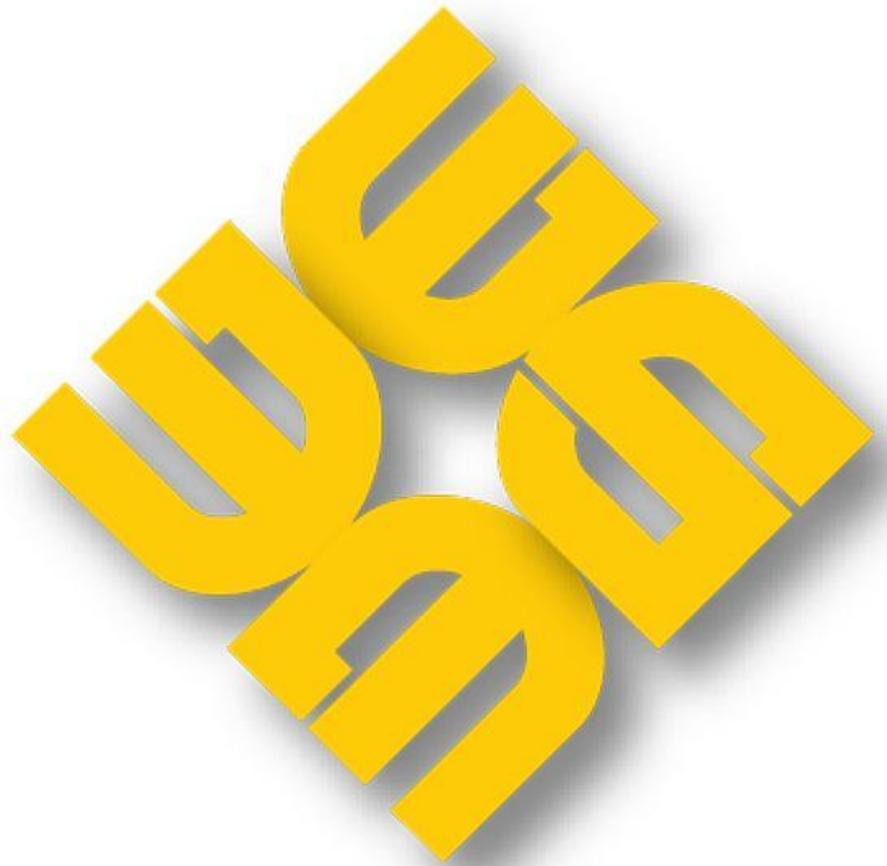


MAG-MMAR-2018-10

# MONTHLY MARKET ASSESSMENT REPORT

For the Billing Period 26 September to 25 October 2018



**PHILIPPINE  
ELECTRICITY  
MARKET  
CORPORATION**

**MARKET ASSESSMENT GROUP  
(MAG)**

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## EXECUTIVE SUMMARY

This monthly report assesses the results of the WESM operation for the October 2018 billing period (26 September to 25 October 2018) and how the market performed compared with the previous month and year. The market prices averaged at PhP3,819/MWh this month, an increase by 28.8 percent from previous month's PhP2,966/MWh due to lower supply margin because of higher demand. However, when this is compared to last year's October billing month, there is a decrease of 3.5 percent from PhP3,960/MWh due to tighter supply margin last year.

With respect to the supply, the WESM registered capacity stood at 18,882 MW by the end of October, posting a 6 MW decrease from previous month's 18,888 MW. This decrease is attributed to the change in the registered capacity of Makban GPP Ormat from 12 MW to 6 MW, due to the updated technical parameters in the plant's Certificate of Compliance (COC) as issued by the Energy Regulatory Commission (ERC).

Of said registered capacity, about 68 percent (from previous month's 67 percent) or an average of 12,911 MW was offered in the market during the month. Outage capacity (13 percent) posted a lower average this month at 2,456 MW from 2,513 MW in the previous month. Meanwhile, 11 percent was attributable to capacity not offered in the market that averaged at 1,992 MW, likewise showing a decline from last month's 2,116 MW. On the other hand, preferential and non-scheduled capacities averaged 1,500 MW, comprising about 8 percent of the total registered capacity. Lastly, an average of 300 MW or about 0.1 percent of the registered capacity was attributed to the capacity designation of Malaya TPP as Must Run Unit (MRU), in cases of supply shortfall and to address system security.

