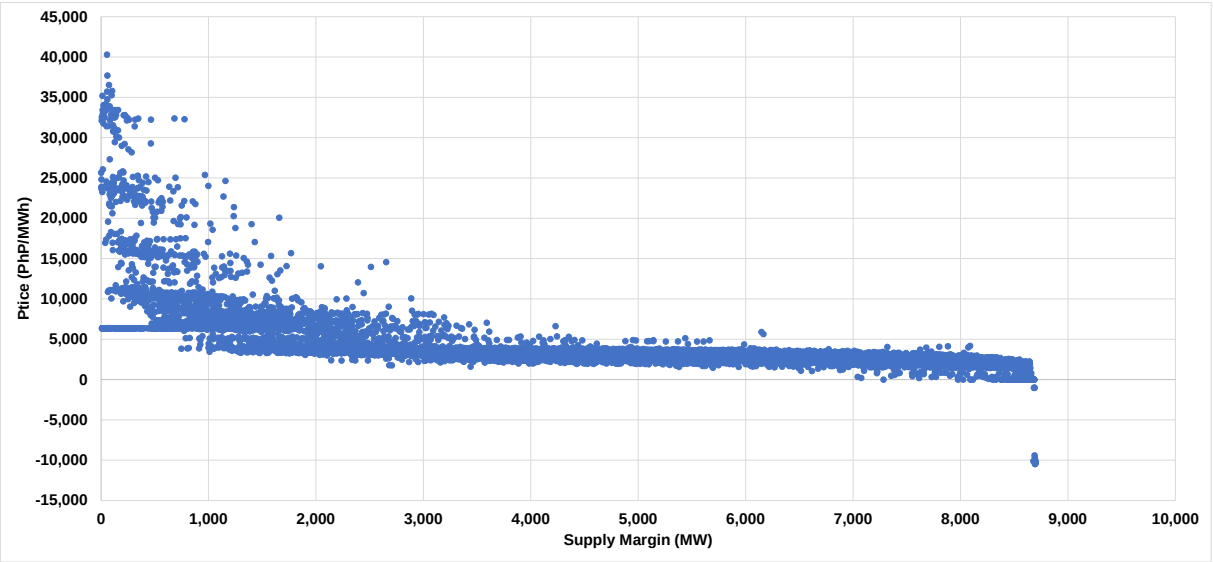


Figure 7. Supply Margin and Price Scatter Plot, 2019

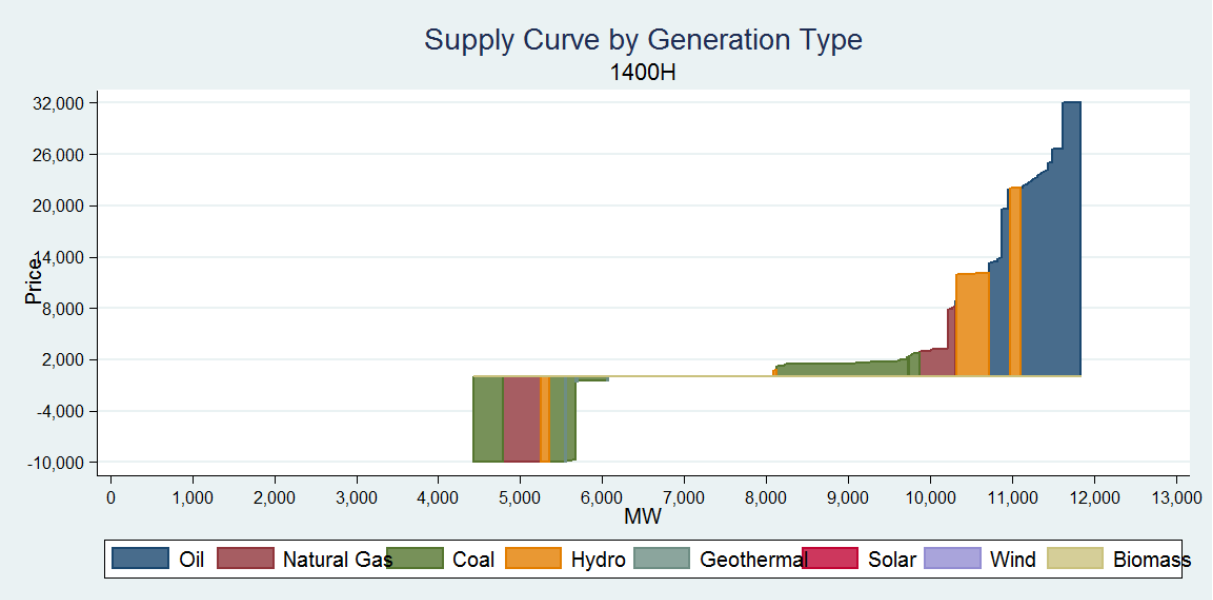


Figure 8. Sample Supply Curve for Hour 14[2]

[2] Pmin, must dispatch, priority dispatch, and non-scheduled generators are excluded

- The hot dry season naturally had the highest recorded LWAP when compared with all the seasons in a year, followed by the rainy season.
- Consistent with the yearly increase in the market price, the following seasons had also experienced a significant increase in average price when compared with last year:
    - Cool Dry – 39 percent increase from PhP2,866/MWh to PhP3,981/MWh
    - Hot Dry – 45 percent increase from PhP4,435/MWh to PhP6,435/MWh
    - Rainy – 32 percent increase from PhP3,451/MWh to PhP4,547/MWh
- Meanwhile, average supply margin for each season had a consistent downward trend coming into 2019:
    - Cool Dry – 8 percent decrease from 2,352 MW to 2,160 MW
    - Hot Dry – 21 percent decrease from 1,658 MW to 1,309 MW
    - Rainy – 14 percent decrease from 2,133 MW to 1,838 MW

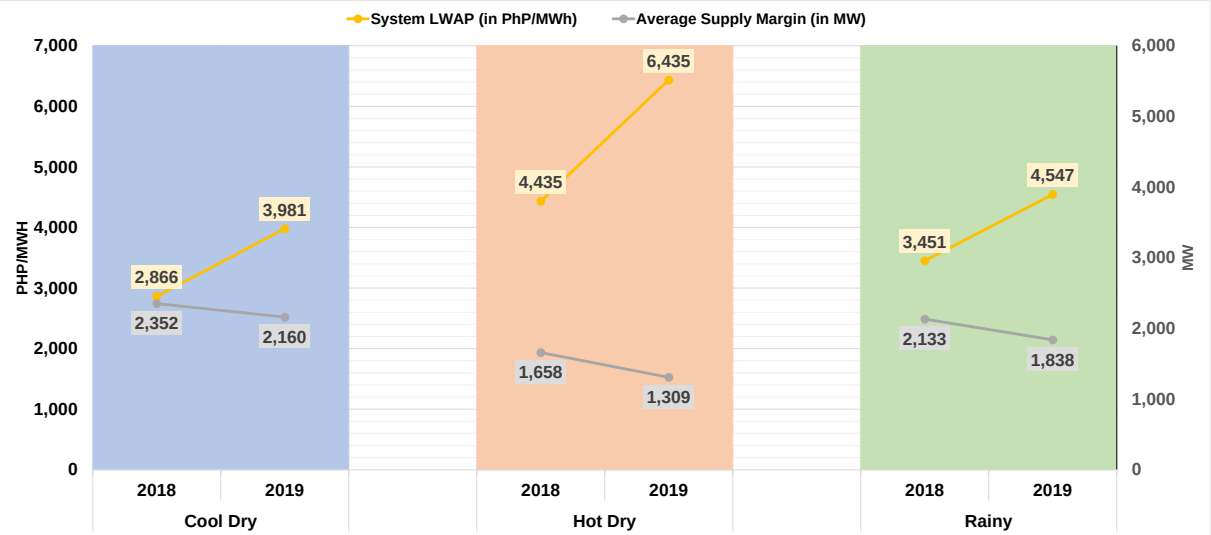


Figure 9. System LWAP and Average Supply Margin, 2018 to 2019 Seasons

- Since market prices are higher in 2019, this likewise corresponded to higher average prices during the off-peak and peak hours for every season.
- It can be noted that there was a significant 51 percent rise in the average price during the peak hours of the cool dry and the hot dry season while the rainy season recorded a 41 percent increase.
- Off peak hours, on the other hand, noted only a marginal increase of about 27 percent for cool dry, 38 percent for hot dry, and 22 percent for rainy season.
- During peak hours where, usually, higher prices can be observed than off-peak hours, a higher percentage increase was noted as prices are more volatile and sensitive to the changes in the supply and demand.

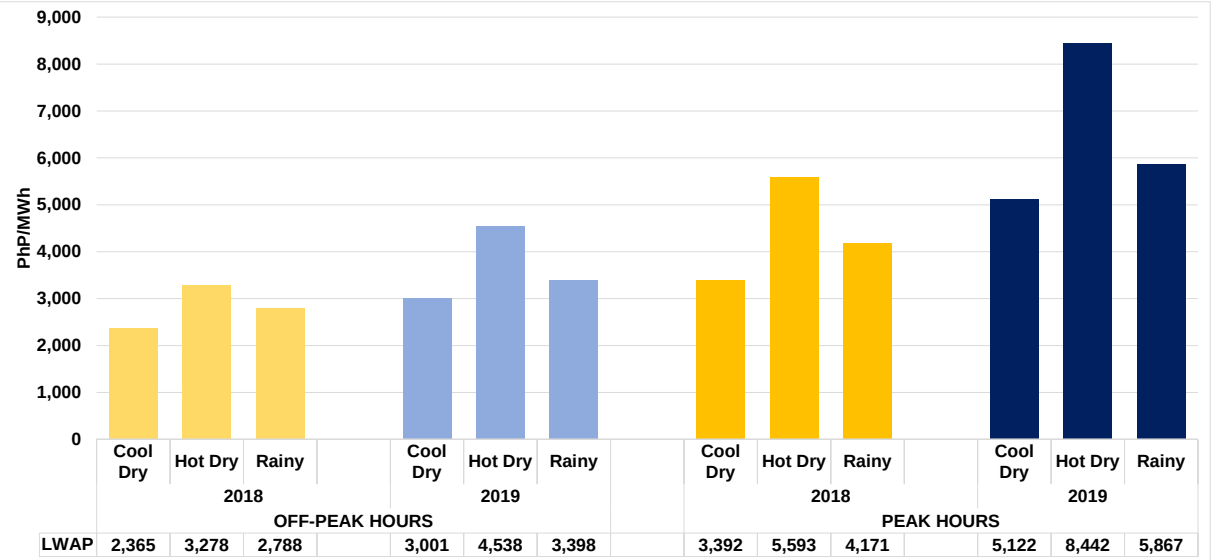


Figure 10. System LWAP Based on Hour Type, 2018 to 2019 Seasons

ii. Price Duration Curve

- In a price duration curve, the steeper the slope or the more it resembles a vertical line, the lower the spread of the price values are in a given period of time. The duration curve utilizes an hourly resolution of LWAPs.
- For off-peak and peak hours in 2018 and 2019, bulk of the prices were concentrated on the PhP0/MWh to PhP5,000/MWh range, noting that prices are more distributed during peak hours.
- About 90 percent of the system LWAP during off-peak hours in 2019 fell below PhP4,909/MWh while about the same percentage of time prices fell below PhP3,317/MWh in 2018.
- Hourly average prices reached a maximum of PhP15,302/MWh and PhP35,914/MWh during off-peak hours in 2018 and 2019, respectively. On the other hand, maximum peak prices in 2018 and 2019 went as high as PhP32,454/MWh and PhP40,293/MWh, respectively.
- Minimum hourly average prices during off-peak hours went as low as PhP-10,359/MWh in 2018 and PhP-10,469/MWh in 2019 while both years also noted a price of PhP0/MWh during peak hours.

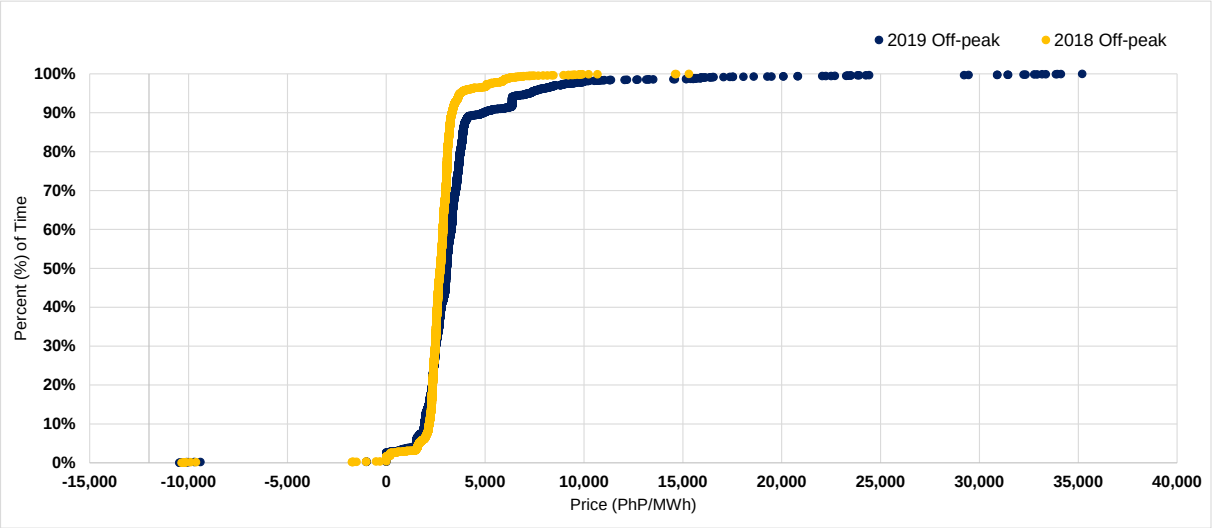


Figure 11. System LWAP Duration Curve for Off-peak Hours, 2018 to 2019

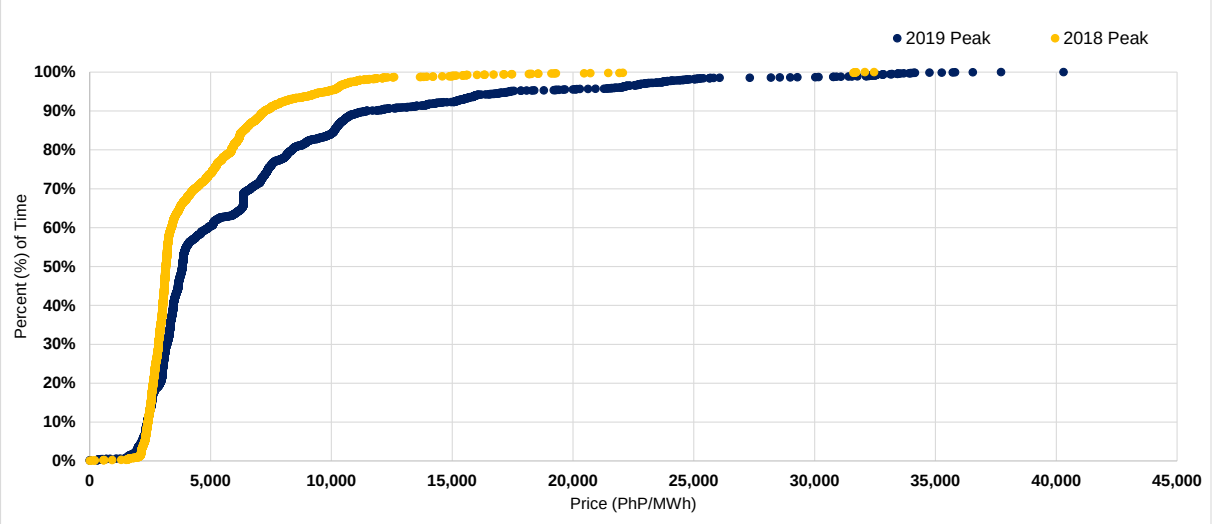
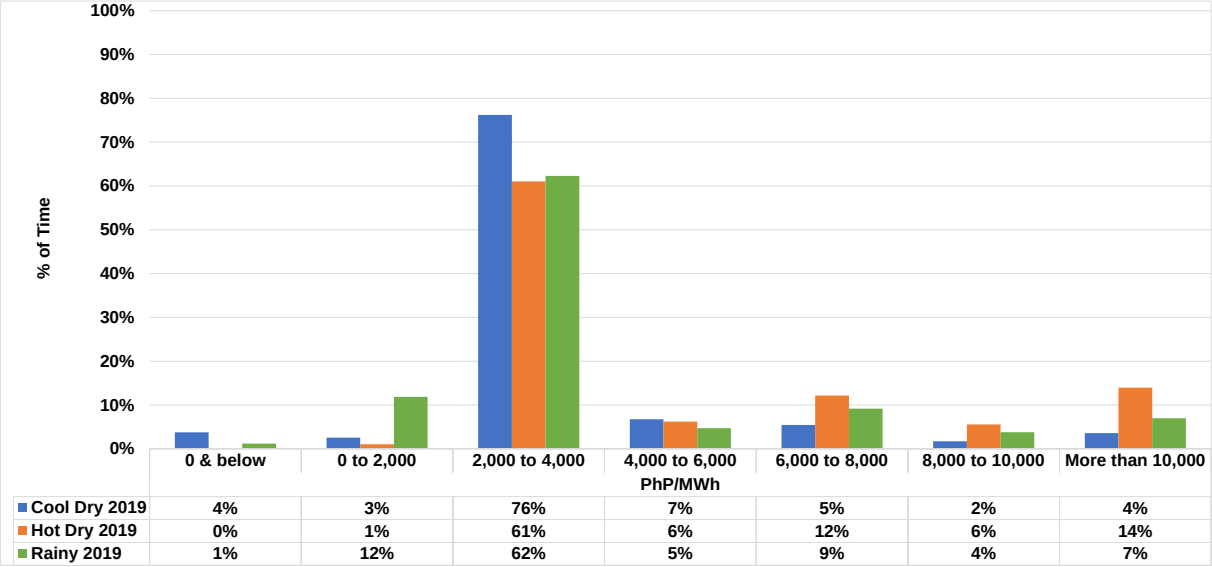


Figure 12. System LWAP Duration Curve for Peak Hours, 2018 to 2019

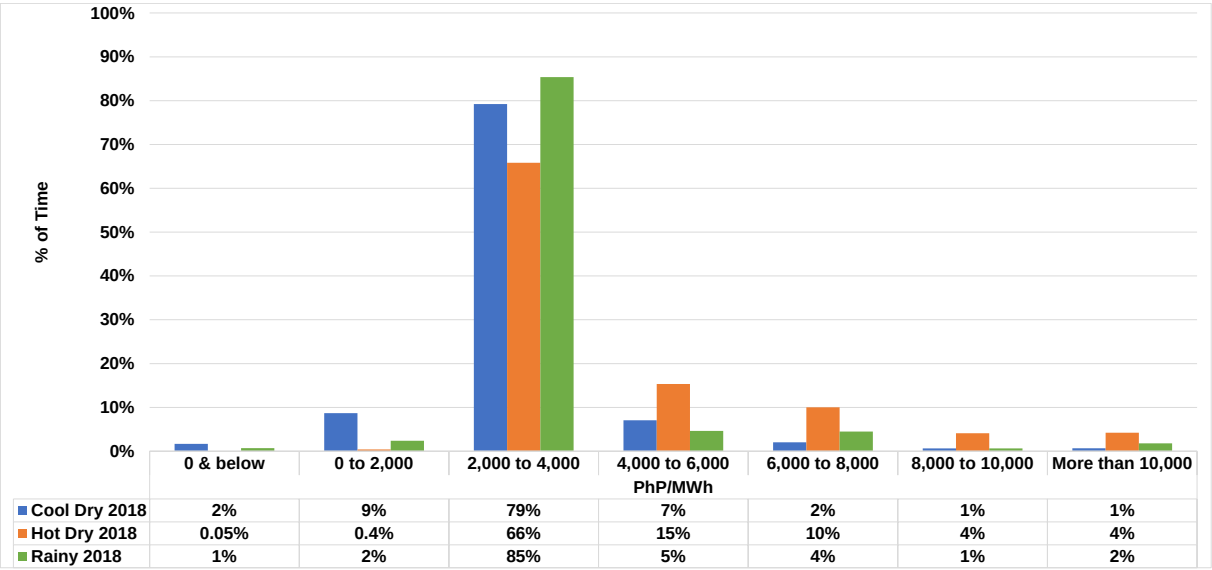
- Majority of the prices was within the PhP2,000/MWh to PhP4,000/MWh range occurring mostly during the cool dry season in 2019.
- However, contrary to the result in 2018, the prices during the rainy season in 2019 in the PhP2,000/MWh to PhP4,000/MWh range significantly fell from 85 percent to 62 percent owing to the evidently high prices this year.
- The observance of these high prices manifested throughout the seasons in 2019 which translated to an uptick in the frequency of intervals with prices greater than PhP4,000/MWh.

- It was also evident that the hot dry season consistently experienced higher market price outcomes as a consequence of higher power demand from consumers among all seasons.



	0 & below	0 to 2,000	2,000 to 4,000	4,000 to 6,000	6,000 to 8,000	8,000 to 10,000	More than 10,000
Cool Dry 2019	4%	3%	76%	7%	5%	2%	4%
Hot Dry 2019	0%	1%	61%	6%	12%	6%	14%
Rainy 2019	1%	12%	62%	5%	9%	4%	7%

Figure 13. System LWAP Frequency Distribution, 2019 Seasons



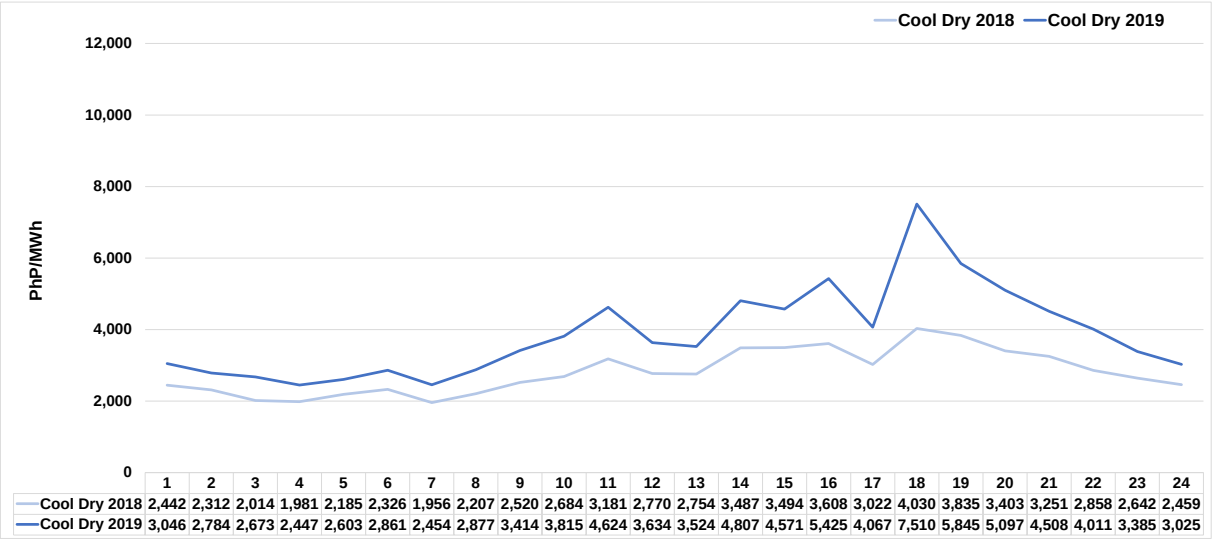
	0 & below	0 to 2,000	2,000 to 4,000	4,000 to 6,000	6,000 to 8,000	8,000 to 10,000	More than 10,000
Cool Dry 2018	2%	9%	79%	7%	2%	1%	1%
Hot Dry 2018	0.05%	0.4%	66%	15%	10%	4%	4%
Rainy 2018	1%	2%	85%	5%	4%	1%	2%

Figure 14. System LWAP Frequency Distribution, 2018 Seasons

iii. Hourly Price Profile

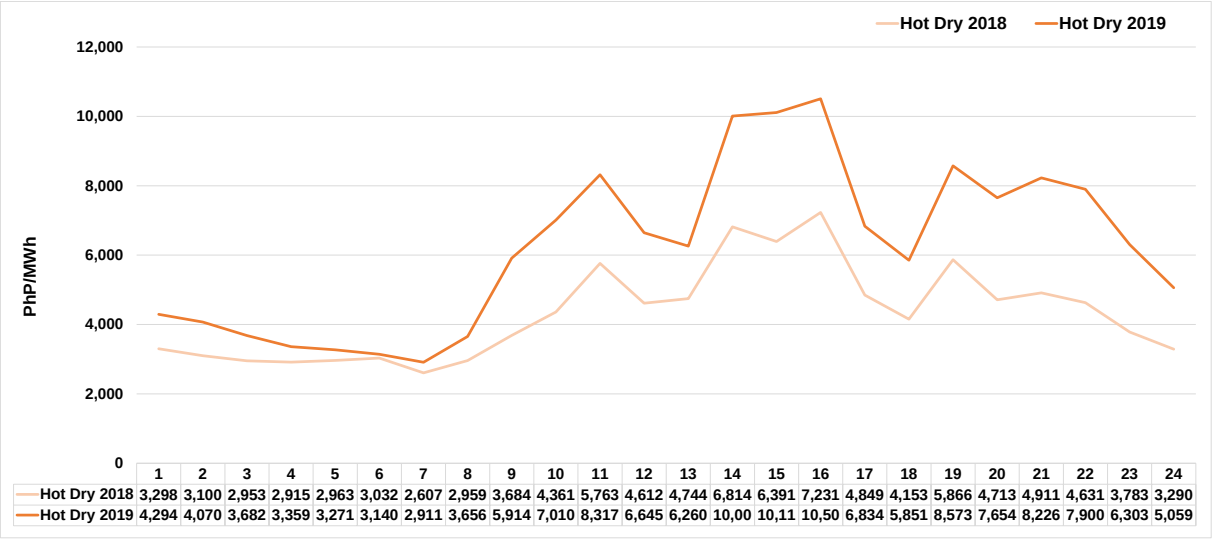
- In an hourly resolution of a price curve, a general elevated change in the movement/pattern of prices can be clearly seen across all the seasons.