Taking into account security limits and ramp rates, effective supply was higher this month by 4.7 percent at an average of 13,160 MW from previous month's 12,570 MW. This is on account of the higher offered capacity submitted by coal plants (1.2 percent) and natural gas plants (4 percent).

On the other hand, system demand recorded an average of 10,119 MW this month, 5.9 percent higher than previous month's 9,559 MW due to the higher temperatures and lower level of precipitation in October than September. The reserve schedule averaged at 1,078 MW. Consequently, the demand plus reserve schedule averaged at 11,196 MW, demonstrating a 7.2 percent increase from last month's 10,444 MW.

Driven by the higher rate of increase in demand compared with effective supply, the supply margin narrowed by 7.7 percent this month at 1,963 MW coming from previous month's 2,126 MW. However, this was wider by 15.2 percent when compared with last year's supply margin of 1,704 MW.

San Miguel Corporation (SMC), Aboitiz Power (AP), First Gen Corporation (FGC) and Power Sector Asset and Liabilities Management (PSALM) continued to dominate the market with a combined market share of 71.1 percent based on registered capacity during the October billing month. SMC held the top spot at 23.8 percent followed by AP (20.9 percent), FGC (15.2 percent) and PSALM (11.2 percent).

Correspondingly, the Herfindahl-Hirschman Index (HHI) calculated based on offered capacity by major participants' grouping indicated a moderately concentrated market for 661 trading intervals (92 percent) of the time and concentrated market for the remaining 59 trading intervals (8 percent) during the October billing month.

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## MONTHLY MARKET ASSESSMENT REPORT

This monthly report assesses the results of the WESM operation for the October 2018 billing period (26 September to 25 October 2018) and how the market performed compared with the previous month and year.

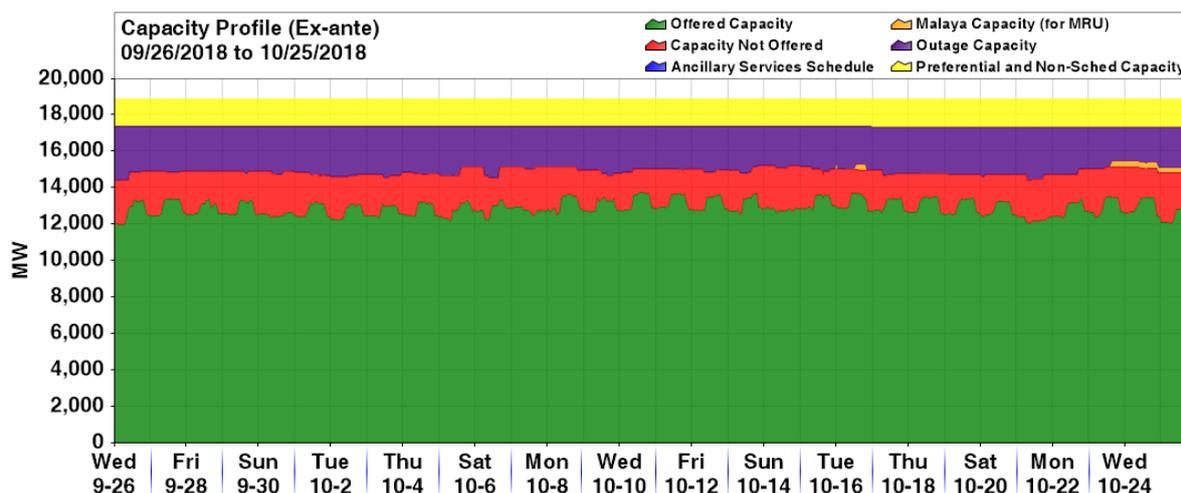
### I. Capacity Profile

The WESM registered capacity stood at 18,882 MW by the end of the October billing month, posting a 6 MW decrease from previous month's 18,888 MW. This decline is attributed to the change in the registered capacity of Makban GPP Ormat from 12 MW to 6 MW, due to the updated technical parameters in the plant's Certificate of Compliance (COC) as issued by the Energy Regulatory Commission (ERC)

Of said registered capacity, about 68 percent (from previous month's 67 percent) or an average of 12,911 MW was offered in the market during the month. Outage capacity (13 percent) posted a lower average this month at 2,456 MW from 2,513 MW in the previous month. Meanwhile, 11 percent was attributable to capacity not offered in the market which averaged at 1,992 MW.

On the other hand, preferential<sup>1</sup> and non-scheduled capacities averaged 1,500 MW, comprising about 8 percent of the total registered capacity. Lastly, an average of 300 MW or about 0.1 percent of the WESM registered capacity was attributed to the capacity designation of Malaya TPP as Must Run Unit (MRU), in cases of supply shortfall and to address system security.

**Figure 1. Capacity Profile (Ex-ante), October 2018**



**Table 1. Capacity Profile (Ex-ante), October 2018, September 2018 and October 2017**

	October 2018 (In MW)		September 2018 (In MW)		October 2017 (In MW)		% M-on-M Change (Sep 2018 - Oct 2018)	% Y-on-Y Change (Oct 2017 - Oct 2018)
	Avg MW	% of RegCap	Avg MW	% of RegCap	Avg MW	% of RegCap		
Registered Capacity (end of month)	18,882		18,888		18,183		(0.0)	3.8
Offered Capacity	12,911	68	12,593	67	11,861	65	2.5	8.9
Outage Capacity	2,456	13	2,513	13	2,868	16	(2.3)	(14.4)
Capacity Not Offered	1,992	11	2,116	11	1,739	10	(5.9)	14.5
Malaya Capacity for MRU	300	0.1	300	0.4	389	2	0.0	(22.9)
Preferential and Non-Scheduled Capacity	1,500	8	1,500	8	1,395	8	(0.0)	7.6

<sup>1</sup> Preferential capacity refers to the combined registered capacities of priority dispatch and must dispatch generating units.

## II. Power Plant Outages

### A. Outage Capacity by Plant Type

System-wide outage capacity observed a 2.3 percent decrease from previous month's 2,513 MW to current month's 2,456 MW. This decrease was driven by the lower outage capacity involving coal plants averaging at 1,055 MW from previous month's 1,201 MW attributable to the resumption of operations of Pagbilao CFTPP unit 3 (420 MW), SLPGC CFTPP unit 1 (150 MW) and PCPC CFTPP (135 MW). Despite the decrease, coal plants still accounted for 43 percent of the system-wide outage capacity, which mainly involved the following: Sual CFTPP unit 1 (647 MW) due to its planned outage since 31 August, SLTEC CFTPP unit 2 (123 MW) due to its forced outage since 18 June, and Pagbilao CFTPP unit 1 (382 MW) due to its maintenance outage from 22 September to 5 October.

Similarly, natural gas plants recorded a lower average outage capacity this month at a mere 19 MW from 123 MW in September. It may be recalled that in the previous month Sta. Rita NGPP (256 MW), San Gabriel NGPP (420 MW), and Avion NGPP units 1 and 2 (2 x 50.3 MW) underwent planned outages in the previous month. This month's outage from natural gas plants was mainly attributable to Sta. Rita NGPP (256 MW) due to its forced outage on 24 September.