- Throughout the different seasons in 2019, market prices peaked at different trading intervals, indicating different patterns of interplay between the supply and demand. Prices peaked at the following season and intervals:
    - Cool Dry – evening at 18H (2018 and 2019)
    - Hot Dry – afternoon at 14H and 16H (2018 and 2019)
    - Rainy – afternoon at 14H (2018), and evening at 21H (2019)
- It is also apparent of the widening of the gap between 2018 and 2019 during peak hours which subsequently levels off towards the morning off-peak intervals (1H-8H).



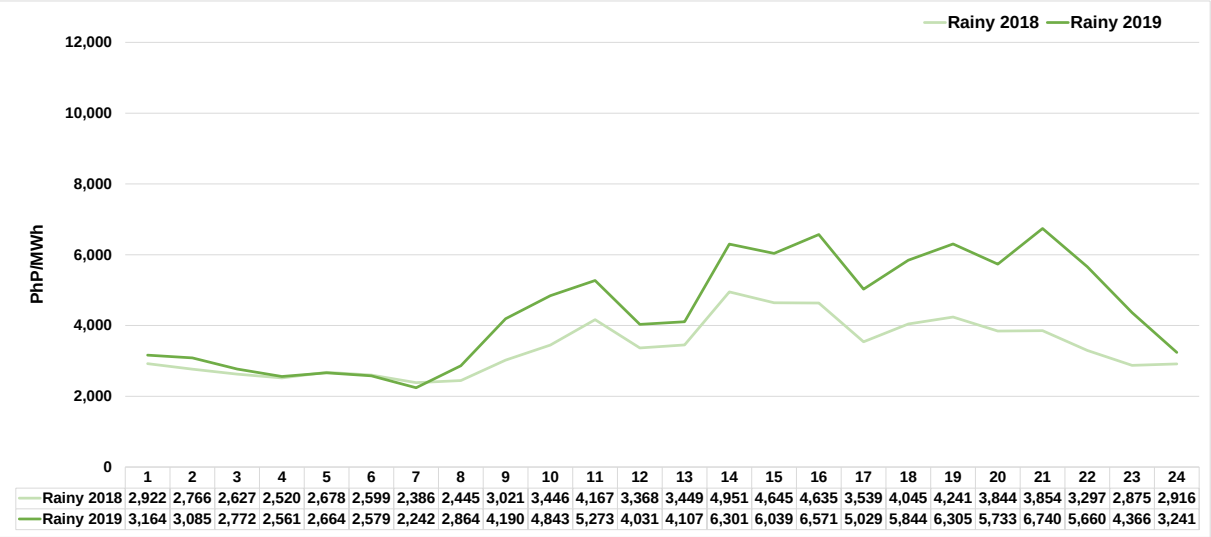
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Cool Dry 2018	2,442	2,312	2,014	1,981	2,185	2,326	1,956	2,207	2,520	2,684	3,181	2,770	2,754	3,487	3,494	3,608	3,022	4,030	3,835	3,403	3,251	2,858	2,642	2,459
Cool Dry 2019	3,046	2,784	2,673	2,447	2,603	2,861	2,454	2,877	3,414	3,815	4,624	3,634	3,524	4,807	4,571	5,425	4,067	7,510	5,845	5,097	4,508	4,011	3,385	3,025

Figure 15. System LWAP Hourly Curve, 2018 to 2019 Cool Dry



	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 2018	3,298	3,100	2,953	2,915	2,963	3,032	2,607	2,959	3,684	4,361	5,763	4,612	4,744	6,814	6,391	7,231	4,849	4,153	5,866	4,713	4,911	4,631	3,783	3,290
Hot Dry 2019	4,294	4,070	3,682	3,359	3,271	3,140	2,911	3,656	5,914	7,010	8,317	6,645	6,260	10,00	10,11	10,50	6,834	5,851	8,573	7,654	8,226	7,900	6,303	5,059

Figure 16. System LWAP Hourly Curve, 2018 to 2019 Hot Dry



	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 2018	2,922	2,766	2,627	2,520	2,678	2,599	2,386	2,445	3,021	3,446	4,167	3,368	3,449	4,951	4,645	4,635	3,539	4,045	4,241	3,844	3,854	3,297	2,875	2,916
Rainy 2019	3,164	3,085	2,772	2,561	2,664	2,579	2,242	2,864	4,190	4,843	5,273	4,031	4,107	6,301	6,039	6,571	5,029	5,844	6,305	5,733	6,740	5,660	4,366	3,241

Figure 17. System LWAP Hourly Curve, 2018 to 2019 Rainy

iv. Interesting Pricing Events

- Interesting pricing events provide the assessment highlights of intervals determined to have prices beyond certain thresholds based on the relationship of market price and supply margin.
- Provided in Annex B is the exhaustive list of interesting pricing events for the year 2019 with the corresponding reasons.
- A total of 209 events, as opposed to last year's 24 events, recorded hourly market prices breaching the upper threshold. Most were confined in the hot dry season, with April recording the highest number with 59 interesting pricing events.
- In summary, most of these events were the result of simultaneous forced outages of several large capacity base load and mid-merit plants coinciding with the persistent high demand level.

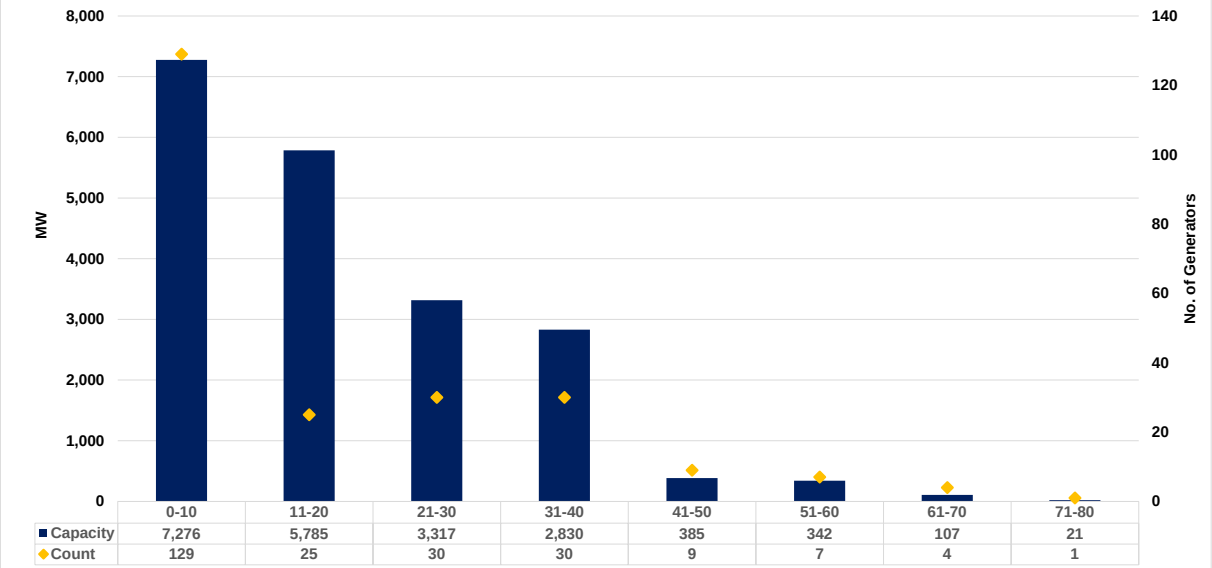
B. Supply

i. Capacity Profile

- Based on age[3] of power plants, 154 generator resources within age range of 0-20 years have an aggregate capacity of 13,060 MW and have continued to comprise 65 percent of the total WESM registered capacity as of 2019.

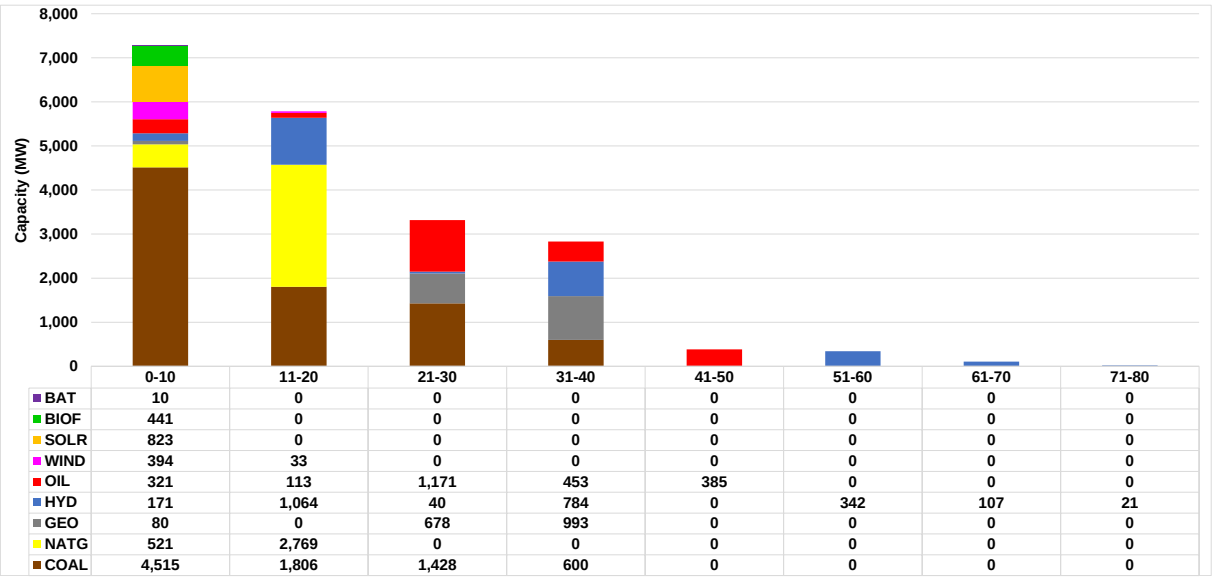
[3] Based on registration date or commercial operations date

- Despite the entry of relatively newer plants, a number of generators beyond 20 years of age remain active in the market with capacities close to 35 percent of the total registered capacity.



	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
Capacity	7,276	5,785	3,317	2,830	385	342	107	21
Count	129	25	30	30	9	7	4	1

Figure 18. Capacity Profile by Age of Plants, 2019



	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
BAT	10	0	0	0	0	0	0	0
BIOF	441	0	0	0	0	0	0	0
SOLR	823	0	0	0	0	0	0	0
WIND	394	33	0	0	0	0	0	0
OIL	321	113	1,171	453	385	0	0	0
HYD	171	1,064	40	784	0	342	107	21
GEO	80	0	678	993	0	0	0	0
NATG	521	2,769	0	0	0	0	0	0
COAL	4,515	1,806	1,428	600	0	0	0	0

Figure 19. Capacity Profile by Age of Plants by Resource Type, 2019

- The WESM registered capacity grew to 20,062 MW at the close of the 2019 billing year posting a 6 percent increase from last year's 18,882 MW.

- About 91 percent or 18,270 MW of the total WESM registered capacity were accounted as capacities of scheduled generators.
- This was followed by must dispatch generators at 6.5 percent or 1,300 MW
- Non-scheduled generators had a 1.7 percent share in the total registered capacity or 345 MW.
- The remaining 0.7 percent was on the account of priority dispatch generators closely with an aggregate capacity of 146 MW.

- Generally, capacities from different generator classifications increased except for priority dispatch generators[4] which had no change in capacity.

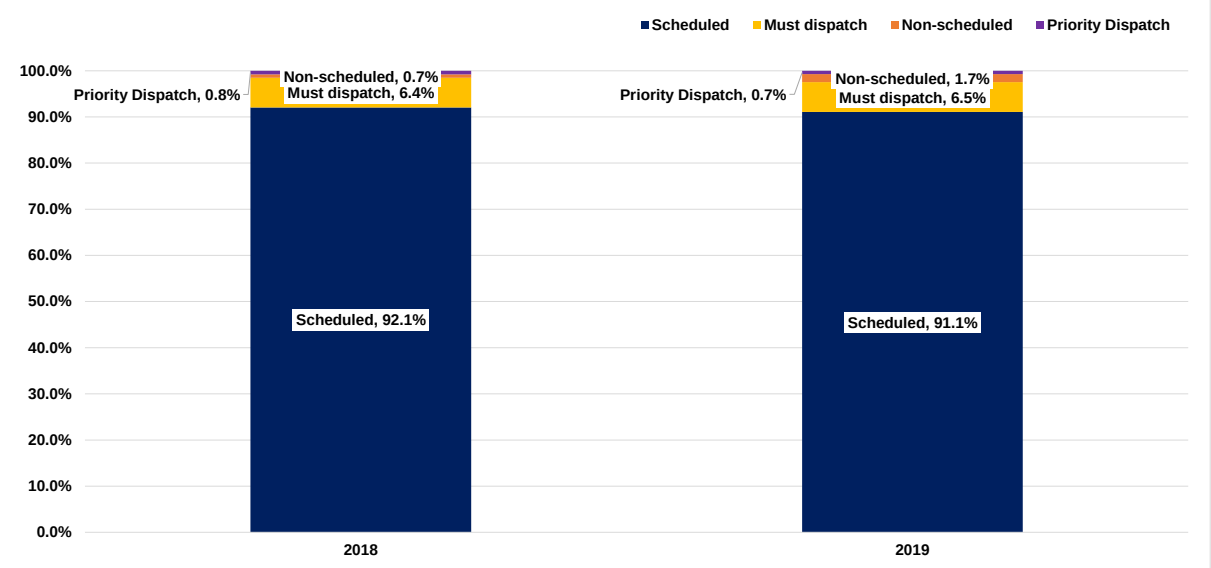


Figure 20. Capacity Profile by Generator Classification, 2018 to 2019

- A net increase of 1,180 MW was accounted in the total registered capacity from 2018 to 2019
- Of the newly registered power plants in the WESM, nearly 63 percent or 790 MW was attributed to the entry of large capacity coal plants, followed by biomass plants at 15 percent or 187 MW, oil-based plants at 11 percent or 144 MW, solar plants at 7 percent or 92 MW, and hydro plants at 4 percent or 46 MW.
- Total changes in capacity accounted the 24.5 MW uprating and 18 MW derating of various existing plant capacities.
- Disaggregated plant capacities recorded almost no change with only one oil-based plant noting a reduction in capacity.

[4] Refers to biomass plants under the Feed-In Tariff System in the dispatch schedule pursuant to Section 7 of the Renewable Energy Act

- A total capacity of 77 MW deregistered in the WESM which was composed of one geothermal, one hydro, and one oil-based facility.
- Motivated by several issuances of various department circulars and laws to improve and further ensure quality, reliability, and security of energy at a reasonable cost, the increase in investments in the power industry, translating to registered capacities in the WESM, was apparent from stakeholders.
- Further, the introduction of the Feed-in-Tariff System, which aims to support the development of RE facilities, have continuously resulted to an increase in number of newly registered solar and biomass plants.

Table 5. Change in WESM Registered Capacity, 2018 to 2019

Plant Type	Market Participant Name	Node ID	Capacity		
			2018	2019	Change
New Registered Plants					
BIOF	Cagayan Biomass Energy Corporation	1CAGBIO_G01		15	15
	Grassgold Renewable Energy Corporation	1GRGOLD_G01		11	11
	BISCOM, Inc.	6BISCOM_G01		30	30
	Central Azucarera de Bais, Inc.	6CABI_G01		24	24
	North Negros Biopower, Inc.	6NTNEGB_G01		25	25
	San Carlos Biopower Inc.	6SCBIOP_G01		20	20
	South Negros Biopower, Inc.	6STNEGB_G01		25	25
	Victorias Milling Company,Inc.	6VMC_G02		38	38
COAL	Masinloc Power Partners Co. Ltd.	1MSINLO_G03		335	335
	San Buenaventura Power Ltd. Co.	3SBPL_G01		455	455
HYD	HEDCOR, Inc.	1AMPHAW_G01		13	13
		1BAKSIP_G01		12	12
		1BINENG_G01		19	19
	Majayjay Hydropower Company, Inc.	3MAJAY_G01		2	2
OIL	Millennium Energy, Inc.	2MILLEN_G01		100	100
	Therma Power Visayas, Inc.	5TPVI_U01		7	7
		5TPVI_U02		7	7
		5TPVI_U03		7	7
		5TPVI_U04		7	7
		5TPVI_U05		7	7
		5TPVI_U06		7	7
SOLR	Solar Philippines Tarlac Corporation	1CONSOL_G01		75	75
	PetroSolar Corporation	1PETSOL_G02		17	17
				SUB-TOTAL:	**1,259**
Plants that Increased Capacity					
COAL	Quezon Power (Philippines) Ltd. Co.	3QPPL_G01	459	460	1
GEO	Green Core Geothermal Inc.	4LGPP_G01	107	120.5	13.5
HYD	SN Aboitiz Power - Magat, Inc.	1MAGAT_U01	95	97	2
		1MAGAT_U02	95	97	2
		1MAGAT_U03	95	97	2
		1MAGAT_U04	95	97	2
OIL	SPC Power Corporation	7TAPAL_PB4	26	28	2
				SUB-TOTAL:	**24.5**
Plants that Decreased Capacity					
COAL	Therma Visayas, Inc.	5THVI_U01	176	169	-7
		5THVI_U02	176	169	-7
OIL	Panay Power Corporation	8PPC_G02	20	16	-4
				SUB-TOTAL:	**-18**
Disaggregated Plants					
OIL	Therma Mobile, Inc.	2TMOBIL_G01	213	64	0
		2TMOBIL_G02		49	
		2TMOBIL_G03		53	
		2TMOBIL_G04		47	
GEO	Bac-Man Geothermal Inc.	3BACMAN_U01	120	60	0
		3BACMAN_U02		60	
OIL	Panay Power Corporation	8PPC1_A	72	32	-9
		8PPC1_B		32	
				SUB-TOTAL:	**-9**
Deregistered Plants					
GEO	AP Renewables Inc.	3TIWI_B	43.7		-43.7
HYD	HEDCOR, Inc.	1HEDCOR_G01	30		-30
OIL	PHINMA Energy Corporation	8GUIM_G01	3		-3
				SUB-TOTAL:	**-77**
				GRAND TOTAL:	**1,179.8**

- Despite the 2 percent increase in the average available capacity[5] in the WESM from 13,870 MW in 2018 to 14,145 MW in 2019, this constituted to a 1.6 percent decline in share in the total registered capacity in the WESM from 73.9 percent to 72.3 percent.
- Following the declining share of available capacity, average effective supply[6] from last year's 12,499 MW to this year's 12,905 MW had also followed the trend with a minimal 0.6 percent decline in share.
- One of the reasons of the decline in supply was the increasing share in capacity not offered by power plants noting an average of 2,629 MW in 2018 to an average of 2,768 MW in 2019.
- The main reason in the decline in supply was the recorded higher share of outage capacity in the total registered capacity from an average of 2,258 MW to 2,638 MW. This was an increase from its preceding year's share of 12 percent to 13.5 percent in 2019.

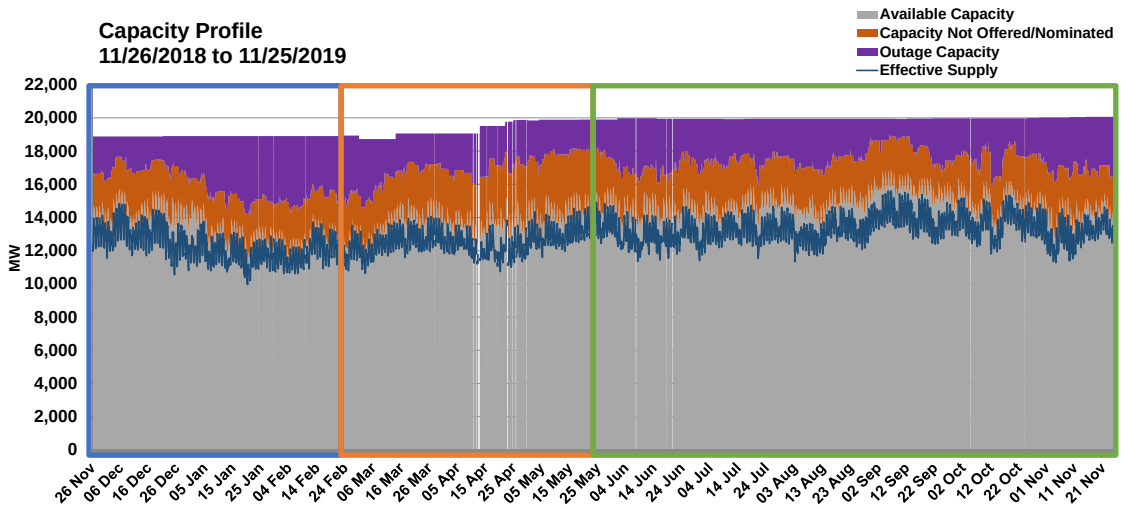
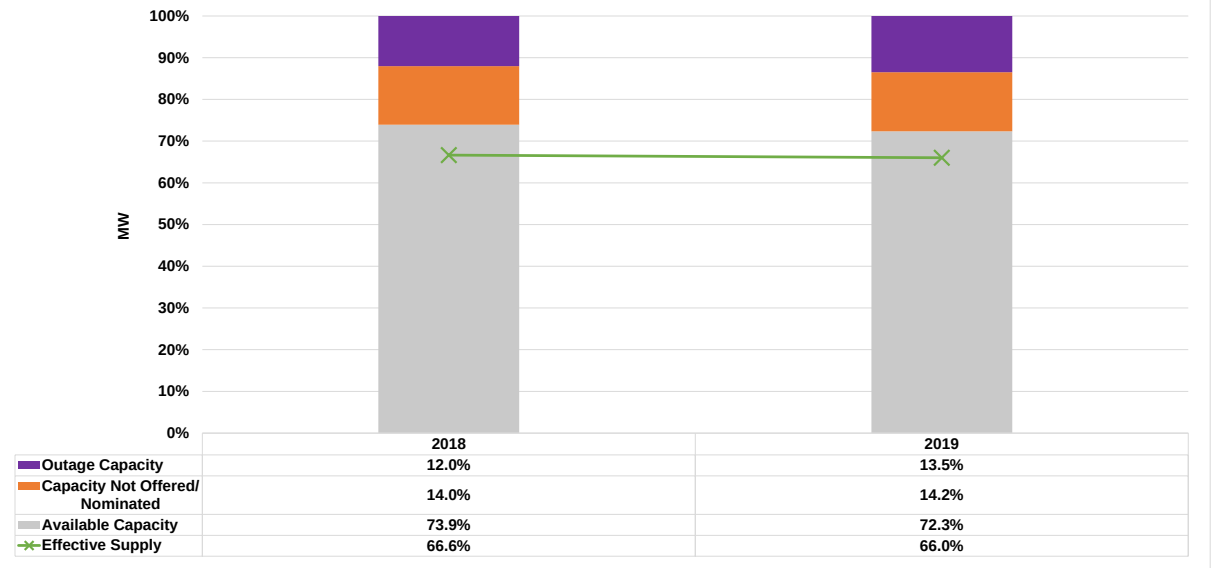


Figure 21. Capacity Profile by Component - Hourly, 2019

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

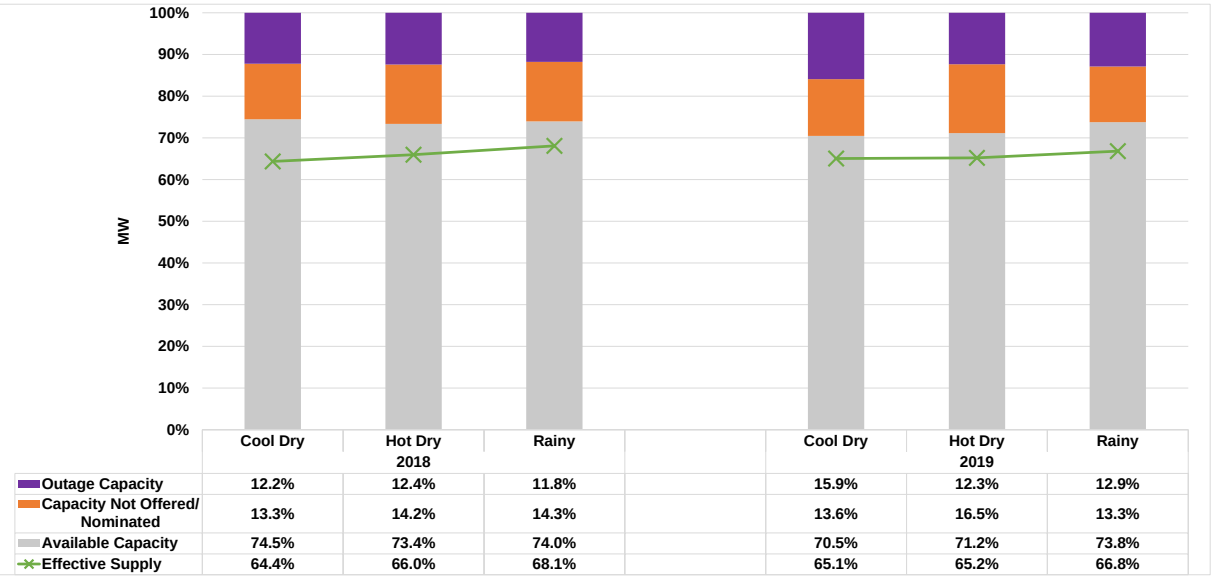
[6] The system effective supply is equal to the offered capacity of all scheduled generator resources, nominated loading level of non-scheduled generating units and projected output of preferential dispatch generating units adjusted for any security limit and ramp rates. Scheduled output of plants on testing and commissioning, through the imposition of security limit by SO, are accounted for in the effected supply. Likewise included is the scheduled output of Malaya plant when it is called to run as Must Run Unit (MRU).