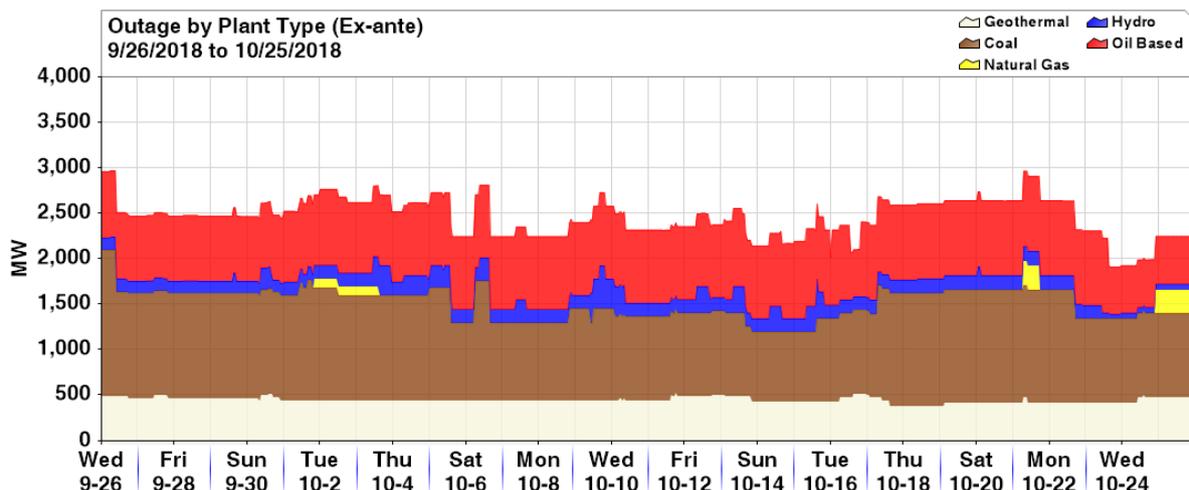
Meanwhile, oil-based plants recorded an increase in its average outage capacity from 676 MW to 769 MW this month attributable to the almost month-long forced outage of Malaya TPP unit 1 (300 MW) from 3 September until 16 October at 1400H and went on outage again at 2100H of the same day which lasted until 23 October. In addition, it was noted that Limay CCGT unit 7 (60 MW) underwent maintenance outage from 1 October until the end of the billing month.

Hydro plants likewise recorded an increase in its average outage capacity from previous month's 86 MW to current month's 164 MW related to the forced outage of Casecanan HEP unit 1 (82.5 MW) from 21 September to 23 October. Geothermal plants also recorded a higher outage capacity averaging at 450 MW (previous month's 428 MW) mainly related to the forced outages of units of Tiwi GPP unit A (59 MW) and Makban GPP unit A (63 MW) on top of the prevailing outages of Makban GPP unit C (2 x 55 MW) and Tiwi GPP unit B (44 MW).

Year-on-year, this month's outage was 14.4 percent lower compared to previous year's average at 2,868 MW.

Provided in Appendix A is the list of major plant outages.

**Figure 2. Plant Outage Capacity (by Plant Type), October 2018**



**Table 2. Outage Summary (Ex-ante), October 2018, September 2018 and October 2017**

Resource Type	October 2018 (In MW)			September 2018 (In MW)			October 2017 (In MW)			% M-on-M Change (Sep 2018 - Oct 2018)			% Y-on-Y Change (Oct 2017 - Oct 2018)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Coal	1,611	770	1,055	2,122	408	1,201	2,937	1,045	1,491	(24.1)	88.7	(12.2)	(45.2)	(26.3)	(29.3)
Natural Gas	266	0	19	521	0	123	1,285	265	441	(49.0)		(84.3)	(79.3)	(100.0)	(95.6)
Geothermal	530	386	450	641	305	428	395	238	287	(17.3)	26.6	5.2	34.2	62.3	56.7
Hydro	472	50	164	316	50	86	388	0	218	49.2	0.0	90.3	21.5		(25.1)
Oil Based	859	520	769	854	470	676	749	33	430	0.6	10.6	13.8	14.7	1,466.3	78.9
<b>TOTAL</b>	<b>2,964</b>	<b>1,912</b>	<b>2,456</b>	<b>3,920</b>	<b>1,295</b>	<b>2,513</b>	<b>4,022</b>	<b>2,027</b>	<b>2,868</b>	<b>(24.4)</b>	<b>47.6</b>	<b>(2.3)</b>	<b>(26.3)</b>	<b>(5.7)</b>	<b>(14.4)</b>