	2018	2019
Outage Capacity	12.0%	13.5%
Capacity Not Offered/ Nominated	14.0%	14.2%
Available Capacity	73.9%	72.3%
Effective Supply	66.6%	66.0%

Figure 22. Capacity Profile by Component - Yearly, 2018 to 2019

- Looking at the 2018 and 2019 seasonal trend, it may be observed that available capacity and effective supply were at its peak during the rainy season with relatively low recorded outages and capacities not offered.
- Meanwhile, it can be noted that outage capacity and capacity not offered was quite high during the hot dry season where there is a much greater need of supply as demand is expected to peak during this time.



	Cool Dry	Hot Dry	Rainy		Cool Dry	Hot Dry	Rainy
	2018				2019		
Outage Capacity	12.2%	12.4%	11.8%		15.9%	12.3%	12.9%
Capacity Not Offered/ Nominated	13.3%	14.2%	14.3%		13.6%	16.5%	13.3%
Available Capacity	74.5%	73.4%	74.0%		70.5%	71.2%	73.8%
Effective Supply	64.4%	66.0%	68.1%		65.1%	65.2%	66.8%

Figure 23. Capacity Profile by Component, 2018 to 2019 Seasons

ii. Capacity Mix and Generation Mix

- In terms of resource types, coal continued to dominate the spot market, holding the largest share of about 42 percent of the total registered capacity.
- All resource types except battery, natural gas, and wind facilities had uptick in registered capacities in 2019.
- The addition of 2 coal plants with large capacities, Masinloc CFTPP unit 3 (335 MW) and SBPL CFTPP (455 MW), further escalated the market share of coal plants by 2 percent, among others.
- Another notable increase came from biomass plants from 254 MW to 441 MW with the addition of several plants in both regions, majority of which are in the Visayas region (161 MW out of a total 186.8 MW).
- Power plants relying on solar energy, likewise, registered an upshift in the capacity mix with the entry of a total of 92 MW new solar facilities.
- As for oil-based plants, several changes in capacities (e.g. additional capacity, increase/decrease in capacity, disaggregated capacity, and deregistered capacity) led to a net increase of 130 MW in the market.
- Hydro plants, on the other hand, recorded a minimal net increase of 24 MW which consisted of the entry of several new hydro plants, with an aggregate capacity of 46 MW, on top of the increase in capacity of Magat HEP by 8 MW. This substantial increase was offset by the deregistration of the 30-MW HEDCOR Inc. hydro plant.
- Contrary to the growth in registered capacities of majority of the different resource types, geothermal plant capacities noted a decrease from 1,782 MW to 1,751 MW, owing to the deregistration of the 43.7-MW Tiwi GPP unit B despite the 13.5-MW increase in capacity of the Leyte GPP.

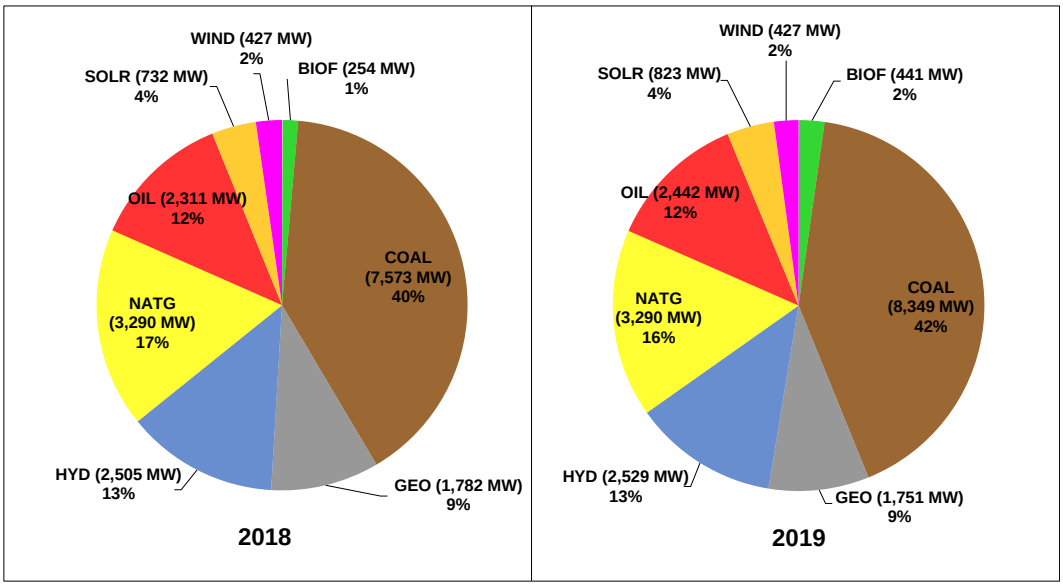


Figure 24. Capacity Mix, 2018 to 2019

- Following the highest market share of coal plants based on total registered capacity, it was evident in all seasons of 2018 and 2019 in the Luzon region that it followed the same trend in terms of generation mix. Coal capacities in the region comprised half of the generation mix in the country as coal is relatively cheaper than other fuel resources.
- Power plants relying on natural gas for their fuel followed with around 29 to 34 percent of the total generation mix.
- Hydro plants held the third spot in the Luzon region registering a low 5 to 6 percent during the hot dry season to as high as 8 to 10 percent in the rainy season as hydro plants are greatly affected by different weather conditions.
- Geothermal plants almost consistently contributed a share of 5 percent, which is almost close to hydro, despite the latter recording a higher share in terms of registered capacity.
- Oil-based plants posted a low share in generation mix at around 1 to 2 percent in the cool dry and rainy season which went up as high as 3 percent during the hot dry season due to the experienced high demand and insufficiency of supply from low-priced generators. Generally, oil-based plants record a lower share due to the fuel being expensive.
- Power plants which source their fuel from renewable resources, aside from hydro and geothermal (i.e. solar, wind, biomass), had an aggregate 3 to 4 percent share in the generation mix in Luzon in line with a low share in registered capacity as well as their dependency with the intermittent energy resources.

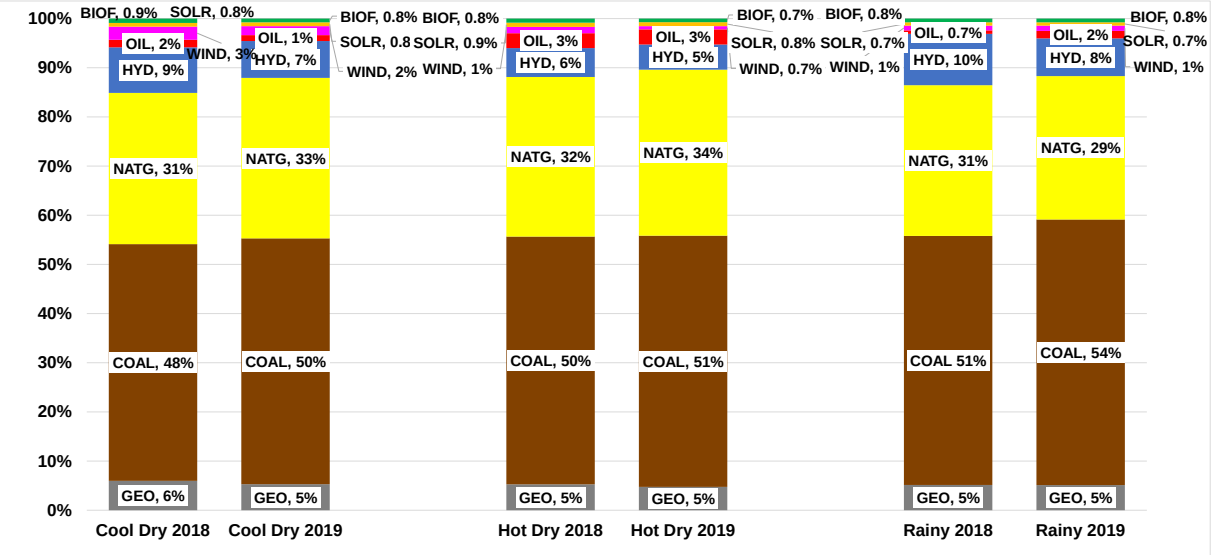


Figure 25. Generation Mix - Luzon, 2018 to 2019 Seasons

- In the Visayas region, the rise in share of geothermal plants made up for the absence of natural gas plants. This constituted almost the same level as that of coal plant's share.
- Despite the notable large share of geothermal plants based on generation mix in the region, coal still dominated the mix at 44 to 49 percent.
- Oil-based plants in Visayas had a similar share as that of Luzon with around 1 to 3 percent.
- However, wind, solar, and biomass plants have a higher percent generation mix in Visayas at 7 to 10 percent as compared with Luzon at 3 to 4 percent.

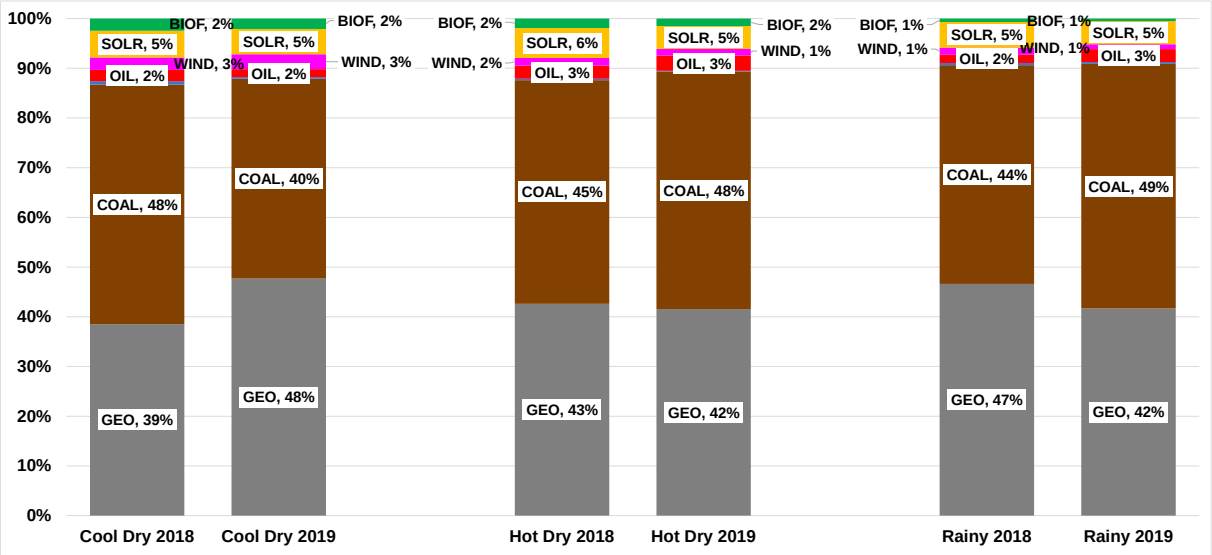
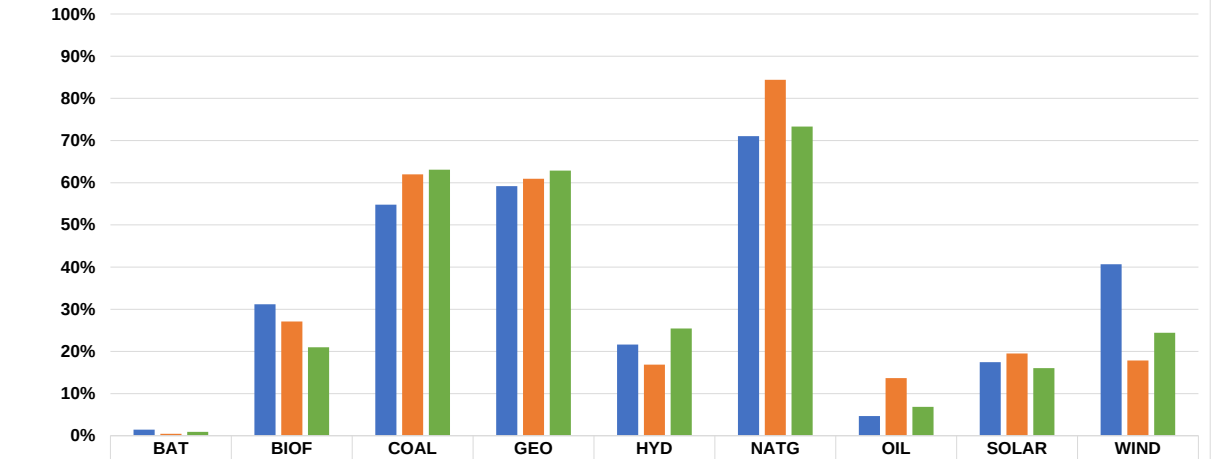


Figure 26. Generation Mix - Visayas, 2018 to 2019 Seasons

iii. Dispatch Factor[7]

- While only second in rank in terms of capacity and generation mix, natural gas plants posted the highest in terms of dispatch factor.
- Geothermal and coal plants had similar dispatch factors of roughly 55-63 percent for each season, indicating more than half of the total capacities being dispatched for the whole billing year.
- Meanwhile, below 50 percent dispatch factor was observed for the rest of the plant types.
- Noted was the low dispatch from the lone battery-powered facility of about 1 percent of its registered capacity.
- Relatively lower dispatch came from hydro plants during the hot dry season in line with the reduction in water supply from rivers and reservoirs in summer.
- As for wind power plants, a notable variance can be observed, indicating the variability in dispatch of power plants depending on intermittent fuel sources every season.

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

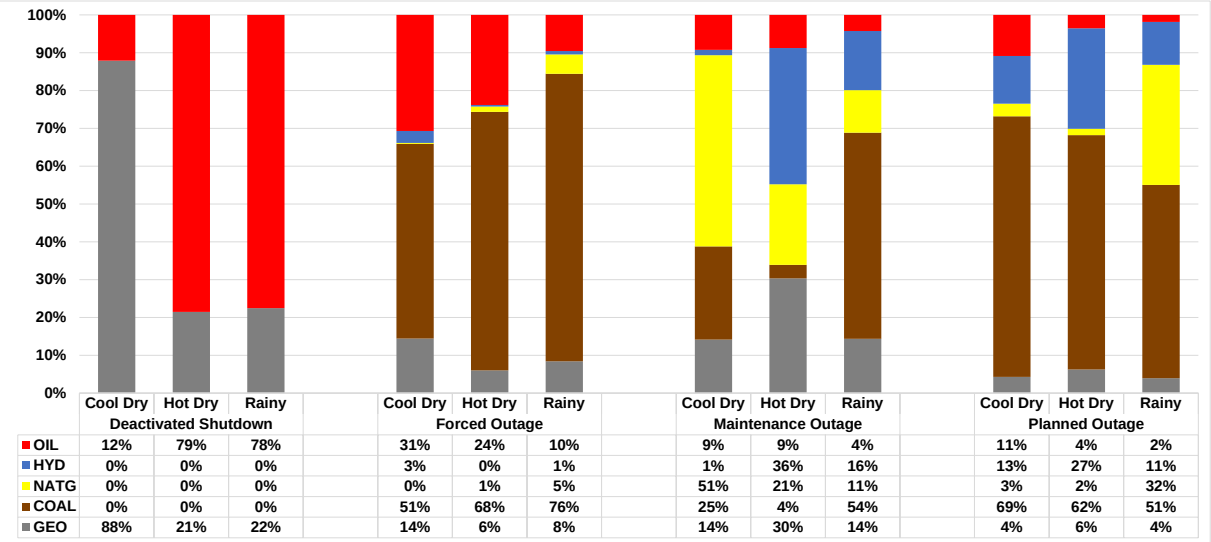


	BAT	BIOF	COAL	GEO	HYD	NATG	OIL	SOLAR	WIND
Cool Dry	1%	31%	55%	59%	22%	71%	5%	17%	41%
Hot Dry	0%	27%	62%	61%	17%	84%	14%	19%	18%
Rainy	1%	21%	63%	63%	25%	73%	7%	16%	24%

Figure 27. Dispatch Factor by Plant Type, 2019 Seasons

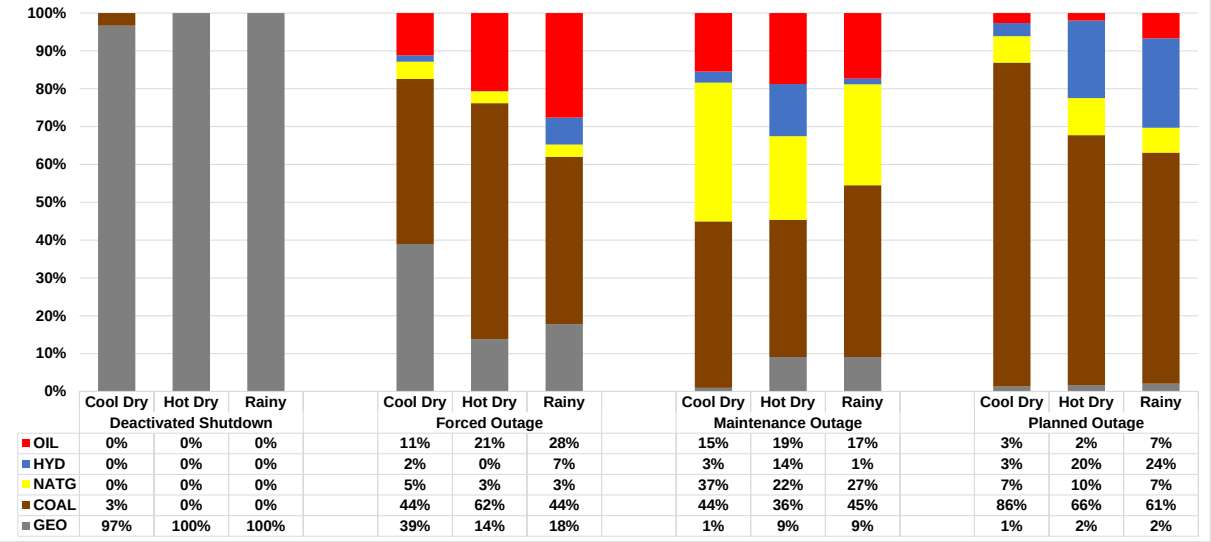
iv. Outage Capacity

- The yearly average outage capacity rose to 2,637 MW at the close of the 2019 billing year coming from 2,258 MW in the previous year.
- The deactivated shutdown in 2019 was composed majorly by Malaya TPP unit 2 (350 MW) which started during the hot dry season and persisted through the rainy season. Other Makban and Tiwi GPP units also contributed to the level of deactivated shutdown. The average deactivated shutdown capacity almost doubled in average from 50 MW to 98 MW.
- Forced outages saw a 48 percent surge from an average of 612 MW last year to 905 MW this year.
- Additionally, forced outages from coal plants recorded the highest during the hot dry season at an average of 683 MW while the rainy season recorded 598 MW. Although the hot dry season noted the highest average, the rainy season had the highest share due to a low level of outage from other plant types.
- Noticeable was the high level of maintenance outage of natural gas plants during the cool dry season, owing to the long outage from San Gabriel NGPP (420 MW). This year saw a decline from 445 MW in 2018 to 275 MW in 2019.
- Average level of planned outages recorded a 40 percent increase from 595 MW to 833 MW. Consistent with last year, coal plants accounted for bulk of the planned outages due to the its large share based on registered capacity.
- Each season recorded the following average level of outage:
    - Cool Dry – 2,633 MW
    - Hot Dry – 1,915 MW
    - Rainy – 1,944 MW



	Deactivated Shutdown			Forced Outage			Maintenance Outage			Planned Outage		
	Cool Dry	Hot Dry	Rainy	Cool Dry	Hot Dry	Rainy	Cool Dry	Hot Dry	Rainy	Cool Dry	Hot Dry	Rainy
OIL	12%	79%	78%	31%	24%	10%	9%	9%	4%	11%	4%	2%
HYD	0%	0%	0%	3%	0%	1%	1%	36%	16%	13%	27%	11%
NATG	0%	0%	0%	0%	1%	5%	51%	21%	11%	3%	2%	32%
COAL	0%	0%	0%	51%	68%	76%	25%	4%	54%	69%	62%	51%
GEO	88%	21%	22%	14%	6%	8%	14%	30%	14%	4%	6%	4%

Figure 28. Outage Capacity, 2019 Seasons



	Deactivated Shutdown			Forced Outage			Maintenance Outage			Planned Outage		
	Cool Dry	Hot Dry	Rainy	Cool Dry	Hot Dry	Rainy	Cool Dry	Hot Dry	Rainy	Cool Dry	Hot Dry	Rainy
OIL	0%	0%	0%	11%	21%	28%	15%	19%	17%	3%	2%	7%
HYD	0%	0%	0%	2%	0%	7%	3%	14%	1%	3%	20%	24%
NATG	0%	0%	0%	5%	3%	3%	37%	22%	27%	7%	10%	7%
COAL	3%	0%	0%	44%	62%	44%	44%	36%	45%	86%	66%	61%
GEO	97%	100%	100%	39%	14%	18%	1%	9%	9%	1%	2%	2%

Figure 29. Outage Capacity, 2018 Seasons

C. Demand

- An increase in average system demand plus reserve was seen for each season recording the following:
    - Cool Dry – 5 percent increase from 9,658 MW to 10,137 MW; system demand plus reserve schedule peaked at 13,226 MW on 06 Dec 2018
    - Hot Dry – 5.7 percent increase from 10,714 MW to 11,321 MW; system demand plus reserve peaked at 14,185 MW on 21 May 2019

  - Rainy – 7.8 percent increase from 10,672 MW to 11,503 MW; system demand plus reserve peaked at 14,324 MW on 21 Oct 2019
- Relative to the growth of electricity demand, the Gross Domestic Product (GDP)[8] also grew by 6.9 percent, noting the increase in economic activity of the whole country.
- Still, the cool dry season recorded the lowest average system demand across all seasons due to relatively lower temperatures and lower electricity consumption from consumers due to the observance of long-duration holidays.
- Contrary to last year where the highest average demand occurred in the hot dry season, the rainy season this year surpassed the hot dry season because of the high demand persisting in the June billing month. In the previous years, electricity demand usually drops on the onset of the rainy season in June.

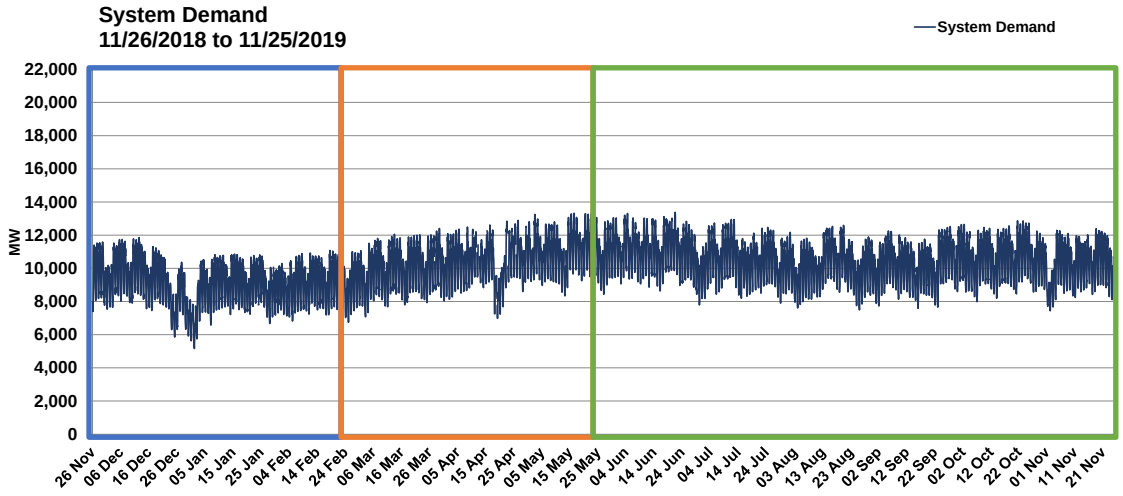


Figure 30. System Demand - Hourly, 2019

[8] Based on the Philippine Statistics Authority's (PSA) Annual National Accounts Data (2000-2019) at current 2018 prices as of April 30, 2020

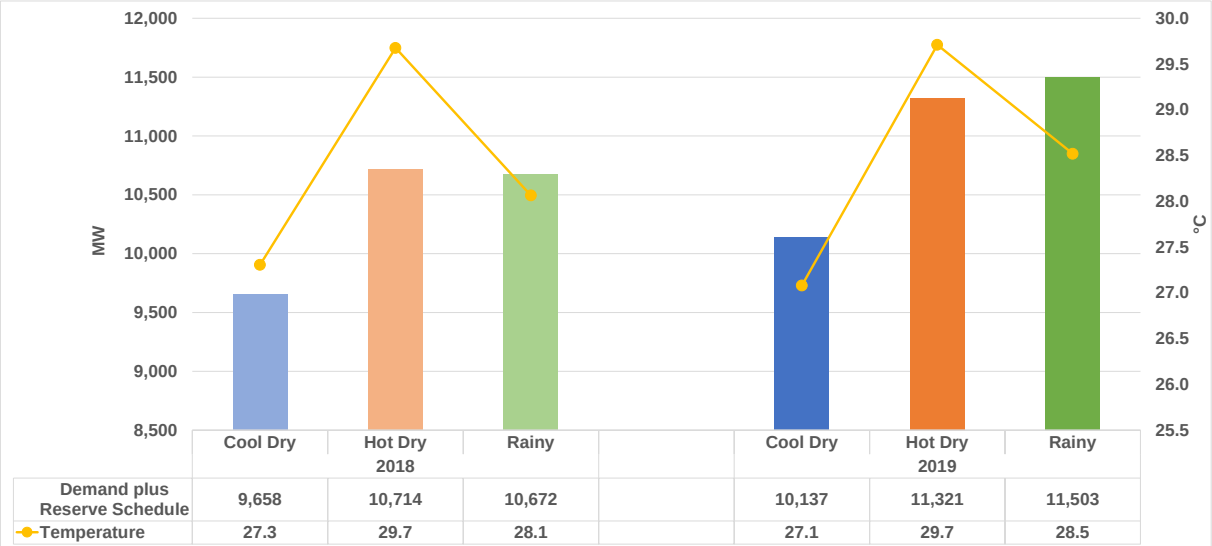


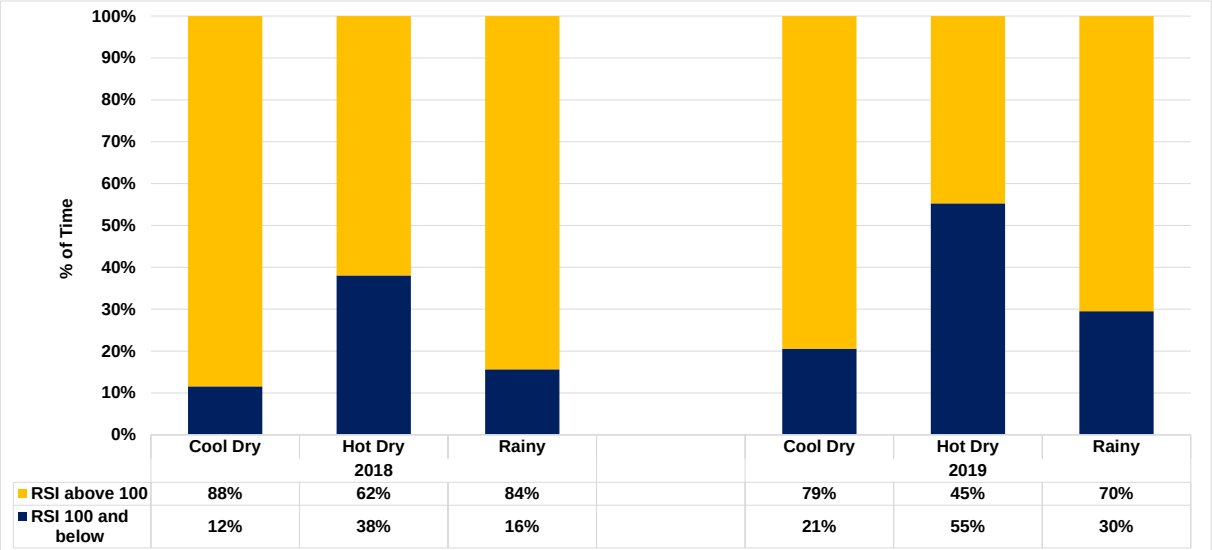
Figure 31. Demand and Temperature, 2018 to 2019 Seasons

IV. Competitiveness Analysis

A. Residual Supply Index (RSI)[9]

- The resulting Market RSI in 2019 went below the 100 percent mark at about 34 percent of the time or 2,938 intervals out of 8,760 intervals. This was an increase from 2018's 20 percent or 1,759 intervals.
- The presence of pivotal suppliers was noted to be the most frequent during the hot dry season in both years at 38 percent and 55 percent of the time, respectively.
- Meanwhile, during other seasons where there is usually a low demand of electricity, the Market RSI was more often above 100 percent indicating that effective supply level was very much sufficient.
- Overall, there was an increase in the frequency of occurrence of pivotal suppliers as more power supply from generators were needed alongside the increasing demand and high level of outages.

[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.



	Cool Dry	Hot Dry 2018	Rainy		Cool Dry	Hot Dry 2019	Rainy
RSI above 100	88%	62%	84%		79%	45%	70%
RSI 100 and below	12%	38%	16%		21%	55%	30%

Figure 32. Market RSI, 2018 to 2019 Seasons

B. Pivotal Suppliers[10]

- In congruence with the increase in Market RSI, the top 10 pivotal suppliers this year were more prevalent than last year.
- The top 4 pivotal suppliers from 2018 retained their spots with a substantial increase in the frequency of being pivotal.
- Sual CFTPP (1,294 MW), Ilijan NGPP (1,200 MW), and Sta Rita NGPP (1,042.5 MW) were pivotal more than 20 percent of the time during the whole 2019 billing year.
- Masinloc CFTPP (994 MW), San Lorenzo NGPP (526.6 MW), and Leyte A GPP (538 MW) jumped one spot above their previous spot in 2018.
- QPPL CFTPP (460 MW) rose 11 spots from last year, being pivotal for 7.2 percent of the time.
- On the other hand, Mariveles CFTPP (632 MW) and Kalayaan PSPP (720 MW) saw a decline in their previous ranks.
- Due to the nature of the plants in the list being pivotal in every season, the table below summarizes the pivotal suppliers in a yearly basis.

[10] The Pivotal Supply Index (PSI) measures how critical a generator is in meeting the total demand at a time. It is a binary variable (1 for pivotal and 0 for not pivotal) which measures the frequency that a generating unit is pivotal for a period.

Table 6. Pivotal Supplier Frequency Index, 2019

Rank	Change in Rank	Plant	Major Participant Group	Frequency	% of Time	Change in Frequency
1	(0)	SUAL CFTPP	SMC	2,530	28.9%	89%
2	(0)	ILIJAN NGPP	SMC	2,402	27.4%	92%
3	(0)	STA RITA NGPP	FGC	2,027	23.1%	78%
4	(0)	PAGBILAO CFTPP	AP	1,088	12.4%	172%
5	(+1)	MASINLOC CFTPP	SMC	954	10.9%	324%
6	(+1)	SAN LORENZO NGPP	FGC	761	8.7%	249%
7	(+11)	QPPL CFTPP	QPPL	631	7.2%	801%
8	(+1)	LEYTE A GPP	PSALM	611	7.0%	340%
9	(-1)	MARIVELES CFTPP	AP	610	7.0%	184%
10	(-5)	KALAYAAN PSPP	PSALM	556	6.3%	107%

C. Pivotal Suppliers and Price Setters above PhP10,000/MWh

- Nineteen (19) plants from Luzon and ten (10) plants from Visayas were simultaneously pivotal and price setters during the billing year, indicating that the plants were crucial in satisfying the demand at a particular trading interval.
- Limay CCGT (540 MW), and Bauang DPP (200 MW) were considered the top 2 pivotal suppliers while setting prices at above PhP10,000/MWh.
- Sixteen (16) oil-based plants dominated the list since, normally, these plants offer their capacities at a much more expensive price in the market.
- Six (6) coal plants, four (4) hydro plants, and three (3) natural gas plants were, likewise, pivotal while setting the market price at above PhP10,000/MWh, noting that coal and natural gas plants in the list accounted for only a low 0.02 to 0.35 percent of the time.

Table 7. Pivotal Supplies and Price Setters above PhP10,000, 2019

Plant	Major Participant Group	Cool Dry		Hot Dry		Rainy	
		Frequency	% of Time	Frequency	% of Time	Frequency	% of Time
LIMAY CCGT	MEI	7	0.32%	84	3.93%	88	1.99%
BAUANG DPP	VEC	3	0.14%	37	1.73%	48	1.09%
SAN ROQUE HEP	SMC	4	0.18%	15	0.70%	10	0.23%
SLPGC GTPP	SMPC	2	0.09%	10	0.47%	12	0.27%
ANDA CFTPP	APC			10	0.47%	14	0.32%
CALUMANGAN DPP	Other IPPs	2	0.09%	9	0.42%	9	0.20%
KALAYAAN PSPP	PSALM	3	0.14%	12	0.56%	5	0.11%
PB 102	AC			3	0.14%	6	0.14%
PANAY DPP III	SPC			2	0.09%	7	0.16%
SUBIC DPP	AC	1	0.05%	7	0.33%		
PB 101	AC			3	0.14%	4	0.09%
AVION NGPP	FGC	1	0.05%	2	0.09%	3	0.07%
TAPGC DPP	AC			5	0.23%		
CIP DPP	AC			5	0.23%		
PANAY DPP I	SPC			1	0.05%	4	0.09%
PPC DPP	GBPC					5	0.11%
PANTABANGAN HEP	FGC	1	0.05%	3	0.14%		
ILIJAN NGPP	SMC					4	0.09%
MILLENNIUM GTPP	MEI			1	0.05%	3	0.07%
TPC (SANGI) CFTPP	GBPC					2	0.05%
NAVOTAS DPP	AP	2	0.09%				
PAGBILAO CFTPP	AP			1	0.05%	1	0.02%
SAN GABRIEL NGPP	FGC	1	0.05%				
PB 104	SPC			1	0.05%		
MASINLOC CFTPP	SMC					1	0.02%
KSPC CFTPP	SPC					1	0.02%
CPPC DPP	AP			1	0.05%		
ANGAT HEP	SMC			1	0.05%		
SUAL CFTPP	SMC					1	0.02%

D. Market Share

- Across all seasons, the WESM remained to be dominated by four (4) major participant groups based on registered capacity: San Miguel Corporation (SMC), Aboitiz Power Corporation (AP), First Gen Corporation (FGC), and Power Sector Assets and Liabilities Management Corporation (PSALM).
- In terms of registered capacities, SMC closed the year with 24.1 percent market share, followed by AP at 19.9 percent, FGC at 14.4 percent, and PSALM at 10.6 percent.
- SMC's and FGC's market share in terms of offered capacity improved when compared to their registered capacities while AP only recorded an increase during the rainy season. PSALM, on the other hand, noted a decline in all seasons.

- The actual generation of the top four (4) market participant groups remained to be similar in share to their offered capacities.

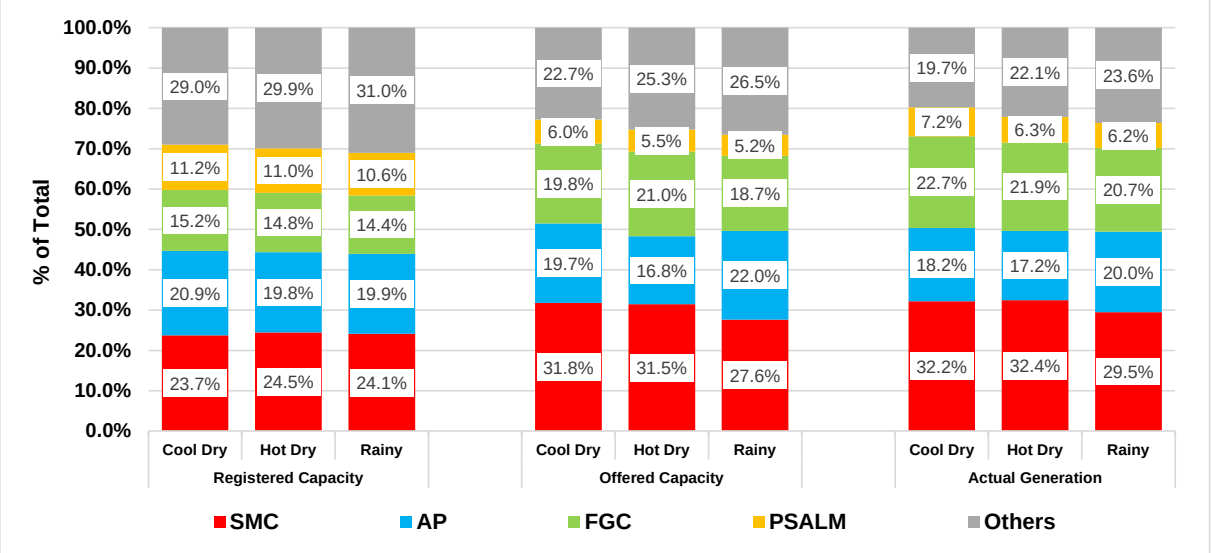


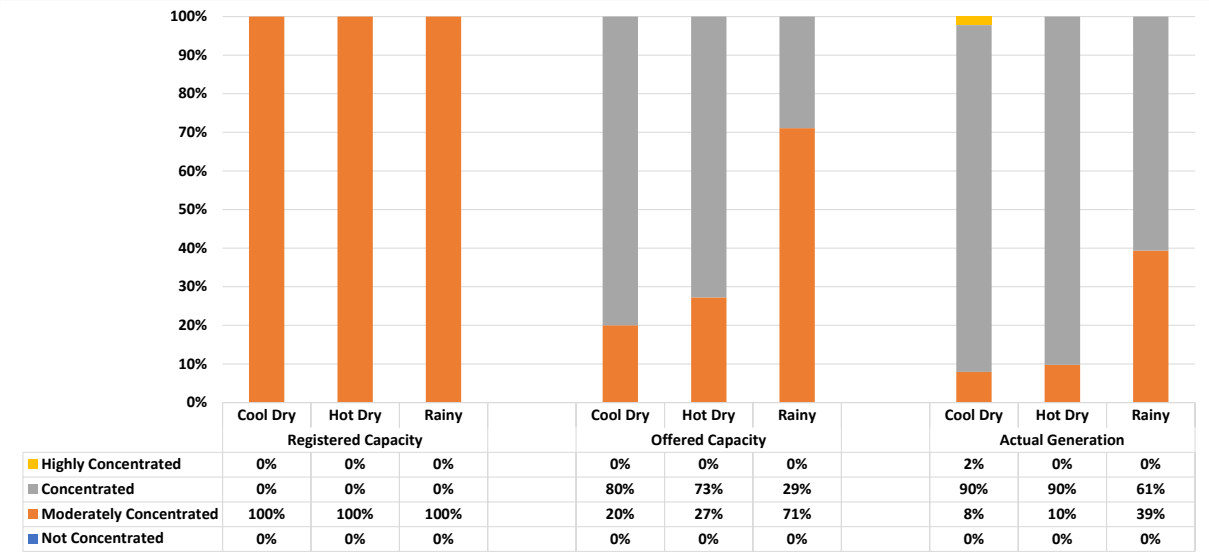
Figure 33. Market Share, 2019 Seasons

E. Herfindahl-Hirschman Index (HHI)[11]

- The signal of an ideal competition is when the HHI results to a not concentrated market.
- The HHI indicated a moderately concentrated market when based solely on the registered capacity throughout the year.
- When measured in terms of offered capacity while going through the year, the market registered a tighter/better market competition with the rainy season ending with a moderately concentrated market for about 71 percent of the total trading intervals in the said season.
- Following the similar trend in the HHI based on offered capacity, the calculated HHI based on actual generation indicated a better market by the end of the billing year.
- In summary, when basing on registered capacity, offered capacity, and actual generation, while going through the year, an improving market competition can be observed.

[11] 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.

- Meanwhile, the change from registered capacities to capacities being intentionally offered in the market indicated a contrasting pattern where it was less than an ideal market. Likewise, offered capacities to actual generated capacities signaled further deviation from a perfect market with a decline in intervals with a moderately concentrated market.



	Registered Capacity			Offered Capacity			Actual Generation		
	Cool Dry	Hot Dry	Rainy	Cool Dry	Hot Dry	Rainy	Cool Dry	Hot Dry	Rainy
Highly Concentrated	0%	0%	0%	0%	0%	0%	2%	0%	0%
Concentrated	0%	0%	0%	80%	73%	29%	90%	90%	61%
Moderately Concentrated	100%	100%	100%	20%	27%	71%	8%	10%	39%
Not Concentrated	0%	0%	0%	0%	0%	0%	0%	0%	0%

Figure 34. Herfindahl-Hirschman Index, 2019 Seasons

V. Generator Trading Behavior

A. Offer Pattern Analysis

- Difference Calculation[12] represents the measure of magnitude of increase or decrease in price offer of a generator, a major participant group (by portfolio), or by plant type.
- In this report, the Average Reference Price, which is the weighted average price using the 2019 Billing Year prices and will be referred to as RP in the succeeding figures, and the Average Subject Price, which is the weighted average price using 2018 Billing Year prices and will be referred to as AP in the succeeding figures, were calculated per trading interval per plant type.
- Contestable quantities are utilized since non-contestable quantities (i.e. Pmin, must dispatch, priority dispatch, and non-scheduled) are not competitively offered in the market.

[12] The methodology of the Offer Pattern Analysis, which is comprised of two parts: Difference Calculation and Outlier Detection, was adopted by the Market Surveillance Committee to easily quantify the offers in the WESM and to evaluate the change in offers if the same is within or outside the set reference levels which was based on historical data of each generator.

- It is important to note that the total offered capacity for each period may not be equal considering the entry of new plants, capacity on outage, capacity not offered in the market, and changes in registered capacity. In line with this, the Average Difference as well as Percent Difference were not calculated when either the Average Reference Price or Average Subject Price was not available.
- The supply curve per plant type was established by stacking all the offers of plants, broken down to 1-MW block sizes, under the plant type arranged in monotonically increasing price for each trading interval. The hourly average supply curve was then derived based on all the supply curves during the period per trading interval.

i. Difference Calculation by Plant Type

- Offer prices of coal plants saw a slight increase in the higher levels of capacities/quantities of about 14.6 percent in average
- Also, a similar pattern in the lower to middle level of capacities from last year was observed.
- It was evident during the seasons that the quantities in 2019 (SP) exceeded the maximum quantities in 2018 (RP) as the newly registered capacities of coal plants were accounted in 2019.

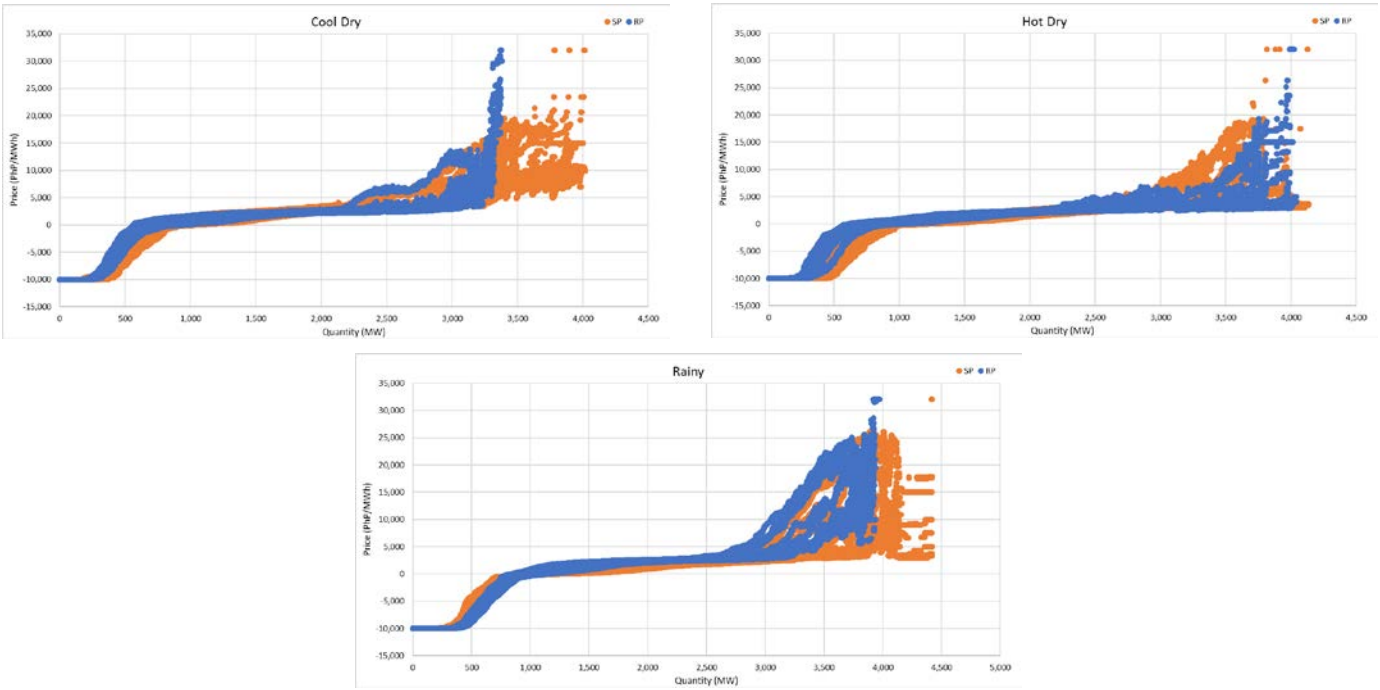


Figure 35. Average Supply Curve - Coal

- Offer prices of natural gas plants saw an increase during the cool dry season in 2019 at the 200 to 1,200 MW capacity range and a notable 40 percent uptick in offer price in 1,600 to 1,800 MW capacity range.
- The 2019 rainy season almost mirrored the cool dry season except for an observed decline in average offer price in the 1,600 to 1,800 MW capacity range.
- Opposite the cool dry and rainy season, the hot dry season generally recorded a decrease in offer capacity in almost all capacity ranges.

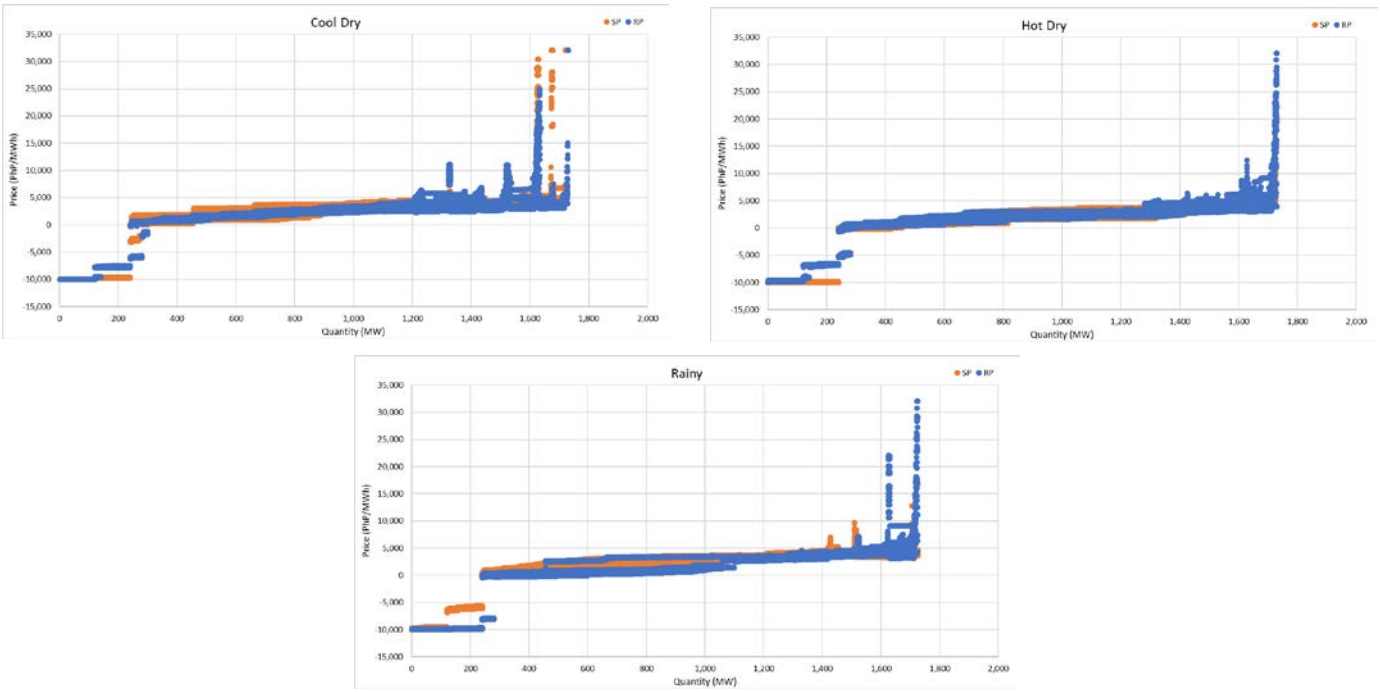


Figure 36. Average Supply Curve – Natural Gas

- Hydro power plants were noted to have a notable increase in offer price across all seasons in 2019.
- The surge ranged from 19 percent to as high as 138 percent.
- Hydro plants were observed to have the steepest supply curve in all plant types offering in the spot market.

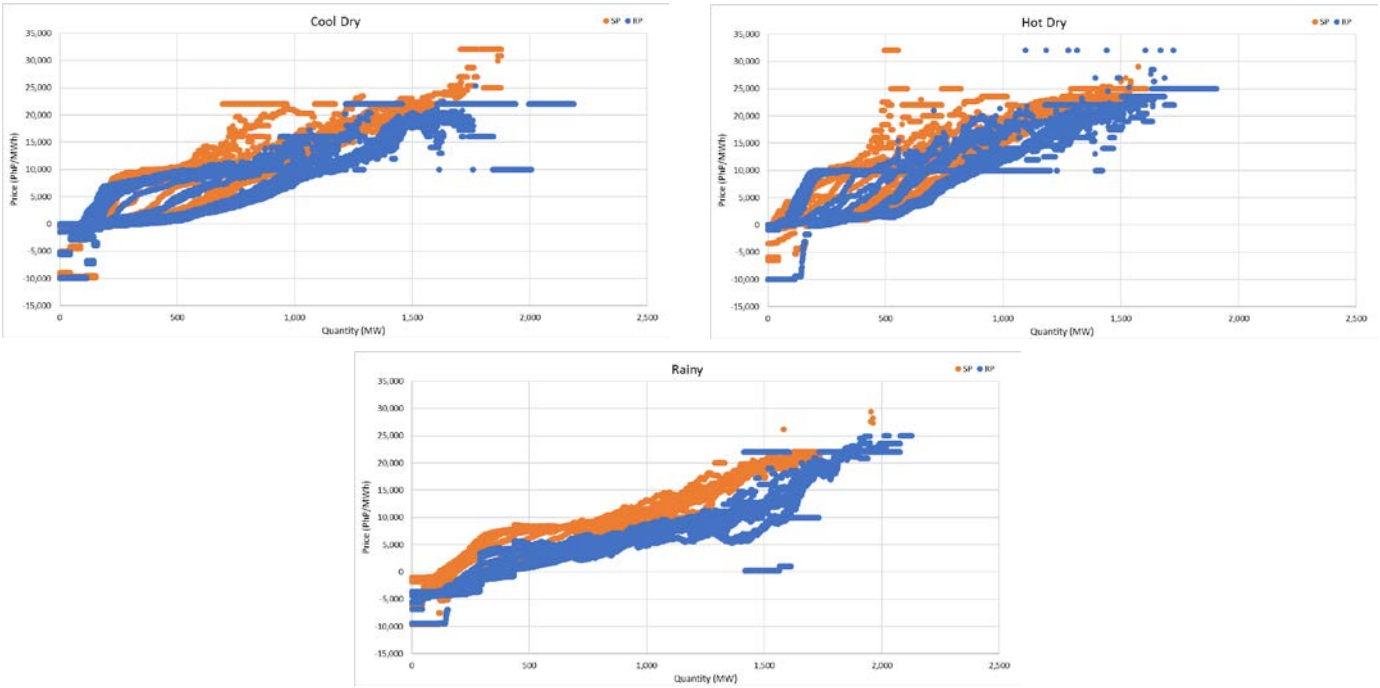


Figure 37. Average Supply Curve – Hydro

- Similar to hydro plants, oil-based plants had notably shifted its offer prices to a much higher level this year for all seasons.
- No decrease in average offer prices was noted for every capacity range.
- The increase in offer pattern ranged from 44 percent to 88 percent in cool dry, 31 percent to 58 percent in hot dry, and 14 percent to 22 percent in rainy.