## B. Outage Capacity by Category

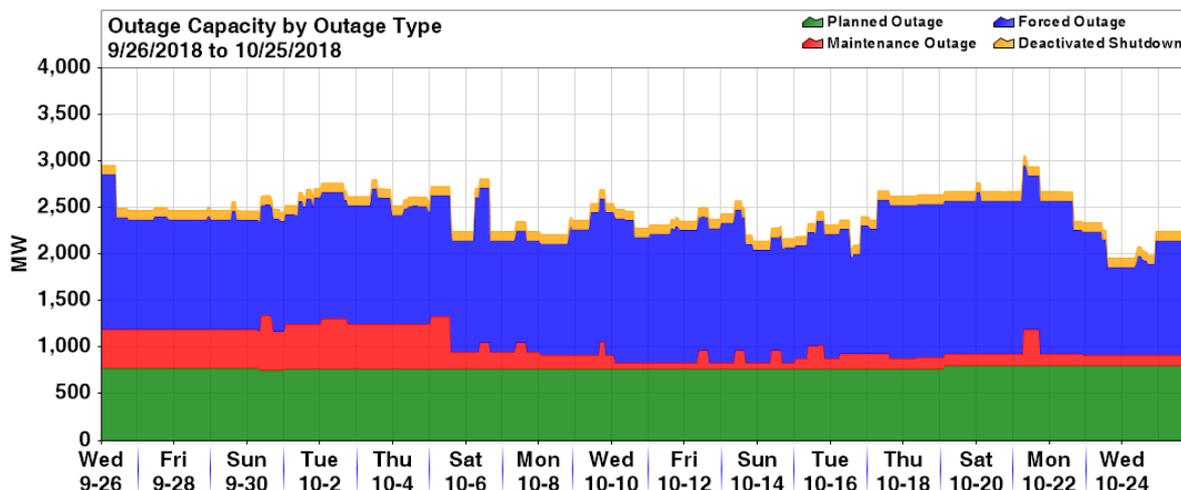
Majority of the outages this month were due to forced outages, accounting for about 54 percent of the total system-wide outage capacity at 1,346 MW. This, however, was a slight 1.5 percent decline from last month's 1,367 MW. Major coal plants that were on short-duration forced outages in October were Masinloc CFTPP unit 1, SMC CFTPP unit 4, QPPL CFTPP, TPC Sangi CFTPP units 1 and 2, PEDC CFTPP unit 2, while SLTEC CFTPP unit 2 (122.9 MW), was on forced outage since 18 June. Oil-based plants Malaya TPP unit 1 (300 MW) underwent forced outages from 03 September to 23 October, whereas Malaya TPP unit 2 (350 MW) was still on its forced outage that started on 19 May. Meanwhile, hydro plant Casecan unit 1 (82.5 MW) was on forced outage from 21 September to 23 October. Geothermal plants Makban GPP units 1, 2, 5 and 9, and Tiwi GPP unit 1 also recorded forced outages in October, while Sta. Rita NGPP unit 2 and Avion NGPP units 1 and 2 were also on forced outages during the month.

Planned outage capacity was also slightly lower this month, averaging at 780 MW from 805 MW in September. Notwithstanding, a considerable 31.7 percent of the total outage capacity was attributable to planned outages, mainly due to Sual CFTPP unit 1 (647 MW), Makban GPP unit 7 (20 MW) and Leyte GPP unit 3 (36 MW), hydro plant Angat M (50 MW) and oil-based plants Limay CCGT unit 3 (60 MW) and TMO DPP unit 4 (46.8 MW).

Maintenance outage capacity averaged at 239 MW, likewise recording a decline (by 7.6 percent) from 258 MW in the previous month. This was mainly due to the maintenance outages recorded by geothermal plant Leyte GPP unit 1 (35 MW) from 29 September to 08 October, and Pagbilao CFTPP unit 1 (382 MW) and PEDC CFTPP unit 2 (83.7 MW).

Meanwhile, outage capacity related to deactivated shutdown remained at an average of 99 MW, attributable to the long-standing deactivating shutdown involving geothermal plants Makban GPP unit C (55 MW) and Tiwi GPP unit B (43.7 MW).