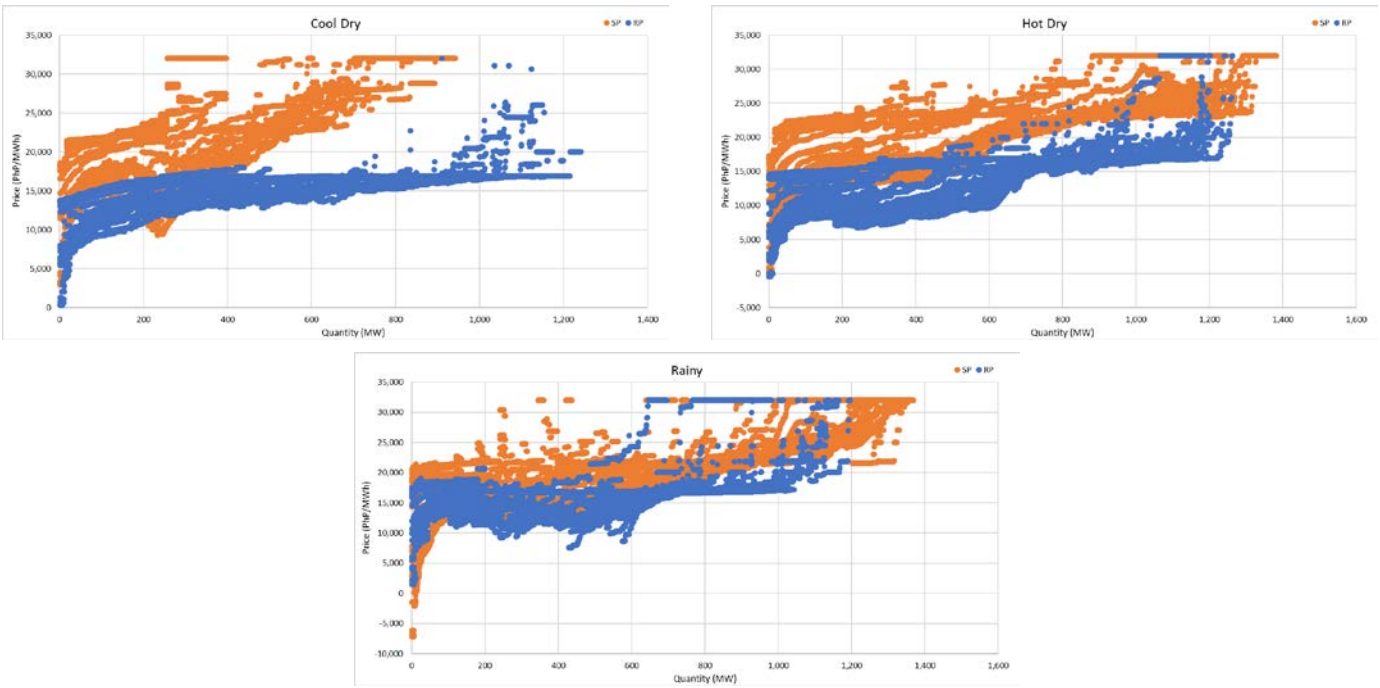


Figure 38. Average Supply Curve – Oil-based

- Geothermal plants, however, were consistently low in their offer prices across all seasons to better utilize the thermal energy coming from steam.
- Further, almost all capacity ranges, except for the 600 to 700 MW capacity range, recorded a decrease in offer price pattern.
- Meanwhile, there was no change in the offer price pattern of geothermal plants in the 100 to 300 MW capacity range in all seasons coming from last year.

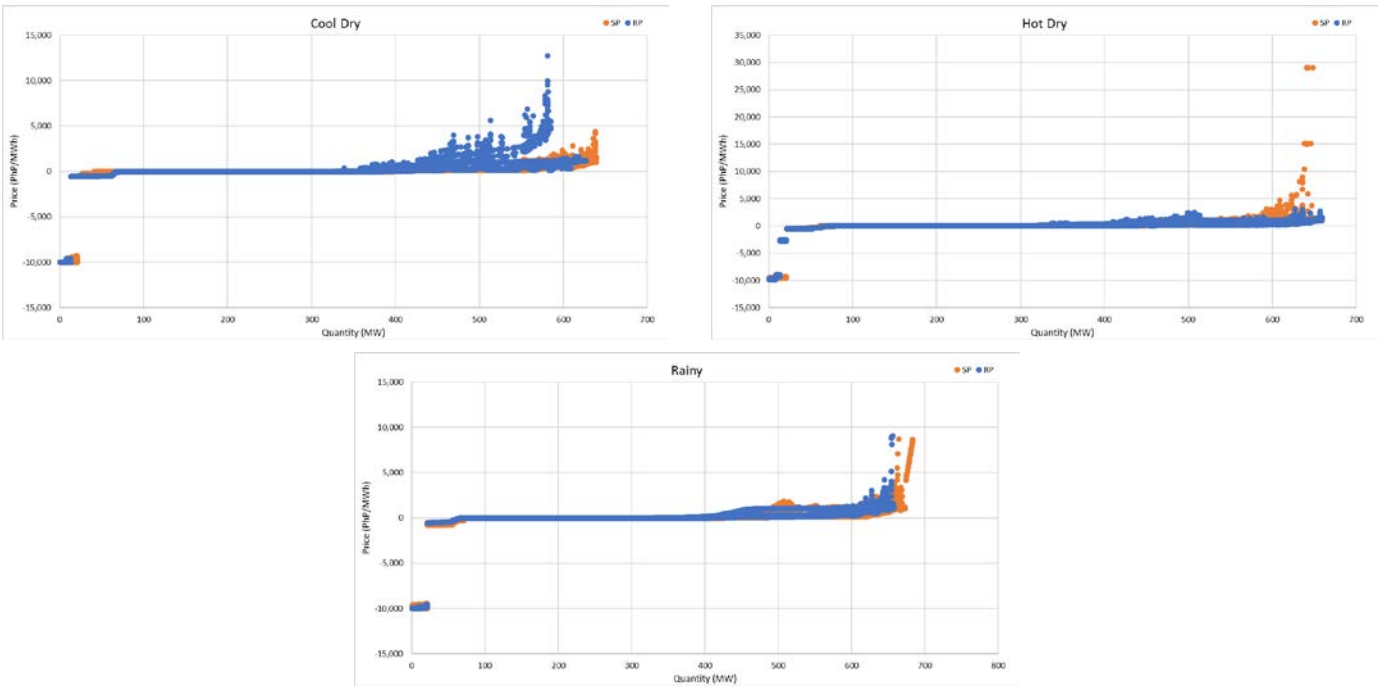


Figure 39. Average Supply Curve – Geothermal

B. Bid Splitting[13] Behavior

- During the cool dry season, a total of 13 generator facilities demonstrated bid splitting behavior for a total of 1,224 occurrences. The number of generators per plant type are as follows: 3 coal, 1 geothermal, 2 hydro, 2 natural gas, and 5 oil-based facilities.
- The hot dry season noted a total of 15 generators which were found to exhibit bid splitting behavior for 2,439 occurrences. The breakdown per plant type is as follows: 3 coal, 1 geothermal, 2 hydro, 2 natural gas, and 7 oil-based facilities.
- Lastly, the rainy season was found to have the highest number of generators who showed bid splitting behavior at 21 generators for 4,890 occurrences. The following number of generators were noted: 3 coal, 2 geothermal, 2 hydro, 2 natural gas, and 12 oil-based generators.
- Also note that the same set of generators may be found to exhibit a bid splitting behavior in each season.

[13] Bid splitting is defined as an offer strategy when a generating unit offers majority or almost its entire capacity at lower prices while simultaneously bidding a small portion of its capacity close or equal to the market offer price cap.

VI. Spot Market Transactions

A. Spot Exposure

- The spot market transaction of generator-trading participants during 2019 was at 16 percent during the cool dry season, at a low 12 percent during the hot dry season, and at 18.2 percent during the rainy season.
- The spot quantities noted a 28 percent decline in average share from last year.
- Consequently, the total energy injected into the grid comprised mostly of bilateral contract quantities (BCQ) at around 82 to 85.8 percent.
- BCQ, in contrast, had a 6.6 percent increase in average share from last year.

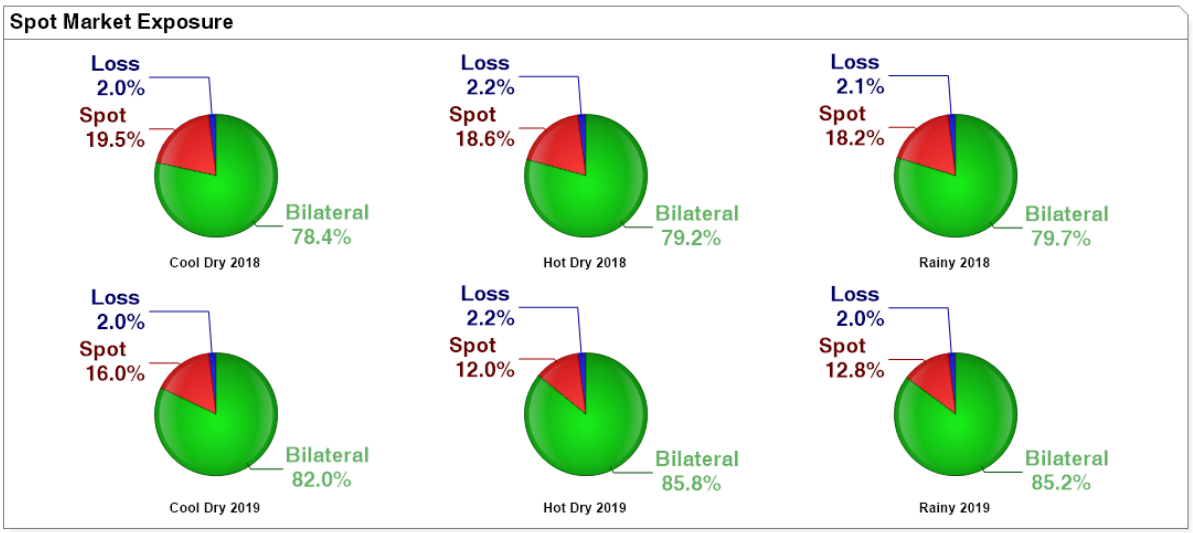
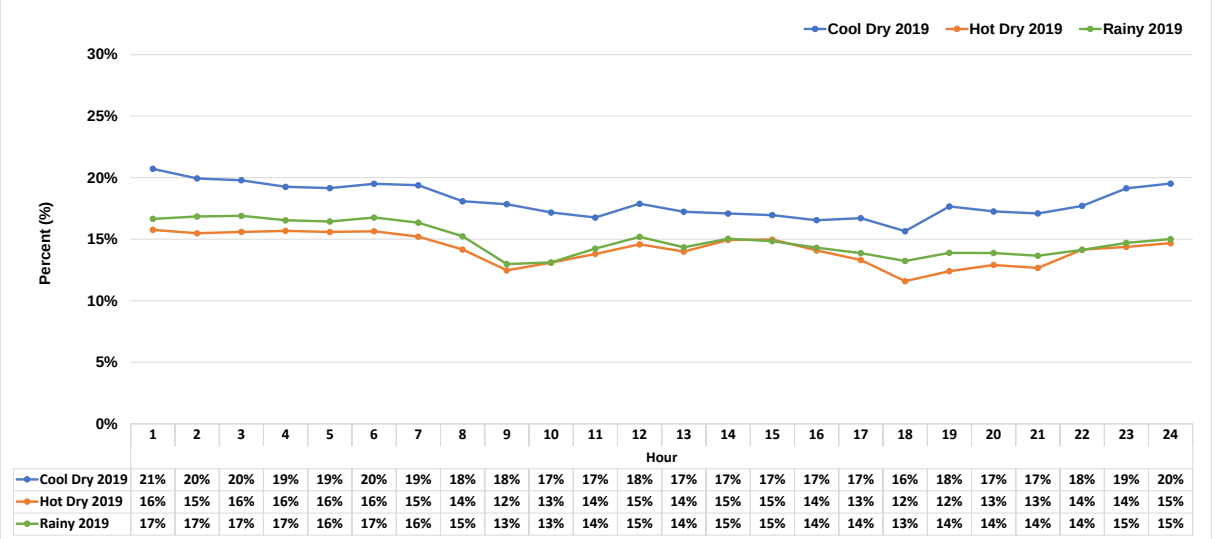


Figure 40. Spot Market Exposure, 2018 to 2019 Seasons

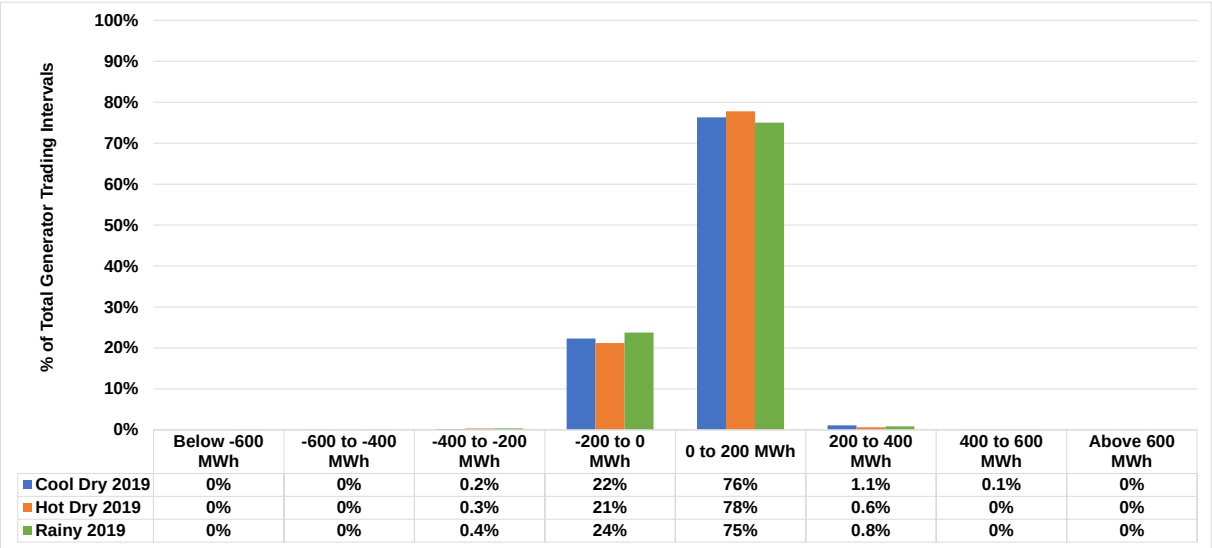
- Hourly generator spot exposure (spot quantities over total energy injected to the grid) indicated an average for the following seasons based on hour type:
    - Cool Dry – Peak: 20 percent; Off-peak: 23 percent
    - Hot Dry – Peak: 20 percent; Off-peak: 21 percent
    - Rainy – Peak: 19 percent; Off-peak: 21 percent
- It was evident that spot exposure is lower in peak hours, indicating that consumers are more covered by bilateral contracts which reduces the risk of exposure in volatile prices in peak hours.



Hour	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 2019	21%	20%	20%	19%	19%	20%	19%	18%	18%	17%	17%	18%	17%	17%	17%	17%	17%	16%	18%	17%	17%	18%	19%	20%
Hot Dry 2019	16%	15%	16%	16%	16%	16%	15%	14%	12%	13%	14%	15%	14%	15%	15%	14%	13%	12%	12%	13%	13%	14%	14%	15%
Rainy 2019	17%	17%	17%	17%	16%	17%	16%	15%	13%	13%	14%	15%	14%	15%	15%	14%	14%	13%	14%	14%	14%	14%	15%	15%

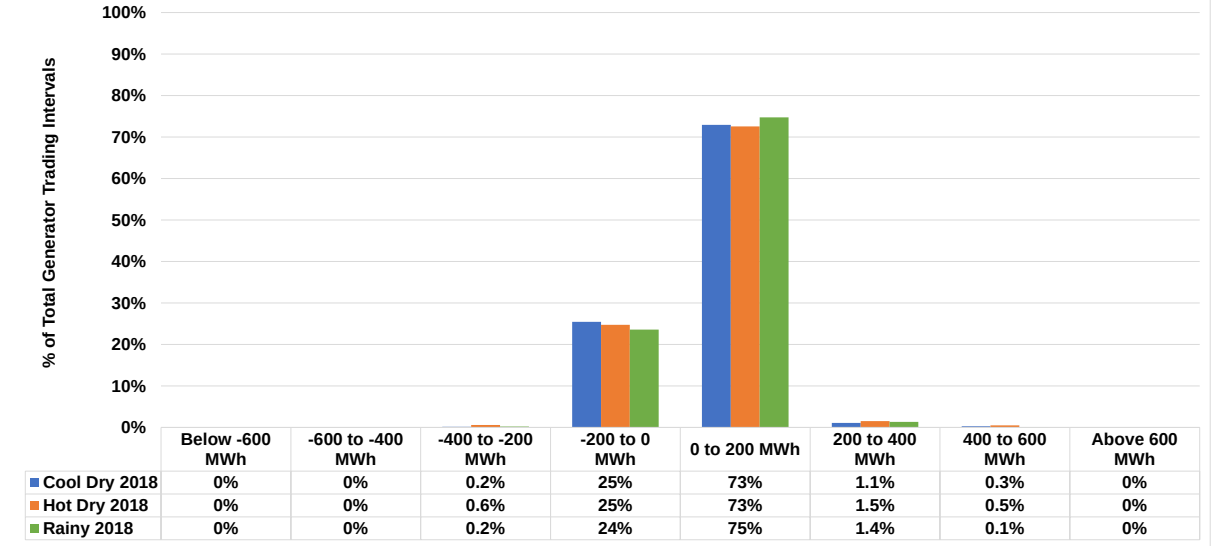
Figure 41. Hourly Generator Spot Market Exposure, 2019 Seasons

- It was observed that bulk of the spot quantities were concentrated on the -200 MWh to 200 MWh range
- Majority or about 76 to 78 percent of the generator transactions in the market in 2019 were positive which indicated generators were net sellers in the market.
- On the other hand, negative spot quantities at about 22 to 24 percent showed that generators were net buyer of energy in the market.
- There was a 2 percent increase in net sellers from 2018 to 2019.



	Below -600 MWh	-600 to -400 MWh	-400 to -200 MWh	-200 to 0 MWh	0 to 200 MWh	200 to 400 MWh	400 to 600 MWh	Above 600 MWh
Cool Dry 2019	0%	0%	0.2%	22%	76%	1.1%	0.1%	0%
Hot Dry 2019	0%	0%	0.3%	21%	78%	0.6%	0%	0%
Rainy 2019	0%	0%	0.4%	24%	75%	0.8%	0%	0%

Figure 42. Spot Frequency Distribution, 2019 Seasons



	Below -600 MWh	-600 to -400 MWh	-400 to -200 MWh	-200 to 0 MWh	0 to 200 MWh	200 to 400 MWh	400 to 600 MWh	Above 600 MWh
Cool Dry 2018	0%	0%	0.2%	25%	73%	1.1%	0.3%	0%
Hot Dry 2018	0%	0%	0.6%	25%	73%	1.5%	0.5%	0%
Rainy 2018	0%	0%	0.2%	24%	75%	1.4%	0.1%	0%

Figure 43. Spot Frequency Distribution, 2018 Seasons

B. Total Trading Amount (TTA)[14] Share

- PSALM consistently held the top spot in terms of TTA at a high 22 percent share and 20 percent spot exposure share despite it being fourth overall in terms of registered capacity.
- Likewise, FGC retained its second spot at 15 percent TTA share with a corresponding 16 spot exposure share.
- SMC went down two spots from third to fifth as Millennium Energy Inc. (MEI) took its third spot at 12 percent TTA share. SMC ended the year with a TTA share of 6 percent and spot exposure share of 12 percent.
- On fourth place was Semirara Mining and Power Corporation (SMPC) with a TTA and spot exposure share of 7 percent and 10 percent, respectively.
- AP had a decline from fourth to sixth in rank with both TTA share and spot exposure share at 6 percent.
- Meanwhile, Ayala Corporation (AC) and Global Business Power Corporation (GBPC) exchanged spots with the former ending in seventh place (eighth in 2018) with both TTA share and spot exposure share at 5 percent and the latter ending in eighth place (seventh in 2018) with a 4 percent TTA share and a 3 percent spot exposure share.

[14] The Total 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 TTA share of a major participant group is measured as a percentage of its TTA over the TTA of all participants during the period.

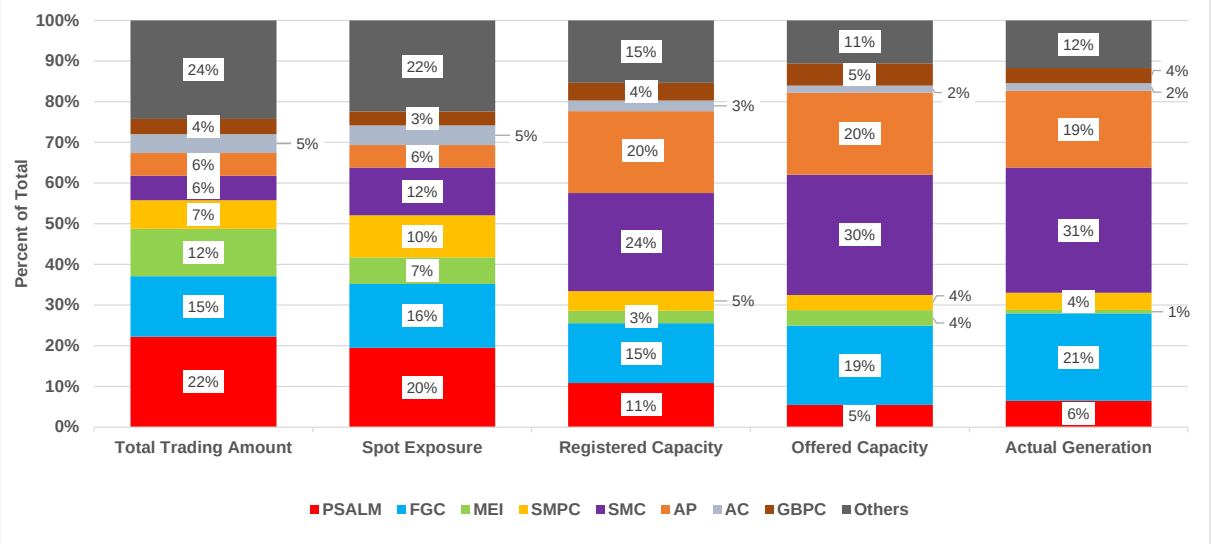


Figure 44. Total Trading Amount and Spot Exposure, 2019

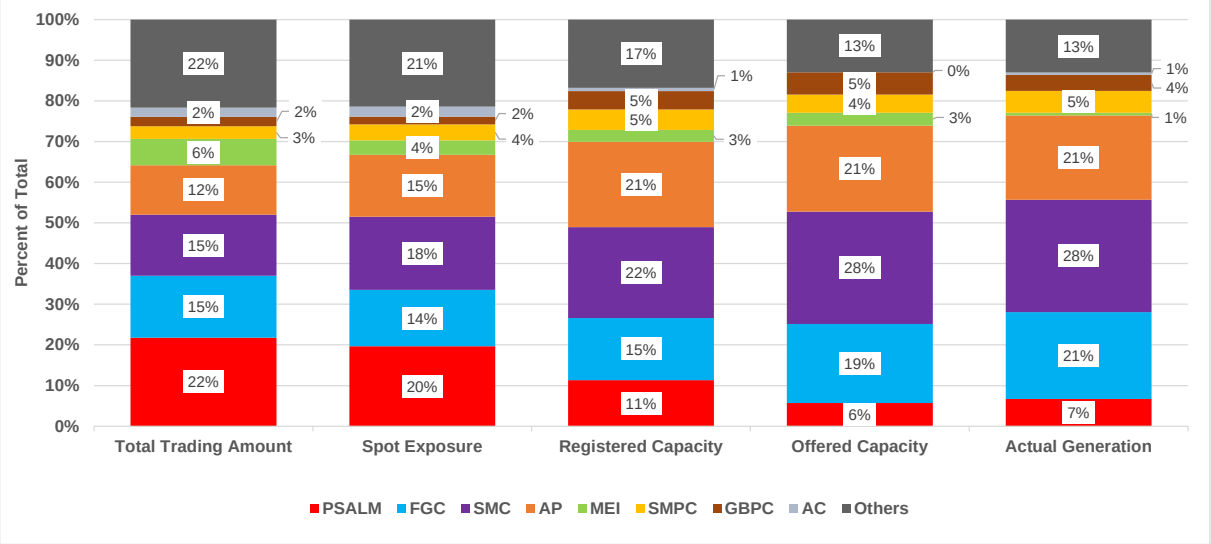


Figure 45. Total Trading Amount and Spot Exposure, 2018

VII. Compliance Monitoring

- Provided in the table is the breakdown of the registered capacity based on the Compliance Monitoring and Assessment of PEMC – Enforcement and Compliance Office.
- In summary, power plants registered a 70 percent compliance to the Must Offer Rule in the spot market.

- Most of the justified reasons resulted from outages of plants at 8.8 percent of the total capacities.
- Justified reasons arising from resource constraints closely followed and accounted 6.1 percent of the capacities. It can also be seen that this was more evident in renewable resource facilities as these were subject to the intermittency of the fuel sources.
- Meanwhile, around 0.8 percent of the capacities provided reasons which were not justified based on PEMC-ECO's evaluation.

Table 8. Compliance Monitoring of Plant Capacities per Resource Type, 2019

Region	Plant Type	Offered/ Compliant	Outage and Component Outages	Resource Constraints	Testing and Commissioning	Ancillary Services	Designated MRU Per DC2014-01-0003	Energy Storage	Other Causes	Not Justified	TOTAL
Luzon	Battery	89.7%	2.3%					0.1%	7.9%		100%
	Biomass	60.0%	4.6%	4.9%	28.3%	2.1%			0.1%	0.02%	100%
	Coal	74.3%	11.5%		4.0%	7.9%			2.2%	0.1%	100%
	Geothermal	50.0%	16.2%	23.8%		4.4%			3.1%	2.4%	100%
	Hydro	52.6%	9.5%	21.5%	0.5%	4.7%		7.0%	3.1%	1.0%	100%
	Natural Gas	91.4%	5.9%	0.7%		1.6%			0.3%		100%
	Oil-Based	50.3%	12.2%			5.5%	2.2%		29.3%	0.5%	100%
	Solar	37.6%	0.2%	39.0%	22.6%				0.5%		100%
	Wind	99.9%								0.1%	100%
Visayas	Biomass	28.3%	0.6%	16.9%	53.2%	0.1%			0.02%	0.9%	100%
	Coal	73.3%	8.0%		14.9%	3.0%			0.8%		100%
	Geothermal	81.0%	1.1%	5.3%		0.3%			1.9%	10.4%	100%
	Hydro	79.8%		19.0%		1.2%				0.1%	100%
	Oil-Based	70.0%	5.8%		5.7%	7.1%			11.4%	0.1%	100%
	Solar	43.4%		44.5%	12.0%						100%
	Wind	100.0%									100%
System		**70%**	**8.8%**	**6.1%**	**3.9%**	**4.7%**	**0.2%**	**0.9%**	**4.4%**	**0.8%**	100%

**Other causes include the following justified reasons: Co-generation, Decommissioned, Pending Legal and Regulatory Requirements, Force Majeure, Security Limit, Start-Up/Shutdown Process, and Transmission-related Constraints*

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
LUZON	OIL	Malaya 1	300	01/26/2018 21:25	03/04/2019 5:57	401.36	Planned Outage	Planned outage	Aug 1975
LUZON	OIL	Malaya 2	350	05/19/2018 13:01	06/22/2019 13:59	399.04	Deactivated Shutdown	Burnt air heater 2A. RECLASSIFIED FROM FORCE. OMC OUTAGE	Apr 1979
LUZON	OIL	Malaya 2	350	05/19/2018 13:01			Forced Outage	Burn air heater 2A	Apr 1979
LUZON	COAL	Sual 2	647	11/16/2018 23:28	12/04/2018 4:20	17.20	Maintenance Outage	Maintenance outage until 16 Dec 2018	Oct 1999
LUZON	COAL	SMC 1	150	11/18/2018 13:20	12/11/2018 12:42	22.97	Forced Outage	High furnace pressure	Nov 2016
LUZON	HYD	Kalayaan 3	180	11/21/2018 0:01	12/01/2018 22:56	10.95	Planned Outage	Maintenance Outage until 25 November 2018	May 2004
LUZON	HYD	Kalayaan 4	180	11/24/2018 0:01	11/28/2018 23:17	4.97	Planned Outage	Planned Outage until 28 November 2018. GOMP	May 2004
LUZON	COAL	QPPL	459	11/30/2018 0:38	12/02/2018 15:10	2.61	Forced Outage	Boiler Tube Leak	May 2000
LUZON	HYD	Kalayaan 3	180	12/03/2018 8:47	12/03/2018 9:20	0.02	Forced Outage	Tripped at 135 MW load	May 2004
LUZON	NATG	San Gabriel	420	12/08/2018 0:36	01/21/2019 16:49	44.68	Maintenance Outage	Maintenance outage until 22 December 2018	Mar 2016
LUZON	COAL	Calaca 2	300	12/08/2018 1:08	12/16/2018 15:35	8.60	Maintenance Outage	Maintenance outage until 15 December 2018	Sep 1984
LUZON	COAL	GN Power 1	316	12/10/2018 0:29	12/14/2018 18:13	4.74	Forced Outage	Drum level transmitter problem	May 2013
LUZON	NATG	San Lorenzo 2	261.8	12/15/2018 4:30	12/16/2018 23:18	1.78	Maintenance Outage	Off line compressor washing	Sep 2002
LUZON	COAL	Calaca 2	300	12/21/2018 11:42	12/22/2018 1:02	0.56	Forced Outage	Intercept valve failure. sudden closing	Sep 1984
LUZON	COAL	Calaca 2	300	12/22/2018 1:33	12/22/2018 10:38	0.38	Forced Outage	Main turbine temperature drop trip.	Sep 1984
LUZON	NATG	San Lorenzo 1	264.8	12/22/2018 4:19	12/23/2018 19:25	1.63	Planned Outage	Offline compressor washing	Sep 2002
LUZON	COAL	Masinloc 1	315	12/23/2018 3:46	12/23/2018 9:38	0.24	Forced Outage	Problem at auto-plant control system	Jun 1998
LUZON	COAL	QPPL	459	12/23/2018 5:52	12/23/2018 22:47	0.70	Forced Outage	Tripped with 185MW load	May 2000
LUZON	COAL	SMC 4	150	12/23/2018 13:40	01/02/2019 10:19	9.86	Maintenance Outage	Correction of punchlist in preparation for commercial operation	Sep 2018
VISAYAS	COAL	PEDC 3	150	12/23/2018 18:19	12/24/2018 6:38	0.51	Forced Outage	Auto tripped due to coal feeder problem	Aug 2016
VISAYAS	COAL	PEDC 3	150	12/25/2018 0:39	01/22/2019 21:31	28.87	Planned Outage	For annual preventive maintenance schedule	Aug 2016
LUZON	COAL	Pagbilao 3	420	12/25/2018 2:07	12/25/2018 3:56	0.08	Forced Outage	High drum level	Jul 2017
LUZON	COAL	Masinloc 2	344	12/26/2018 18:36	12/30/2018 7:43	3.55	Forced Outage	Drag chain conveyor trouble	Jun 1998
LUZON	COAL	Calaca 2	300	12/28/2018 6:46	12/28/2018 14:18	0.31	Forced Outage	Turbine fault	Sep 1984
LUZON	NATG	Sta. Rita 4	264	12/29/2018 4:33	12/30/2018 22:53	1.76	Planned Outage	GT offline compressor washing	Oct 2001
LUZON	COAL	Calaca 2	300	12/30/2018 2:10	01/03/2019 19:39	4.73	Forced Outage	Emergency shutdown due to boiler tube leak	Sep 1984
LUZON	COAL	Masinloc 2	344	12/30/2018 8:08	12/30/2018 9:09	0.04	Forced Outage	Tripped at 17 MW load	Jun 1998
LUZON	COAL	Masinloc 2	344	12/30/2018 9:30	12/30/2018 10:29	0.04	Forced Outage	Tripped at 30 MW load	Jun 1998
LUZON	COAL	Calaca 1	300	12/30/2018 22:38			Planned Outage	APMT until 25 June 2019 (GOMP)	Sep 1984
LUZON	COAL	GN Power 2	316	01/02/2019 6:19	01/03/2019 10:06	1.16	Maintenance Outage	Maintenance outage	May 2013
LUZON	COAL	SMC 3	150	01/04/2019 19:24	02/05/2019 10:37	31.63	Planned Outage	Planned outage until 25 January 2019	Nov 2017
LUZON	COAL	Masinloc 1	315	01/04/2019 23:20	01/25/2019 11:38	20.51	Planned Outage	Planned outage until 24 January 2019 (GOMP)	Jun 1998
LUZON	NATG	Sta. Rita 3	265.5	01/05/2019 4:31	01/06/2019 20:04	1.65	Planned Outage	Offline compressor washing until 6 January 2019	Oct 2001
LUZON	NATG	San Lorenzo 1	264.8	01/05/2019 18:29	01/06/2019 6:26	0.50	Forced Outage	Fault reading on generator current transformer	Sep 2002
LUZON	COAL	Pagbilao 3	420	01/06/2019 1:22	03/06/2019 15:22	59.58	Planned Outage	Planned outage until 4 February 2019. GOMP	Jul 2017
LUZON	COAL	GN Power 1	316	01/07/2019 0:03	02/10/2019 0:55	34.04	Planned Outage	Maintenance Outage until 2-11-19	May 2013
LUZON	COAL	GN Power 2	316	01/07/2019 20:08	01/08/2019 0:34	0.18	Forced Outage	Tripped due to boiler trouble	May 2013
LUZON	COAL	GN Power 2	316	01/08/2019 8:09	01/08/2019 15:20	0.30	Forced Outage	Exhaust high temperature at the turbine side. System Frequency 59.057hz	May 2013
LUZON	COAL	QPPL	459	01/12/2019 0:26	01/13/2019 17:11	1.70	Forced Outage	Boiler tube leak	May 2000
LUZON	NATG	Sta. Rita 1	257.3	01/12/2019 4:40	01/13/2019 23:15	1.77	Planned Outage	Compressor offline washing until 2400H of 13 January 2019	Jun 2000
LUZON	COAL	GN Power 2	316	01/12/2019 8:57	01/12/2019 20:54	0.50	Forced Outage	Circulating water pump tripping	May 2013
LUZON	NATG	Sta. Rita 1	257.3	01/13/2019 23:27	01/14/2019 2:18	0.12	Forced Outage	HP bypass station trouble	Jun 2000
LUZON	COAL	SLPGC 2	150	01/14/2019 7:01	03/08/2019 5:24	52.93	Forced Outage	Emergency shutdown due to boiler tube leak	Jan 2015
LUZON	COAL	Calaca 2	300	01/16/2019 13:32	01/26/2019 0:44	9.47	Forced Outage	Boiler Tube Leak	Sep 1984
LUZON	COAL	SLPGC 1	150	01/17/2019 11:09	02/01/2019 22:13	15.46	Forced Outage	Boiler Tube Leak	Jan 2015
LUZON	COAL	QPPL	459	01/18/2019 23:58	02/08/2019 23:55	21.00	Planned Outage	Maintenance Outage until 02 February 2019	May 2000
LUZON	NATG	Sta. Rita 2	255.7	01/19/2019 4:32	01/20/2019 20:01	1.65	Planned Outage	Offline washing	Jun 2000
LUZON	NATG	Sta. Rita 1	257.3	01/21/2019 0:37	01/21/2019 5:07	0.19	Forced Outage	Steam Turbine HP control valve rectification	Jun 2000
LUZON	COAL	Masinloc 2	344	01/25/2019 19:47	01/31/2019 8:02	5.51	Forced Outage	Emergency shutdown due to IDF 1 and 2 inlet vane reaching their upper limits and positi	Jun 1998
LUZON	OIL	Malaya 1	300	01/26/2019 21:25			Planned Outage	Planned outage	Aug 1975
LUZON	COAL	Calaca 2	300	01/29/2019 21:54	01/30/2019 0:12	0.10	Forced Outage	Generator excitation trouble	Sep 1984
LUZON	COAL	Calaca 2	300	01/31/2019 20:22	02/12/2019 5:02	11.36	Forced Outage	Emergency shutdown due to boiler tube leak	Sep 1984
LUZON	NATG	San Lorenzo 2	261.8	02/03/2019 6:30	02/04/2019 19:23	1.54	Maintenance Outage	Compressor off-line washing	Sep 2002
LUZON	HYD	Kalayaan 3	180	02/04/2019 0:01	02/11/2019 23:21	7.97	Planned Outage	Planned outage until 11 February 2019	May 2004
LUZON	HYD	Kalayaan 4	180	02/04/2019 0:01	02/14/2019 21:50	10.91	Planned Outage	Planned outage until 11 February 2019	May 2004
LUZON	COAL	SLPGC 1	150	02/04/2019 13:38	02/13/2019 23:02	9.39	Forced Outage	Tripped at 104MW load	Jan 2015
LUZON	COAL	SMC 1	150	02/06/2019 23:14	03/23/2019 4:31	44.22	Planned Outage	Planned outage until 28 February 2019.RECLASSIFIED FROM FORCE. OMC OUTAGE. RECL	Nov 2016
LUZON	COAL	GN Power 2	316	02/09/2019 16:47	02/09/2019 19:08	0.10	Forced Outage	Tripped due to actuation of generator differential protection	May 2013
LUZON	COAL	GN Power 1	316	02/10/2019 2:12	02/10/2019 3:04	0.04	Forced Outage	Tripped	May 2013
LUZON	NATG	Sta. Rita 4	264	02/10/2019 6:38	02/10/2019 15:40	0.38	Maintenance Outage	GT off-line Compressor Washing	Oct 2001
LUZON	COAL	GN Power 1	316	02/10/2019 11:42	02/11/2019 16:35	1.20	Forced Outage	Induced Draft Fan. IDF trouble	May 2013
LUZON	COAL	Calaca 2	300	02/12/2019 17:39	03/16/2019 22:14	32.19	Forced Outage	Boiler tube leak	Sep 1984
LUZON	HYD	Kalayaan 1	180	02/13/2019 0:01	03/09/2019 19:53	24.83	Planned Outage	Maintenance Outage until 06 March 2019	Aug 1982
LUZON	HYD	Kalayaan 2	180	02/15/2019 11:48	02/15/2019 19:11	0.31	Forced Outage	Tripped at 90MW load. Governor trouble	Aug 1982
LUZON	HYD	Kalayaan 2	180	02/16/2019 4:15	02/23/2019 23:59	7.82	Forced Outage	Spherical valve leak	Aug 1982
LUZON	NATG	Sta. Rita 1	257.3	02/16/2019 4:59	02/21/2019 6:49	5.08	Maintenance Outage	Maintenance outage until 2400H of 2-20-2019	Jun 2000
LUZON	NATG	Sta. Rita 3	265.5	02/19/2019 0:36	02/19/2019 2:10	0.07	Forced Outage	Resetting of GT Automation processor communication fault	Oct 2001
LUZON	COAL	SLPGC 1	150	02/20/2019 14:00	02/20/2019 18:36	0.19	Forced Outage	Tripped with 150MW load	Jan 2015
LUZON	COAL	Sual 2	647	02/20/2019 22:30	02/21/2019 10:42	0.51	Forced Outage	High Furnace Pressure. System Frequency is 58.822hz.	Oct 1999
LUZON	COAL	Sual 2	647	02/21/2019 10:48	02/21/2019 11:49	0.04	Forced Outage	Tripped with 86MW load	Oct 1999
LUZON	COAL	Sual 2	647	02/21/2019 11:55	02/21/2019 12:24	0.02	Forced Outage	Tripped with 75MW load	Oct 1999
LUZON	NATG	Ilijan A2	190	02/22/2019 20:46	02/23/2019 21:08	1.02	Maintenance Outage	Maintenance Outage until 24 February 2019	Jun 2002
LUZON	COAL	Masinloc 1	315	02/22/2019 23:43	02/25/2019 11:03	2.47	Maintenance Outage	Maintenance Outage until 25 February 2019	Jun 1998
LUZON	NATG	Ilijan A1	190	02/23/2019 23:07	02/25/2019 20:28	1.89	Maintenance Outage	Maintenance Outage	Jun 2002
LUZON	HYD	Kalayaan 2	180	02/24/2019 0:00	03/09/2019 21:45	13.91	Maintenance Outage	Maintenance Outage	Aug 1982
LUZON	NATG	San Lorenzo 1	264.8	02/24/2019 6:34	02/24/2019 17:49	0.47	Planned Outage	GT off line compressor washing	Sep 2002
LUZON	COAL	SLPGC 1	150	02/24/2019 7:56	02/28/2019 0:17	3.68	Forced Outage	Tripped due to detached governor valve drain line	Jan 2015
LUZON	COAL	SMC 3	150	02/25/2019 2:12	02/25/2019 4:11	0.08	Forced Outage	Low furnace pressure	Nov 2017
LUZON	NATG	Sta. Rita 2	255.7	02/26/2019 4:34	02/26/2019 7:12	0.11	Forced Outage	Tripped at 161MW load	Jun 2000
LUZON	NATG	Ilijan A1	190	02/26/2019 11:53	02/26/2019 20:48	0.37	Forced Outage	Fuel gas pilot pressure control valve trouble	Jun 2002
LUZON	COAL	QPPL	459	02/28/2019 13:53	03/03/2019 7:53	2.75	Forced Outage	hotspot correction on phase B high side bushing	May 2000
LUZON	COAL	Sual 2	647	03/01/2019 14:57	03/05/2019 19:08	4.17	Forced Outage	Boiler tube leak	Oct 1999
LUZON	OIL	Malaya 1	300	03/04/2019 7:17	03/07/2019 14:45	3.31	Forced Outage	Motor boiler feed pump trouble	Aug 1975
LUZON	COAL	SMC 2	150	03/05/2019 9:47	03/24/2019 14:22	19.19	Forced Outage	Suspected boiler tube leak	Mar 2017
LUZON	COAL	Sual 2	647	03/05/2019 19:43	03/05/2019 22:44	0.13	Forced Outage	HP turbine bypass valve trouble	Oct 1999
LUZON	COAL	Pagbilao 3	420	03/06/2019 15:28	03/06/2019 17:05	0.07	Forced Outage	Tripped by reverse power	Jul 2017
LUZON	COAL	GN Power 2	316	03/07/2019 0:20	03/10/2019 1:18	3.04	Forced Outage	Boiler Tube Leak	May 2013
LUZON	NATG	Sta. Rita 1	257.3	03/08/2019 8:51	03/08/2019 12:49	0.17	Forced Outage	Gas line vent vavle trouble	Jun 2000
LUZON	COAL	Pagbilao 3	420	03/09/2019 0:40	03/09/2019 11:37	0.46	Forced Outage	Tripping of Induced Draft Fan A and B	Jul 2017
LUZON	HYD	Kalayaan 2	180	03/11/2019 7:51	03/11/2019 8:23	0.02	Forced Outage	Cooling System Trouble	Aug 1982
LUZON	HYD	Kalayaan 2	180	03/11/2019 8:23	03/11/2019 15:03	0.28	Forced Outage	Cooling System Trouble	Aug 1982
LUZON	NATG	Sta. Rita 2	255.7	03/16/2019 6:22	03/16/2019 11:56	0.23	Forced Outage	Tripped due to GT power supply trouble	Jun 2000
LUZON	NATG	San Lorenzo 2	261.8	03/17/2019 0:29	03/17/2019 23:12	0.95	Maintenance Outage	Offline GT compressor washing	Sep 2002
LUZON	NATG	San Gabriel	420	03/22/2019 4:30			Maintenance Outage	Maintenance outage until 24 March 2019	Mar 2016
LUZON	NATG	San Gabriel	420	03/22/2019 4:30	03/26/2019 7:24	4.12	Maintenance Outage	Maintenance outage until 27 March 2019	Mar 2016
LUZON	COAL	Pagbilao 1	382	03/26/2019 2:36	03/30/2019 0:00	3.89	Forced Outage	Boiler Tube Leak.	Mar 1996
LUZON	COAL	Masinloc 2	344	03/29/2019 23:50	04/04/2019 1:15	5.06	Forced Outage	Boiler slagging trouble	Jun 1998
LUZON	COAL	Pagbilao 1	382	03/30/2019 0:01	04/24/2019 10:45	25.45	Planned Outage	Maintenance Outage until 28 April 2019 2400H	Mar 1996
LUZON	COAL	Pagbilao 3	420	04/02/2019 0:59	04/16/2019 7:48	14.28	Forced Outage	Boiler slagging	Jul 2017

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
LUZON	NATG	San Lorenzo 2	261.8	04/03/2019 16:25	04/03/2019 22:28	0.25	Forced Outage	On emergency shutdown due to exciter trouble	Sep 2002
LUZON	COAL	SLPGC 2	150	04/07/2019 4:09	04/20/2019 23:14	13.80	Forced Outage	Primary Air Fan A high stator winding temp and Primary Air Fan B high motor bearing vib	Jan 2015
LUZON	COAL	Sual 1	647	04/09/2019 21:49	04/16/2019 4:42	6.29	Forced Outage	Boiler circulating pump piping leak	Oct 1999
LUZON	COAL	SMC 2	150	04/11/2019 16:28	04/22/2019 1:50	10.39	Forced Outage	High furnace pressure	Mar 2017
LUZON	NATG	Sta. Rita 2	255.7	04/18/2019 4:40	04/21/2019 16:14	3.48	Planned Outage	Maintenance Outage until 21 April 2019	Jun 2000
LUZON	COAL	SMC 4	150	04/18/2019 6:31	04/21/2019 4:28	2.91	Planned Outage	On Commissioning Test	Sep 2018
LUZON	COAL	GN Power 1	316	04/22/2019 17:11	04/25/2019 21:58	3.20	Forced Outage	Isolated due tripping of Hermosa-Limay 230kV L1. L2 and L3 caused by 6.1 magnitude ea	May 2013
LUZON	COAL	GN Power 2	316	04/22/2019 17:11	05/05/2019 19:25	13.09	Forced Outage	Isolated due tripping of Hermosa-Limay 230kV L1. L2 and L3 caused by 6.1 magnitude ea	May 2013
LUZON	COAL	SMC 1	150	04/22/2019 17:11	04/30/2019 16:36	7.98	Forced Outage	Isolated due tripping of Hermosa-Limay 230kV L1. L2 and L3 caused by 6.1 magnitude ea	Nov 2016
LUZON	COAL	SMC 2	150	04/22/2019 17:11	04/30/2019 14:26	7.89	Forced Outage	Isolated due tripping of Hermosa-Limay 230kV L1. L2 and L3 caused by 6.1 magnitude ea	Mar 2017
LUZON	COAL	SMC 3	150	04/22/2019 17:11	04/24/2019 3:42	1.44	Forced Outage	Isolated due tripping of Hermosa-Limay 230kV L1. L2 and L3 caused by 6.1 magnitude ea	Nov 2017
LUZON	COAL	SMC 4	150	04/22/2019 17:11	04/23/2019 6:32	0.56	Forced Outage	Isolated due tripping of Hermosa-Limay 230kV L1. L2 and L3 caused by 6.1 magnitude ea	Sep 2018
LUZON	COAL	Pagbilao 1	382	04/24/2019 22:56	04/24/2019 23:59	0.04	Planned Outage	Conducted Load Rejection Test(LRT) at 30MW load	Mar 1996
LUZON	COAL	Pagbilao 1	382	04/25/2019 0:00	04/25/2019 10:24	0.43	Forced Outage	Fiber Optic controller problem	Mar 1996
LUZON	COAL	SLPGC 1	150	04/25/2019 15:32	04/25/2019 18:09	0.11	Forced Outage	Batangas SIPS activation	Jan 2015
LUZON	COAL	SLPGC 2	150	04/25/2019 15:32	04/25/2019 21:30	0.25	Forced Outage	Batangas SIPS activation	Jan 2015
LUZON	NATG	Sta. Rita 3	265.5	04/27/2019 0:45	04/30/2019 1:55	3.05	Forced Outage	Replacement of burner for combustion chamber	Oct 2001
LUZON	COAL	Calaca 2	300	04/27/2019 2:49	05/05/2019 4:56	8.09	Forced Outage	Boiler Tube Leak	Sep 1984
LUZON	HYD	Kalayaan 2	180	04/29/2019 9:23	04/29/2019 11:32	0.09	Forced Outage	Failed start-up.	Aug 1982
LUZON	COAL	Pagbilao 1	382	05/02/2019 15:27	05/14/2019 21:14	12.24	Forced Outage	Tripped due to excessive water leak at feed water flow sensing line	Mar 1996
LUZON	HYD	Kalayaan 1	180	05/03/2019 17:08	05/03/2019 21:21	0.18	Forced Outage	Main Transformer tripping with neutral overcurrent indication(RECLASSIFIED FROM FOR	Aug 1982
LUZON	OIL	Malaya 1	300	05/03/2019 18:21			Forced Outage	Declared unavailable due to motorization of unit generator caused by the non-opening o	Aug 1975
LUZON	COAL	SBPL	455	05/03/2019 18:41	05/03/2019 21:58	0.14	Planned Outage	Unit tripped at 210MW load. (Commissioning Test)	Apr 2019
LUZON	NATG	San Lorenzo 2	261.8	05/05/2019 21:11	05/06/2019 1:23	0.17	Forced Outage	Tripped while in the process of fuel change-over from gas to oil	Sep 2002
LUZON	HYD	Kalayaan 2	180	05/09/2019 8:48	05/09/2019 11:41	0.12	Forced Outage	Failed to synchronize	Aug 1982
LUZON	COAL	GN Power 1	316	05/09/2019 14:21	05/21/2019 12:59	11.94	Forced Outage	High Turbine Vibration	May 2013
LUZON	HYD	Kalayaan 3	180	05/14/2019 13:11	05/14/2019 16:52	0.15	Forced Outage	Declared unavailable due to Generator Breaker Problem	May 2004
LUZON	HYD	Kalayaan 1	180	05/14/2019 14:32	05/14/2019 16:42	0.09	Forced Outage	Tripped due to arcflash of exploded grading capacitor of PBC 8- 02CB24SJU	Aug 1982
LUZON	HYD	Kalayaan 2	180	05/14/2019 14:32	05/14/2019 16:34	0.08	Forced Outage	Tripped due to arcflash of exploded grading capacitor of PBC 8- 02CB24SJU	Aug 1982
LUZON	COAL	SMC 3	150	05/15/2019 5:19	05/15/2019 6:53	0.07	Forced Outage	Tripped due to High Drum Level	Nov 2017
LUZON	NATG	Ilijan A1	190	05/15/2019 17:19	05/15/2019 23:35	0.26	Forced Outage	Cumbustor Pressure Fluctuation(CPF) trouble. Tripped at 190MW load. System Frequenc	Jun 2002
LUZON	NATG	Sta. Rita 1	257.3	05/16/2019 13:45	05/16/2019 18:27	0.20	Forced Outage	Emergency shutdown due to open vent valve of gas supply	Jun 2000
LUZON	NATG	Sta. Rita 1	257.3	05/21/2019 9:08	05/21/2019 10:37	0.06	Forced Outage	Tripped due to GT protection triggered by radio interference signal.	Jun 2000
LUZON	COAL	GN Power 1	316	05/21/2019 13:02	05/22/2019 23:38	1.44	Forced Outage	Emergency shutdown due to intercept valve 2 trouble	May 2013
LUZON	COAL	SBPL	455	05/22/2019 20:33	05/22/2019 23:32	0.12	Forced Outage	Tripped at 400MW load. Feedwater flow problem. On Commissioning Test.	Apr 2019
LUZON	COAL	SBPL	455	05/25/2019 20:26	05/25/2019 23:52	0.14	Forced Outage	Tripped due to GSUT Oil Temperature High High (On commissioning Test)	Apr 2019
LUZON	COAL	SBPL	455	05/27/2019 15:28	06/14/2019 15:55	18.02	Forced Outage	Tripped at 95MW load. On Commissioning Test	Apr 2019
LUZON	NATG	Ilijan A1	190	05/30/2019 23:58	06/01/2019 10:25	1.44	Maintenance Outage	Maintenance outage until 02 June 2019.	Jun 2002
LUZON	COAL	QPPL	459	05/31/2019 14:45	06/01/2019 15:27	1.03	Forced Outage	Hydraulic leak at Control Valve 2	May 2000
LUZON	COAL	Sual 2	647	06/01/2019 19:18	06/02/2019 23:00	1.15	Forced Outage	Tripped by generator transformer BUCCHOLZ relay actuation	Oct 1999
LUZON	COAL	SMC 1	150	06/02/2019 4:50	06/12/2019 20:29	10.65	Forced Outage	Emergency shutdown due to boiler tube leak	Nov 2016
LUZON	NATG	San Lorenzo 2	261.8	06/02/2019 6:34	06/02/2019 11:39	0.21	Forced Outage	Loss redundancy of critical automation processor of the unit	Sep 2002
LUZON	COAL	GN Power 1	316	06/02/2019 11:07	06/09/2019 1:47	6.61	Forced Outage	Air Heater Trouble... System frequency is 59.024hz	May 2013
LUZON	NATG	San Gabriel	420	06/04/2019 18:04	06/06/2019 7:13	1.55	Forced Outage	On emergency shutdown due to differential pressure air filter trouble.	Mar 2016
LUZON	COAL	SMC 4	150	06/05/2019 11:46			Forced Outage	High furnace pressure	Sep 2018
LUZON	COAL	SMC 4	150	06/05/2019 11:46	06/20/2019 7:17	14.81	Forced Outage	High furnace pressure. On Commissioning Test	Sep 2018
LUZON	COAL	Calaca 2	300	06/06/2019 15:06	06/08/2019 5:11	1.59	Forced Outage	Tripped with 203MW load	Sep 1984
LUZON	NATG	San Lorenzo 1	264.8	06/08/2019 4:41	06/09/2019 21:27	1.70	Planned Outage	Maintenance Outage	Sep 2002
LUZON	NATG	San Lorenzo 2	261.8	06/08/2019 9:20	06/10/2019 5:32	1.84	Forced Outage	Tripped while on the process of change over of fuel from natural gas to fuel oil.	Sep 2002
LUZON	COAL	SMC 1	150	06/13/2019 9:46	06/23/2019 3:55	9.76	Forced Outage	Suspected Boiler tube leak	Nov 2016
LUZON	COAL	SBPL	455	06/14/2019 18:09	06/16/2019 9:53	1.66	Forced Outage	Hotspot correction of transformer. On Commissioning Test	Apr 2019
LUZON	COAL	GN Power 2	316	06/14/2019 20:02	07/19/2019 9:17	34.55	Forced Outage	Loss of power supply of coal feeder	May 2013
LUZON	COAL	Sual 2	647	06/14/2019 21:39	06/16/2019 3:59	1.26	Maintenance Outage	Maintenance Outage until 17 June 2019	Oct 1999
LUZON	COAL	Masinloc 3	335	06/15/2019 1:35	07/06/2019 2:45	21.05	Planned Outage	On Commissioning Test	Mar 2019
LUZON	NATG	San Lorenzo 2	261.8	06/16/2019 0:18	06/16/2019 23:42	0.98	Planned Outage	GT off-line compressor washing	Sep 2002
LUZON	COAL	SBPL	455	06/17/2019 8:45	06/21/2019 9:38	4.04	Forced Outage	Hot spot at the Unit Transformer high side bushing	Apr 2019
LUZON	NATG	San Gabriel	420	06/18/2019 21:39	06/19/2019 7:42	0.42	Forced Outage	Malampaya Natural Gas Supply Restriction	Mar 2016
LUZON	NATG	San Lorenzo 2	261.8	06/19/2019 9:57	06/19/2019 10:45	0.03	Forced Outage	Fuel supply change-over from gas to oil	Sep 2002
LUZON	COAL	SBPL	455	06/21/2019 16:51	06/21/2019 23:10	0.26	Forced Outage	Loss of flame and DCS trouble	Apr 2019
LUZON	COAL	SBPL	455	06/22/2019 0:47	06/22/2019 23:30	0.95	Forced Outage	Tripped at 176MW load. System frequency is 59.47hz. Induced Draft fan vibration	Apr 2019
LUZON	NATG	Sta. Rita 1	257.3	06/22/2019 4:27	06/23/2019 21:25	1.71	Maintenance Outage	Off Line Compressor Washing until 23 June 2019	Jun 2000
LUZON	COAL	SLPGC 2	150	06/23/2019 3:17	06/23/2019 14:09	0.45	Forced Outage	Hotspot correction at Main Transformer bushing. phase B	Jan 2015
LUZON	COAL	SBPL	455	06/24/2019 15:45	06/25/2019 0:49	0.38	Forced Outage	Unit Transformer bushing hot spot correction. On Commissioning Test.	Apr 2019
LUZON	COAL	Calaca 1	300	06/26/2019 0:01	08/22/2019 23:21	57.97	Forced Outage	Extended outage until 30 July 2019	Sep 1984
LUZON	NATG	Sta. Rita 2	255.7	06/26/2019 4:37	07/01/2019 20:14	5.65	Maintenance Outage	Maintenance Outage until 30 June 2019	Jun 2000
LUZON	COAL	SBPL	455	06/26/2019 18:18	06/27/2019 4:06	0.41	Forced Outage	Emergency Shutdown due to Tube Leak. On Commissioning Test	Apr 2019
LUZON	NATG	Ilijan B2	190	06/28/2019 21:53	07/01/2019 22:50	3.04	Maintenance Outage	Maintenance Outage until 06 July 2019	Jun 2002
VISAYAS	COAL	PEDC 3	150	06/29/2019 16:31	07/01/2019 16:56	2.02	Forced Outage	Debri filter problem	Aug 2016
LUZON	COAL	SBPL	455	06/29/2019 16:33	06/30/2019 21:12	1.19	Planned Outage	On Commissioning Test	Apr 2019
LUZON	COAL	Pagbilao 2	382	07/01/2019 1:10			Forced Outage	Boiler Tube Leak. On Maintenance outage from 06-30 July 2019.(RECLASSIFIED FROM FO	Mar 1996
LUZON	COAL	Pagbilao 2	382	07/01/2019 1:10	07/23/2019 12:12	22.46	Maintenance Outage	Boiler Tube Leak. On Maintenance outage from 06-30 July 2019.(RECLASSIFIED FROM FO	Mar 1996
LUZON	COAL	Pagbilao 3	420	07/02/2019 1:27	07/02/2019 3:45	0.10	Forced Outage	Tripped with 261MW load	Jul 2017
LUZON	NATG	Sta. Rita 4	264	07/03/2019 12:47	07/04/2019 3:49	0.63	Forced Outage	Tripped during changeover from gas to fuel oil	Oct 2001
LUZON	COAL	SBPL	455	07/04/2019 17:58	07/05/2019 3:06	0.38	Forced Outage	On commissioning test	Apr 2019
LUZON	COAL	Masinloc 1	315	07/05/2019 23:48	07/08/2019 17:34	2.74	Forced Outage	Repair of electrostatic precipitator. air preheater and induced-draft fan.	Jun 1998
LUZON	NATG	Sta. Rita 4	264	07/06/2019 4:48	07/11/2019 0:01	4.80	Planned Outage	On maintenance outage until 10 July 2019(2400H)	Oct 2001
LUZON	OIL	Malaya 2	350	07/08/2019 3:04	07/10/2019 15:36	2.52	Forced Outage	Auxiliary steam line trouble	Apr 1979
LUZON	HYD	Kalayaan 3	180	07/09/2019 0:01	07/10/2019 19:28	1.81	Forced Outage	Scheduled shutdown was deferred but plant proceed with their shutdown	May 2004
LUZON	NATG	Sta. Rita 4	264	07/11/2019 0:01	07/12/2019 10:01	1.42	Forced Outage	Delayed completion of Maintenance activities	Oct 2001
LUZON	HYD	Kalayaan 1	180	07/13/2019 0:01	07/17/2019 20:24	4.85	Maintenance Outage	Maintenance Outage until 17 July 2019	Aug 1982
LUZON	NATG	Sta. Rita 3	265.5	07/13/2019 2:44	07/15/2019 20:24	2.74	Planned Outage	Maintenance Outage until 14 July 2019	Oct 2001
LUZON	COAL	SMC 1	150	07/13/2019 23:57	07/14/2019 10:51	0.45	Forced Outage	Rectification of stuck turbine	Nov 2016
LUZON	COAL	Masinloc 3	335	07/17/2019 21:04	08/09/2019 12:34	22.65	Forced Outage	Tripped at 115MW. On Commissioning Test	Mar 2019
LUZON	COAL	Calaca 2	300	07/18/2019 13:44	07/18/2019 18:05	0.18	Forced Outage	Tripped at 200MW laod.	Sep 1984
LUZON	COAL	SMC 2	150	07/19/2019 11:35	07/28/2019 6:15	8.78	Forced Outage	Tripped at 120MW. Turbine Vibration.System Frequency is 59.53hz	Mar 2017
LUZON	COAL	SBPL	455	07/19/2019 12:59	07/19/2019 18:55	0.25	Planned Outage	On Commissioning Test	Apr 2019
LUZON	COAL	Sual 2	647	07/19/2019 21:36	07/21/2019 9:58	1.52	Maintenance Outage	On maintenance outage until 21 July 2019	Oct 1999
LUZON	HYD	Kalayaan 2	180	07/20/2019 0:01	07/24/2019 20:22	4.85	Maintenance Outage	Maintenance Outage until 24 July 2019	Aug 1982
LUZON	COAL	SBPL	455	07/20/2019 11:48	07/26/2019 1:40	5.58	Planned Outage	On Commissioning Test	Apr 2019
LUZON	NATG	San Lorenzo 1	264.8	07/20/2019 23:50	07/21/2019 0:41	0.04	Forced Outage	Tripped during the process of fuel changed-ove from gas to oil.	Sep 2002
LUZON	NATG	San Gabriel	420	07/21/2019 0:54	07/21/2019 9:17	0.35	Forced Outage	On emergency shutdown until 1000H of 21 July 2019	Mar 2016
LUZON	COAL	Calaca 2	300	07/22/2019 16:28	07/22/2019 20:01	0.15	Forced Outage	Sudden closing of aux. steam isolating valve	Sep 1984
LUZON	COAL	SLPGC 1	150	07/24/2019 12:04	07/24/2019 17:10	0.21	Forced Outage	Reason still under investigation	Jan 2015
LUZON	NATG	Ilijan B1	190	07/25/2019 0:41	08/29/2019 6:14	35.23	Planned Outage	Maintenance Outage till 28 August 2019	Jun 2002
LUZON	COAL	SBPL	455	07/26/2019 1:54	07/26/2019 7:08	0.22	Planned Outage	Commissioning Test.(RECLASSIFIED FROM FORCE. OMC OUTAGE)	Apr 2019
LUZON	NATG	Sta. Rita 2	255.7	07/27/2019 0:25	07/27/2019 13:37	0.55	Maintenance Outage	For compressor washing	Jun 2000
LUZON	NATG	Ilijan B3	220	07/28/2019 0:24	08/29/2019 11:32	32.46	Planned Outage	Maintenance Outage until 28 August 2019	Jun 2002
LUZON	NATG	Ilijan B2	190	07/28/2019 0:37	08/30/2019 1:41	33.04	Planned Outage	Maintenance Outage till 31 August 2019	Jun 2002
LUZON	HYD	Kalayaan 3	180	08/01/2019 0:01	10/20/2019 23:56	81.00	Planned Outage	Planned Outage until 19 October 2019(GOMP).	May 2004
LUZON	COAL	Pagbilao 2	382	08/01/2019 7:20	08/01/2019 9:59	0.11	Forced Outage	Boiler Feed Pump trouble	Mar 1996

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
LUZON	NATG	Sta. Rita 4	264	08/03/2019 0:54	08/03/2019 23:45	0.95	Planned Outage	GT offline compressor washing	Oct 2001
LUZON	NATG	San Lorenzo 2	261.8	08/03/2019 2:30	08/03/2019 13:14	0.45	Maintenance Outage	Maintenance Outage	Sep 2002
LUZON	COAL	SMC 4	150	08/03/2019 4:02	08/13/2019 20:18	10.68	Forced Outage	Boiler tube leak	Sep 2018
LUZON	COAL	SBPL	455	08/03/2019 6:24	08/03/2019 7:26	0.04	Planned Outage	Conducted Load Rejection Test (LRT) at 455MW. System Frequency is 59.35hz.	Apr 2019
LUZON	COAL	SBPL	455	08/04/2019 0:14	08/04/2019 8:25	0.34	Planned Outage	On Commissioning Test	Apr 2019
LUZON	COAL	Calaca 2	300	08/05/2019 7:12	08/16/2019 5:15	10.92	Forced Outage	Suspected boiler tube leak	Sep 1984
LUZON	COAL	Masinloc 3	335	08/09/2019 13:56	08/09/2019 22:01	0.34	Forced Outage	Tripped. On commissioning test	Mar 2019
LUZON	COAL	Masinloc 2	344	08/09/2019 19:41	08/14/2019 19:15	4.98	Maintenance Outage	Maintenance Outage	Jun 1998
LUZON	NATG	Sta. Rita 3	265.5	08/10/2019 0:47	08/16/2019 16:35	6.66	Planned Outage	Maintenance Outage till 14 August 2019	Oct 2001
LUZON	COAL	Masinloc 3	335	08/11/2019 10:04	08/11/2019 13:34	0.15	Forced Outage	Tripped at 160MW load. Turbine trip actuation. System Frequency is 59.54hz	Mar 2019
LUZON	COAL	Masinloc 3	335	08/13/2019 2:22	08/14/2019 5:39	1.14	Forced Outage	Unit on commissioning test	Mar 2019
LUZON	COAL	Masinloc 3	335	08/15/2019 0:37	08/16/2019 12:57	1.51	Forced Outage	Unit on commissioning test	Mar 2019
LUZON	NATG	Sta. Rita 3	265.5	08/16/2019 17:40	08/16/2019 22:37	0.21	Forced Outage	Fuel oil leak at gas turbine burner	Oct 2001
LUZON	NATG	Sta. Rita 4	264	08/17/2019 0:46	08/17/2019 20:55	0.84	Planned Outage	Planned Outage until 1400H 17 August 2019	Oct 2001
LUZON	COAL	Masinloc 3	335	08/17/2019 12:58	08/27/2019 2:29	9.56	Forced Outage	Emergency Shutdown. Under Commissioning Test	Mar 2019
LUZON	NATG	Sta. Rita 2	255.7	08/18/2019 1:34	08/18/2019 17:52	0.68	Planned Outage	GT offline compressor washing	Jun 2000
LUZON	COAL	Calaca 1	300	08/23/2019 3:42	08/29/2019 14:40	6.46	Forced Outage	Tripped at 65MW load. System frequency at 59.82hz	Sep 1984
LUZON	NATG	San Lorenzo 1	264.8	08/24/2019 0:01	08/25/2019 21:06	1.88	Planned Outage	GT Off Line Compressor Washing until 25 August 2019.	Sep 2002
LUZON	NATG	San Gabriel	420	08/26/2019 22:36	08/28/2019 10:18	1.49	Forced Outage	Restriction of Natural Gas Fuel Supply from SPEX Malampaya	Mar 2016
LUZON	COAL	SMC 1	150	08/27/2019 3:22	08/30/2019 5:11	3.08	Forced Outage	Low furnace temperature	Nov 2016
LUZON	HYD	Kalayaan 2	180	08/28/2019 12:58	08/28/2019 14:15	0.05	Forced Outage	Tripped due to main transformer trouble	Aug 1982
LUZON	NATG	Ilijan B3	220	08/29/2019 16:29	08/29/2019 17:25	0.04	Planned Outage	Conducted Mechanical Overspeed Test as part of their Maintenance Outage	Jun 2002
LUZON	COAL	Calaca 1	300	08/29/2019 19:16	08/29/2019 20:15	0.04	Forced Outage	Shutdown as part of their Commissioning Test after Overhauling	Sep 1984
LUZON	COAL	Masinloc 3	335	08/30/2019 6:07	08/30/2019 16:56	0.45	Forced Outage	On Commissioning Test	Mar 2019
LUZON	NATG	Ilijan B1	190	08/30/2019 8:52	08/30/2019 21:27	0.52	Forced Outage	High temperature at disc cavity	Jun 2002
LUZON	COAL	Calaca 1	300	08/30/2019 17:32	09/05/2019 19:53	6.10	Forced Outage	Instrument air pressure trouble	Sep 1984
LUZON	COAL	Sual 2	647	09/02/2019 8:40	09/02/2019 22:11	0.56	Forced Outage	Tripped at 480MW load. Generator stator cooling water level low.	Oct 1999
LUZON	NATG	Sta. Rita 2	255.7	09/08/2019 0:32	09/08/2019 20:31	0.83	Planned Outage	GT off line compressor washing	Jun 2000
LUZON	COAL	Masinloc 3	335	09/12/2019 13:24	09/12/2019 15:43	0.10	Forced Outage	Tripped at 216MW. On Commissioning Test.System Frequency is 59.43hz	Mar 2019
LUZON	NATG	Sta. Rita 3	265.5	09/13/2019 0:42	09/16/2019 4:07	3.14	Maintenance Outage	Compressor washing and rectification of steam and lube oil leak	Oct 2001
LUZON	COAL	SLPGC 2	150	09/13/2019 23:59	09/21/2019 22:12	7.93	Forced Outage	Emergency Shutdown for Repair of Air Pre-heater Tube Leak	Jan 2015
LUZON	COAL	Masinloc 3	335	09/14/2019 6:35	09/15/2019 14:10	1.32	Planned Outage	Conducted Load Rejection Test at 335MW	Mar 2019
LUZON	COAL	Calaca 1	300	09/15/2019 11:53	09/29/2019 12:18	14.02	Forced Outage	Boiler tube leak	Sep 1984
LUZON	COAL	SMC 3	150	09/16/2019 1:11	09/25/2019 10:25	9.38	Forced Outage	Suspected Boiler Tube Leak	Nov 2017
LUZON	COAL	Masinloc 3	335	09/19/2019 15:00	09/24/2019 10:54	4.83	Forced Outage	Repair of HP heater 7 Bypass MOV. On Commissioning Test	Mar 2019
LUZON	COAL	SBPL	455	09/20/2019 7:04	09/25/2019 18:01	5.46	Planned Outage	Commissioning Test	Apr 2019
LUZON	COAL	GN Power 1	316	09/20/2019 23:18			Maintenance Outage	To facilitate correction of governor valves	May 2013
LUZON	NATG	Ilijan A2	190	09/21/2019 0:36	10/09/2019 18:39	18.75	Planned Outage	Maintenance Outage until 19 October 2019	Jun 2002
LUZON	NATG	San Lorenzo 1	264.8	09/21/2019 17:18	09/21/2019 20:46	0.14	Forced Outage	Tripped due to pilot gas control valve trouble	Sep 2002
LUZON	COAL	SLPGC 2	150	09/21/2019 22:59	09/22/2019 5:10	0.26	Forced Outage	Tripped at 10MW load during load stabilization from start-up. Due to HP Turbine Differe	Jan 2015
LUZON	NATG	Ilijan A1	190	09/23/2019 0:46	10/08/2019 16:10	15.64	Planned Outage	Maintenance Outage until 06 October 2019	Jun 2002
LUZON	NATG	Ilijan A3	220	09/24/2019 0:35	10/08/2019 22:15	14.90	Planned Outage	Maintenance Outage	Jun 2002
LUZON	COAL	Calaca 2	300	09/24/2019 7:29	09/24/2019 13:51	0.27	Forced Outage	High turbine vibration	Sep 1984
LUZON	COAL	Masinloc 3	335	09/24/2019 19:35	10/01/2019 9:52	6.60	Forced Outage	Steam leak at Main Steam Line	Mar 2019
LUZON	COAL	SBPL	455	09/26/2019 11:49	09/26/2019 19:01	0.30	Forced Outage	Tripped due to main transformer trouble (sudden pressure relief trip). On commissionin	Apr 2019
LUZON	COAL	GN Power 2	316	09/27/2019 22:15	09/28/2019 7:07	0.37	Forced Outage	Initial report from plant - main fuel trip	May 2013
LUZON	COAL	Calaca 1	300	10/01/2019 15:36	10/02/2019 4:42	0.55	Forced Outage	Tripped at 230MW load	Sep 1984
LUZON	COAL	SLPGC 2	150	10/03/2019 15:02	10/13/2019 15:07	10.00	Forced Outage	Unplanned outage due to boiler tube leak	Jan 2015
LUZON	COAL	Masinloc 3	335	10/04/2019 4:13	10/04/2019 20:24	0.67	Forced Outage	Tripped at 335MW load. Turbine tripped indication. On Commissioning Test	Mar 2019
LUZON	COAL	SMC 1	150	10/04/2019 22:33	10/05/2019 20:03	0.90	Forced Outage	Coal feeder replacement	Nov 2016
LUZON	NATG	Sta. Rita 4	264	10/05/2019 2:36	10/07/2019 21:26	2.78	Maintenance Outage	Maintenance Outage until 07 October 2019	Oct 2001
LUZON	COAL	Sual 1	647	10/06/2019 20:22	10/07/2019 15:03	0.78	Forced Outage	Turbine External Trip	Oct 1999
LUZON	COAL	Sual 1	647	10/07/2019 16:42	10/08/2019 14:06	0.89	Forced Outage	Condenser tube leak	Oct 1999
LUZON	COAL	Masinloc 3	335	10/07/2019 17:01	10/08/2019 11:45	0.78	Forced Outage	Excessive leak at economizer inlet pipe	Mar 2019
LUZON	NATG	Ilijan A1	190	10/08/2019 16:36	10/08/2019 18:09	0.06	Forced Outage	Tripped at 16MW load	Jun 2002
LUZON	COAL	Calaca 1	300	10/09/2019 16:42	10/09/2019 23:02	0.26	Forced Outage	Excitation system trouble	Sep 1984
LUZON	NATG	Sta. Rita 1	257.3	10/10/2019 4:40	10/11/2019 1:27	0.87	Maintenance Outage	Maintenance Outage	Jun 2000
LUZON	COAL	Masinloc 3	335	10/10/2019 8:49	10/11/2019 5:34	0.86	Forced Outage	Unit on commissioning test	Mar 2019
LUZON	COAL	Sual 1	647	10/11/2019 8:37	10/18/2019 2:46	6.76	Forced Outage	Condenser tube leak	Oct 1999
LUZON	NATG	Ilijan B2	190	10/11/2019 22:24	10/16/2019 12:02	4.57	Planned Outage	SPEX-Malampaya on Planned Outage until 12 Oct. 2019.(RECLASSIFIED FROM FORCE. ON	Jun 2002
LUZON	NATG	Ilijan B3	220	10/11/2019 22:38	10/16/2019 19:57	4.89	Planned Outage	SPEX-Malampaya on Planned Outage until 15 Oct. 2019.(RECLASSIFIED FROM FORCE. ON	Jun 2002
LUZON	NATG	Sta. Rita 2	255.7	10/11/2019 22:38	10/12/2019 0:27	0.08	Forced Outage	Tripped at 115MW load. On Fuel change-over	Jun 2000
LUZON	NATG	Ilijan B1	190	10/11/2019 22:50	10/16/2019 18:28	4.82	Planned Outage	SPEX-Malampaya on Planned Outage until 15 Oct. 2019.(RECLASSIFIED FROM FORCE. ON	Jun 2002
LUZON	NATG	Ilijan A1	190	10/11/2019 23:27	10/16/2019 0:41	4.05	Planned Outage	SPEX-Malampaya on Planned Outage until 15 Oct. 2019.(RECLASSIFIED FROM FORCE. ON	Jun 2002
LUZON	NATG	Sta. Rita 3	265.5	10/11/2019 23:34	10/12/2019 19:25	0.83	Forced Outage	Tripped at 226MW load. On Fuel change-over.	Oct 2001
LUZON	NATG	Ilijan A3	220	10/11/2019 23:45	10/16/2019 3:25	4.15	Planned Outage	SPEX-Malampaya on Planned Outage until 15 Oct 2019.(RECLASSIFIED FROM FORCE. OM	Jun 2002
LUZON	NATG	Ilijan A2	190	10/11/2019 23:54	10/16/2019 4:25	4.19	Planned Outage	SPEX-Malampaya on Planned Outage until 15 Oct 2019.(RECLASSIFIED FROM FORCE. OM	Jun 2002
LUZON	NATG	San Gabriel	420	10/11/2019 23:55	10/16/2019 0:02	4.00	Planned Outage	SPEX-Malampaya on Planned Outage until 15 Oct 2019.(RECLASSIFIED FROM FORCE. OM	Mar 2016
LUZON	NATG	Sta. Rita 1	257.3	10/12/2019 14:17	10/12/2019 18:30	0.18	Forced Outage	Cleaning of clogged fuel oil filter	Jun 2000
LUZON	NATG	Sta. Rita 3	265.5	10/15/2019 0:48	10/15/2019 4:25	0.15	Forced Outage	To facilitate cleaning of Suction filter for fuel oil injection pump	Oct 2001
LUZON	COAL	Masinloc 3	335	10/15/2019 5:59	10/15/2019 10:01	0.17	Forced Outage	Tripped due to high thrust bearing temperature. ALD occured at Meralco and NGCP feed	Mar 2019
LUZON	NATG	Ilijan A1	190	10/16/2019 0:41	10/16/2019 2:03	0.06	Forced Outage	Turbine tripped	Jun 2002
LUZON	NATG	Ilijan B2	190	10/16/2019 12:06	10/16/2019 13:52	0.07	Forced Outage	GT Blade hot temperature (high).	Jun 2002
LUZON	NATG	Ilijan B2	190	10/16/2019 15:54	10/16/2019 21:06	0.22	Forced Outage	Tripped at 50MW load.	Jun 2002
LUZON	NATG	Ilijan A1	190	10/16/2019 17:07	10/16/2019 18:30	0.06	Forced Outage	Tripped at 97MW load.	Jun 2002
LUZON	COAL	Calaca 2	300	10/17/2019 23:49			Planned Outage	Maintenance Outage until 02 March 2020	Sep 1984
LUZON	NATG	Sta. Rita 4	264	10/19/2019 0:42	10/19/2019 19:25	0.78	Maintenance Outage	Maintenance Outage until 20 Oct 2019	Oct 2001
LUZON	COAL	Sual 2	647	10/20/2019 23:48	11/14/2019 18:08	24.76	Planned Outage	Maintenance Outage until 11.17.2019 (2400H)	Oct 1999
LUZON	HYD	Kalayaan 1	180	10/21/2019 0:01	10/25/2019 19:13	4.80	Maintenance Outage	Maintenance Outage until 25 October 2019	Aug 1982
LUZON	COAL	SMC 3	150	10/26/2019 4:38	10/26/2019 18:25	0.57	Forced Outage	Feed water control pump leak	Nov 2017
LUZON	COAL	SMC 1	150	10/28/2019 6:08	10/28/2019 20:06	0.58	Forced Outage	Tripped with 150MW load	Nov 2016
LUZON	COAL	SMC 2	150	10/28/2019 6:08	10/28/2019 19:02	0.54	Forced Outage	Tripped with 90MW load	Mar 2017
LUZON	NATG	Sta. Rita 2	255.7	10/29/2019 11:39	10/29/2019 13:18	0.07	Forced Outage	Tripped due to GT Enclosure High Temperature	Jun 2000
VISAYAS	COAL	PEDC 3	150	10/29/2019 17:27	10/30/2019 18:18	1.04	Forced Outage	under investigation	Aug 2016
LUZON	COAL	Masinloc 2	344	10/30/2019 23:34			Planned Outage	Planned Outage(GOP)	Jun 1998
LUZON	NATG	San Lorenzo 1	264.8	11/01/2019 0:58	11/08/2019 23:37	7.94	Planned Outage	Planned Outage until 05 November 2019	Sep 2002
LUZON	NATG	San Lorenzo 2	261.8	11/01/2019 1:44	11/09/2019 23:59	8.93	Planned Outage	Planned Outage until 05 November 2019	Sep 2002
LUZON	COAL	Sual 1	647	11/03/2019 6:34	11/04/2019 19:33	1.54	Forced Outage	Tripped with 542MW load.(RECLASSIFIED FROM FORCE. OMC OUTAGE)	Oct 1999
LUZON	NATG	Ilijan B2	190	11/04/2019 9:44	11/04/2019 11:44	0.08	Forced Outage	Tripped with 190MW load	Jun 2002
LUZON	COAL	Sual 1	647	11/08/2019 18:52	11/10/2019 9:21	1.60	Forced Outage	Emergency Shutdown due to Boiler Tube Leak	Oct 1999
LUZON	COAL	SMC 3	150	11/08/2019 19:38	11/16/2019 13:48	7.76	Forced Outage	Emergency Shutdown due to Boiler Tube Leak	Nov 2017
LUZON	NATG	Sta. Rita 4	264	11/10/2019 13:15	11/10/2019 16:34	0.14	Forced Outage	Tripped at 112MW load	Oct 2001
LUZON	NATG	Ilijan A3	220	11/11/2019 12:14	11/11/2019 13:28	0.05	Forced Outage	Tripped with 154MW load.	Jun 2002
LUZON	COAL	SBPL	455	11/11/2019 23:14	11/13/2019 20:11	1.87	Forced Outage	Pressure Relief Device protection activation of Unit Transformer	Apr 2019
LUZON	HYD	Kalayaan 2	180	11/12/2019 0:01	11/16/2019 19:39	4.82	Planned Outage	Planned Outage until 17 November 2019	Aug 1982
LUZON	COAL	SBPL	455	11/14/2019 10:52	11/14/2019 16:12	0.22	Forced Outage	Tripping of Primary Air and Forced Draft Fan	Apr 2019
LUZON	NATG	Sta. Rita 1	257.3	11/14/2019 18:22	11/16/2019 16:28	1.92	Forced Outage	Tripped while on the process of fuel changeover due to combustion chamber trouble	Jun 2000
LUZON	COAL	Sual 2	647	11/15/2019 7:50	11/19/2019 17:42	4.41	Forced Outage	Boiler Tube Leak	Oct 1999
LUZON	COAL	Pagbilao 3	420	11/16/2019 0:59			Planned Outage	Planned Outage (GOP).	Jul 2017
LUZON	NATG	Sta. Rita 1	257.3	11/16/2019 17:28	11/16/2019 19:07	0.07	Forced Outage	Tripped due to GT High Temperature	Jun 2000
LUZON	HYD	Kalayaan 3	180	11/19/2019 0:01			Planned Outage	Planned Outage until 06 December 2019	May 2004
LUZON	HYD	Kalayaan 4	180	11/19/2019 0:01			Planned Outage	Planned Outage until 10 December 2019	May 2004
LUZON	COAL	Sual 2	647	11/22/2019 16:40	11/22/2019 18:53	0.09	Forced Outage	Tripping of Boiler feed pump C.	Oct 1999
LUZON	COAL	Sual 1	647	11/23/2019 7:45			Planned Outage	Planned Outage	Oct 1999
LUZON	HYD	Kalayaan 2	180	11/23/2019 9:46	11/23/2019 16:17	0.27	Forced Outage	Grid connection failure - hotspot at DS 8-03DS09SJU	Aug 1982
LUZON	COAL	QPPL	460	11/24/2019 16:51			Forced Outage	Inlet Valve trouble of Forced Draft Fan(FDF)-A and High Furnace Pressure.	May 2000
LUZON	COAL	SBPL	455	11/25/2019 14:28			Forced Outage	Induced Draft Fan (IDF) hydraulic leak trouble.	Apr 2019

Annex B. Interesting Pricing Events

Calendar Month	Day	Trading Interval	Supply Margin	Market Price	Lower Price Threshold	Upper Price Threshold	Reasons for the High Market Price
January	8	11	716	20,282	-3,794	16,424	• Occurence of forced outage of 2 coal plants (437 MW)
		18	613	24,021	-3,794	16,424	
	11	18	793	17,052	-5,017	15,201	• Higher demand requirement during evening
	12	14	91	30,157	515	20,733	• Occurence of forced outage of 2 coal plants, 1 hydro plant, 1 natural gas plant, and 1 oil-based plant (945 MW)
		16	223	25,273	515	20,733	
		18	4	32,468	515	20,733	
		19	4	32,576	515	20,733	
		20	83	32,532	515	20,733	
		21	318	32,236	-2,072	18,146	
	16	18	385	21,415	-2,072	18,146	• Higher demand requirement during evening; and • Lower effective supply due to capacity on outage of 1 coal plant (300 MW)
	17	18	683	24,646	-3,794	16,424	• Higher demand requirement during evening; and • Lower effective supply due to outage of 2 coal plants (450 MW)
	19	18	458	25,040	-2,072	18,146	• Occurence of forced outage of 1 coal plant, and 1 natural gas plant (715 MW)
		19	467	23,852	-2,072	18,146	
		20	361	24,718	-2,072	18,146	
		21	595	25,383	-3,794	16,424	
		22	450	23,339	-2,072	18,146	
	20	19	346	25,032	-2,072	18,146	
		20	427	23,919	-2,072	18,146	
	21	18	205	32,234	515	20,733	• Higher demand requirement during evening; and • Lower effective supply due to capacity on outage of 2 coal plants (609 MW)
	24	18	849	15,338	-5,017	15,201	• Higher demand requirement during evening; and • Lower effective supply due to high capacity on outage (3,793 MW)
February	4	16	204	31,394	515	20,733	• Occurence of forced outage of 3 hydro plants, and 1 coal plant (520 MW)
		17	242	23,891	515	20,733	
		18	305	24,488	-2,072	18,146	
		19	273	23,533	-2,072	18,146	
March	1	16	113	25,647	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 2 coal plants (1,106 MW)
		19	188	25,134	515	20,733	
		20	229	24,735	515	20,733	
	4	14	14	34,142	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 2 coal plants, and 1 oil-based plant (1,029 MW)
		15	14	34,115	515	20,733	
		16	72	32,504	515	20,733	
		19	128	25,816	515	20,733	
		20	224	25,252	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 3 coal plants, and 1 oil-based plant (1,152 MW)
	5	16	145	32,525	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 2 coal plants, and 1 oil-based plant (1,097 MW)
		17	261	24,406	-2,072	18,146	
		18	509	20,102	-3,794	16,424	
		19	287	23,444	-2,072	18,146	
		20	346	20,099	-2,072	18,146	
		21	479	19,992	-2,072	18,146	
	7	16	185	23,890	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 4 coal plants (710 MW)
	8	10	282	21,937	-2,072	18,146	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 4 coal plants, 1 natural gas plant, and 1 geothermal plant (1,027 MW)
		11	148	22,314	515	20,733	
		14	151	23,669	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 4 coal plants (710 MW)
	22	14	130	24,689	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 2 coal plants, and 1 natural gas plant (644 MW)
		16	96	25,014	515	20,733	

Annex B. Interesting Pricing Events

Calendar Month	Day	Trading Interval	Supply Margin	Market Price	Lower Price Threshold	Upper Price Threshold	Reasons for the High Market Price
April	2	14	49	32,802	515	20,733	• Occurence of forced outage of 1 coal plant (420 MW)
		15	54	32,495	515	20,733	
		16	51	32,848	515	20,733	
	3	19	3	33,121	515	20,733	• Occurence of forced outage of 1 coal plant, and 1 natural gas plant (682 MW)
		20	3	33,440	515	20,733	
		22	33	31,446	515	20,733	
	8	15	226	23,764	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 1 coal plant (150 MW)
	9	23	379	22,492	-2,072	18,146	• Occurence of forced outage of 2 coal plants (797 MW)
	10	9	32	24,250	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 2 coal plants (797 MW)
		10	15	24,558	515	20,733	
		11	33	24,298	515	20,733	
		12	54	22,971	515	20,733	
		13	57	23,772	515	20,733	
		18	3	31,768	515	20,733	
		19	2	32,118	515	20,733	
		20	0	25,651	515	20,733	
		21	1	24,826	515	20,733	
		22	2	23,911	515	20,733	
		23	3	23,253	515	20,733	
		24	18	31,421	515	20,733	
	11	10	127	24,179	515	20,733	• Occurence of forced outage of 2 coal plants (797 MW)
		14	57	35,803	515	20,733	
		15	53	35,256	515	20,733	
		16	46	23,023	515	20,733	
		17	41	33,900	515	20,733	
		18	34	33,682	515	20,733	• Occurence of forced outage of 2 coal plants (947 MW)
	15	14	222	22,233	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 2 coal plants (797 MW)
		15	86	23,720	515	20,733	
		16	2	32,551	515	20,733	
		17	172	23,301	515	20,733	
		19	127	23,617	515	20,733	
		20	3	26,064	515	20,733	
		21	2	23,661	515	20,733	
		22	3	35,194	515	20,733	
		23	68	24,412	515	20,733	
	22	14	64	31,533	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 1 coal plant (103 MW)
		15	43	32,166	515	20,733	
		24	22	33,864	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 7 coal plants, and 1 oil-based plant (1,404 MW)
	23	9	50	22,678	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 7 coal plants (1,249 MW)
		10	17	24,088	515	20,733	• Occurence of forced outage of 7 coal plants (1,249 MW)
		11	26	23,697	515	20,733	
		12	73	23,219	515	20,733	
		13	71	23,128	515	20,733	
		14	132	24,073	515	20,733	
		15	145	24,092	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 7 coal plants (1,249 MW)
		16	109	23,736	515	20,733	
		17	115	22,154	515	20,733	• Occurence of forced outage of 7 coal plants (1,249 MW)
		19	87	30,776	515	20,733	
		20	131	22,580	515	20,733	
		21	68	24,414	515	20,733	
		22	1	23,832	515	20,733	
		23	105	23,495	515	20,733	
	24	1	79	30,887	515	20,733	• Occurence of forced outage of 9 coal plants (1,432 MW)
		2	136	29,219	515	20,733	
		3	127	23,473	515	20,733	
		9	124	23,314	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 7 coal plants, and 2 oil-based plants (1,372 MW)
		10	242	22,711	515	20,733	• Occurence of forced outage of 7 coal plants, and 2 oil-based plants (1,372 MW)
		11	222	23,719	515	20,733	
		12	254	22,738	-2,072	18,146	• Occurence of forced outage of 6 coal plants, and 2 oil-based plants (1,249 MW)
	29	10	127	22,662	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 2 coal plants, and 1 natural gas plant (727 MW)
		11	157	28,552	515	20,733	
May	3	14	236	22,758	515	20,733	• Occurence of forced outage of 1 coal plant (382 MW)
	14	14	85	33,420	515	20,733	• Occurence of forced outage of 1 coal plant (316 MW)
		15	61	33,439	515	20,733	• Occurence of forced outage of 1 coal plant and 1 hydro plant (496 MW)
		16	99	33,430	515	20,733	
		21	137	32,799	515	20,733	• Occurence of forced outage of 1 coal plant (316 MW)
		22	13	33,351	515	20,733	
		23	14	34,112	515	20,733	
	15	11	130	25,688	515	20,733	• Occurence of forced outage of 1 coal plant, 1 geothermal plant, and 1 oil-based plant (382 MW)
		15	107	30,025	515	20,733	• Occurence of forced outage of 1 coal plant, 1 geothermal plant, and 2 oil-based plants (482 MW)
		16	133	22,787	515	20,733	• Occurence of forced outage of 1 coal plant, 1 geothermal plant, and 1 oil-based plants (382 MW)
	31	17	8	33,963	515	20,733	• Occurence of forced outage of 1 coal plant (459 MW)
		19	3	34,039	515	20,733	
		20	72	23,845	515	20,733	
		21	3	33,958	515	20,733	
		22	3	33,940	515	20,733	
		23	248	22,225	515	20,733	

Annex B. Interesting Pricing Events

Calendar Month	Day	Trading Interval	Supply Margin	Market Price	Lower Price Threshold	Upper Price Threshold	Reasons for the High Market Price
June	1	21	146	32,132	515	20,733	• Occurence of forced outage of 1 coal plant (647 MW)
	2	19	3	33,198	515	20,733	• Occurence of forced outage of 3 coal plants (1,113 MW)
		20	3	33,169	515	20,733	
		21	3	32,910	515	20,733	
		22	3	33,166	515	20,733	
	3	15	35	21,729	515	20,733	• Occurence of forced outage of 2 coal plants (466 MW)
	5	21	80	29,443	515	20,733	• Occurence of forced outage of 1 coal plant, and 1 natural gas plant (570 MW)
		22	131	32,772	515	20,733	
	6	20	323	21,278	-2,072	18,146	• Occurence of forced outage of 2 coal plants (450 MW)
		21	123	28,986	515	20,733	• Occurence of forced outage of 3 coal plants, and 1 hydro plant (627 MW)
	7	23	333	20,798	-2,072	18,146	• Occurence of forced outage of 2 coal plants (450 MW)
	8	11	88	22,032	515	20,733	• Higher demand requirement; and • Lower effective supply due to capacity on outage of 1 natural gas plant (262 MW)
		14	56	22,793	515	20,733	• Occurence of forced outage of 1 natural gas plant (262 MW)
		16	36	21,837	515	20,733	
	11	16	258	21,588	-2,072	18,146	• Occurence of forced outage of 1 geothermal plant, and 1 oil-based plant (132 MW)
		21	179	28,185	515	20,733	• Occurence of forced outage of 1 oil-based plant (60 MW)
	14	11	65	24,572	515	20,733	• Occurence of forced outage of 1 coal plant, and 2 oil-based plant (310 MW)
	16	21	508	17,529	-3,794	16,424	• Occurence of forced outage of 2 coal plants, and 1 geothermal plant (469 MW)
	17	14	39	22,970	515	20,733	• Occurence of forced outage of 1 coal plant, and 2 oil-based plant (605 MW)
		15	46	22,974	515	20,733	
		16	67	23,031	515	20,733	
		17	66	30,895	515	20,733	
		18	318	29,278	-2,072	18,146	
		19	65	30,762	515	20,733	• Occurence of forced outage of 1 coal plant (455 MW)
		20	205	21,676	515	20,733	
		21	81	31,081	515	20,733	
		22	97	30,903	515	20,733	
		23	357	20,818	-2,072	18,146	
	18	16	47	22,536	515	20,733	• Occurence of forced outage of 1 coal plant (455 MW)
	19	23	155	32,330	515	20,733	• Occurence of forced outage of 1 coal plant (455 MW)
	20	23	165	32,226	515	20,733	• Occurence of forced outage of 1 coal plant (455 MW)
	22	14	54	21,479	515	20,733	• Occurence of forced outage of 1 coal plant, and 1 natural gas plant (712 MW)
		15	43	27,313	515	20,733	• Occurence of forced outage of 1 coal plant, and 1 natural gas plant (712 MW)
		22	612	17,052	-3,794	16,424	
July	3	14	168	23,008	515	20,733	• Occurence of forced outage of 1 natural gas plant (264 MW)
		16	279	22,054	-2,072	18,146	
	8	16	538	22,088	-3,794	16,424	• Occurence of forced outage of 1 oil-based plant (350 MW)
	11	15	451	19,659	-2,072	18,146	• Occurence of forced outage of 1 natural gas plant (264 MW)
		16	470	19,283	-2,072	18,146	
	12	15	483	19,263	-2,072	18,146	• Occurence of maintenance outage of 1 natural gas plant (50 MW)
	13	22	779	19,266	-5,017	15,201	• Occurence of maintenance outage of 1 hydro plant and 1 natural gas plant, and forced outage of 1 geothermal plant (337 MW)
	20	21	252	22,573	-2,072	18,146	• Occurence of maintenance outage of 1 coal plant and 1 hydro plant, and forced outage of 1 coal plant (977 MW)
		22	386	22,041	-2,072	18,146	
	21	1	636	18,580	-3,794	16,424	• Occurence of maintenance outage of 1 coal plant and 1 hydro plant, and forced outage of 1 natural gas plant, and 1 coal plant (1,397 MW)
		2	877	20,080	-5,017	15,201	
August	13	14	368	22,224	-2,072	18,146	• Occurence of forced outage of 1 coal plant (335 MW)
October	7	18	63	25,127	515	20,733	• Occurence of forced outage of 1 coal plant, and 1 natural gas plant (911 MW)
		19	282	22,109	-2,072	18,146	• Occurence of maintenance outage of 1 natural gas plant, and forced outage of 2 coal plants (1,246 MW)
		20	485	20,155	-2,072	18,146	
		21	256	22,192	-2,072	18,146	
	12	11	723	18,789	-3,794	16,424	• Occurence of planned outage of 3 natural gas plants due to SPEX-Malampaya maintenance, and forced outage of 1 coal plant, and 1 natural gas plant (2,533 MW)
		14	623	19,343	-3,794	16,424	
		16	377	20,927	-2,072	18,146	• Occurence of planned outage of 3 natural gas plants due to SPEX-Malampaya maintenance, and forced outage of 1 coal plant, and 2 natural gas plants (2,790 MW)
		18	232	22,758	515	20,733	
		19	195	22,881	515	20,733	
		20	488	21,594	-2,072	18,146	• Occurence of planned outage of 3 natural gas plants due to SPEX-Malampaya maintenance, and forced outage of 1 coal plant, and 1 natural gas plant (2,533 MW)
		21	501	22,152	-3,794	16,424	• Occurence of planned outage of 3 natural gas plants due to SPEX-Malampaya maintenance, and forced outage of 1 coal plant (2,267 MW)
	14	9	337	20,076	-2,072	18,146	• Occurence of planned outage of 3 natural gas plants due to SPEX-Malampaya maintenance, and forced outage of 1 coal plant (2,267 MW)
		10	546	19,198	-3,794	16,424	
		15	549	21,767	-3,794	16,424	
		16	259	22,669	-2,072	18,146	
		17	199	22,676	515	20,733	
		18	107	25,117	515	20,733	
		19	171	22,805	515	20,733	
		21	321	22,086	-2,072	18,146	

Annex B. Interesting Pricing Events

Calendar Month	Day	Trading Interval	Supply Margin	Market Price	Lower Price Threshold	Upper Price Threshold	Reasons for the High Market Price
November	4	9	338	19,474	-2,072	18,146	• Occurence of forced outage of 1 coal plant (647 MW)
		14	45	21,529	515	20,733	
		15	34	36,539	515	20,733	
		16	21	40,293	515	20,733	
		17	24	34,750	515	20,733	
		18	24	37,707	515	20,733	
		19	25	33,544	515	20,733	
		20	228	22,119	515	20,733	
		21	200	22,078	515	20,733	
	7	18	373	22,042	-2,072	18,146	• Occurence of forced outage of 3 geothermal plants (191 MW)
	8	19	284	25,187	-2,072	18,146	• Occurence of forced outage of 2 coal plants (797 MW)
		20	206	22,572	515	20,733	
		21	21	35,709	515	20,733	
	13	18	717	21,383	-3,794	16,424	• Occurence of forced outage of 2 coal plants (578 MW)
	15	16	1,192	14,567	-5,913	14,305	• Occurence of forced outage of 1 coal plant, and 1 geothermal plant (679 MW)
	18	18	909	15,675	-5,017	15,201	• Occurence of forced outage of 2 oil-based plants, and maintenance outage of 1 geothermal plant (155 MW)
	22	18	226	32,374	515	20,733	• Occurence of forced outage of 1 coal plant (647 MW)
		19	434	22,216	-2,072	18,146	
	25	16	501	32,283	-3,794	16,424	• Occurence of forced outage of 2 coal plants (915 MW)
		17	678	22,699	-3,794	16,424	
		18	455	32,378	-2,072	18,146	
		19	201	23,106	515	20,733	
		20	365	21,965	-2,072	18,146	

Annex C. Methodology in Determining Interesting Pricing Events

Supply margin is defined as the MW difference between the system effective supply[15] and demand requirement plus reserve schedules[16].

The market price is represented by the load weighted average of the final prices (LWAP) used for settlements which could either be of the following: (i) ex-ante prices for trading intervals without pricing error during ex-ante, (ii) ex-post prices for trading intervals with pricing error during ex-ante but without pricing error during ex-post, (iii) market re-run prices for trading intervals with pricing error both during ex-ante and ex-post, and (iv) estimated load reference prices (ELRP) for trading intervals where the ERC-approved Price Substitution Mechanism (PSM) was applied.

To determine the interesting pricing events, a combination of statistical methods namely, bandwidth method, ordinary least squares (OLS) method and non-parametric method was used to create the upper and lower reference price thresholds[17]. Further, the following criteria were considered in the determination of thresholds:

1. Market prices and supply margin from 26 December 2013 to 25 December 2017 to only include the periods when the PhP32,000/MWh offer price cap was adopted;
2. Upper and lower reference price thresholds were computed using ±3 percent standard deviations to provide a reasonable tolerance price levels;
3. Exclusion of intervals with market intervention and/or suspension and secondary price cap imposition; and
4. Exclusion of intervals with negative supply margin to ensure normal market conditions (e.g. no under-generation).

The resulting reference price thresholds corresponding to the supply margin range are provided in the Table 1.

[15] The system effective supply is equal to the offered capacity of all scheduled generator resources, nominated loading level of non-scheduled generating units and projected output of preferential dispatch generating units. Scheduled output of plants on testing and commissioning, through the imposition of security limit by SO, are accounted for in the effective supply. Likewise included is the scheduled output of Malaya plant when it is called to run as Must Run Unit (MRU).

[16] With the implementation of the central scheduling and dispatch of energy and contracted reserves in Luzon beginning 22 December 2015, and in Visayas beginning 07 October 2017, the level that the supply has to fill up is higher as it also has to sufficiently meet the hourly reserve schedule.

[17] The methodology adopted in this report is closely similar to the methodology discussed by the Market Surveillance Administrator of the Alberta Electricity System Operator in their report entitled “Supply Cushion Methodology and Detection of Events of Interest” published at www.albertamsa.ca.

Annex C. Methodology in Determining Interesting Pricing Events

Table 1: Fixed Reference Price Thresholds

Supply Margin Range (in MW)	Reference Price Threshold	
	Upper (PhP/MWh)	Lower (PhP/MWh)
0 to 250	20,733	515
250 to 500	18,146	(2,072)
500 to 750	16,424	(3,794)
750 to 1000	15,201	(5,017)
1,000 to 1,250	14,305	(5,913)
1,250 to 1,500	13,609	(6,609)
1,500 to 1,750	13,023	(7,195)
1,750 to 2,000	12,501	(7,717)
2,000 to 2,250	12,050	(8,167)
2,250 to 2,500	11,680	(8,538)
2,500 to 2,750	11,374	(8,720)
2,750 to 3,000	11,127	(8,844)
3,000 and above	11,504	(9,091)

Prices within the upper and lower reference price thresholds are considered as “normal prices”, while prices outside or beyond the thresholds are tagged as “interesting pricing events”.