**Figure 3. Plant Outage Capacity (by Outage Category), October 2018**



**Table 3. Outage Summary, by Outage Category, October 2018 and September 2018**

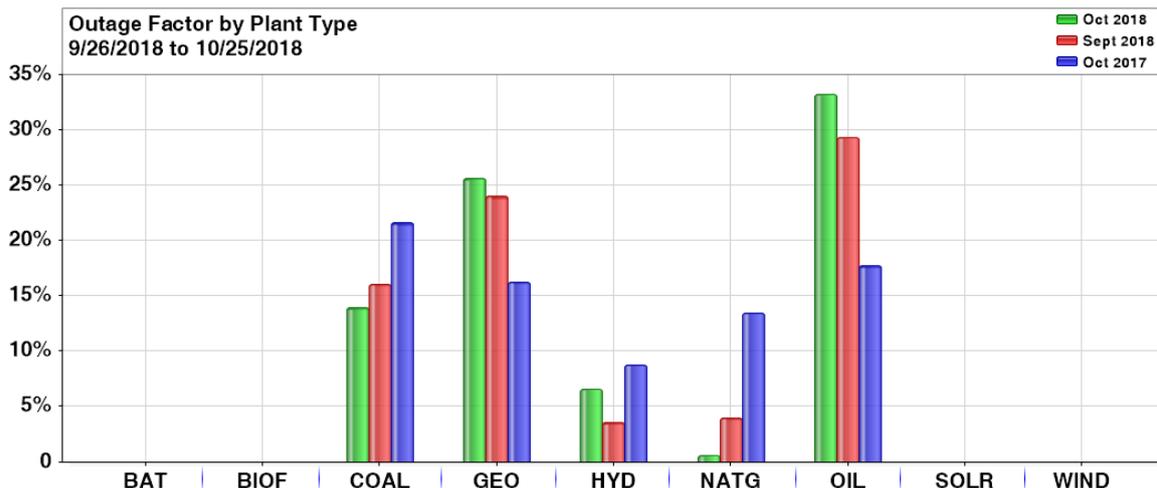
Resource Type	October 2018 (In MW)			September 2018 (In MW)			% M-on-M Change (Sep 2018 - Oct 2018)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Planned	807	757	780	1,053	305	805	(23.3)	148.2	(3.1)
Maintenance	585	60	239	799	35	258	(26.8)		(7.6)
Forced	1,762	945	1,346	2,565	836	1,367	(31.3)	13.0	(1.5)
Deactivated Shutdown	99	99	99	99	99	99	0.0	0.0	0.0

### C. Outage Factor

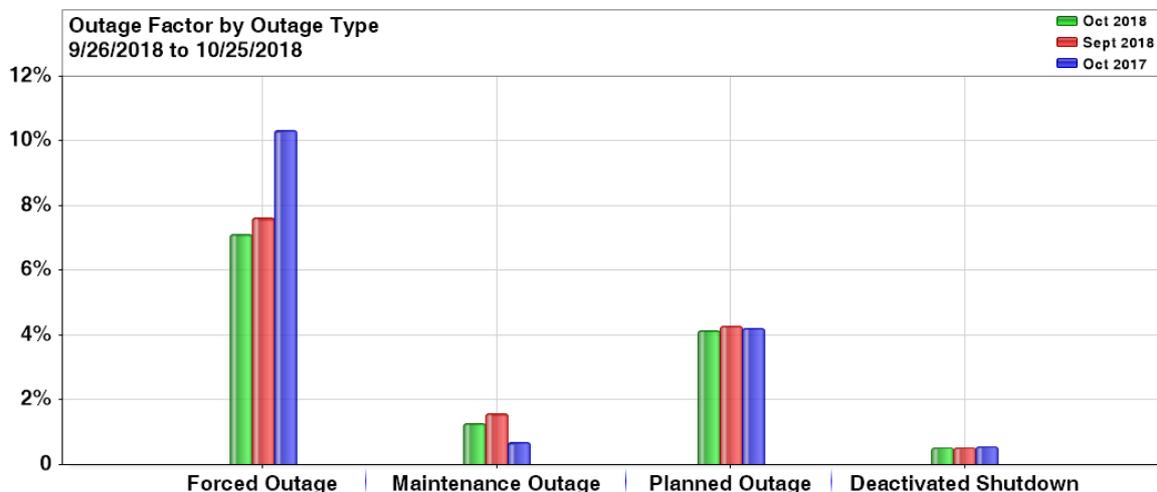
13.3 percent of the total registered capacity went on outage in the October billing month, a decrease from last month’s 14 percent and last year’s 15.9 percent. Oil-based plants (33.2 percent), geothermal plants (25.6 percent) and coal plants (13.9 percent) demonstrated the highest outage factors in October, while hydro and solar plants contributed 6.6 percent and 0.9 percent, respectively, to the total outage factor during the month.

Meanwhile, consistent with the discussions above, outage factor by category showed that forced outage capacity continued to be the main driver for most of the outages in the current month, recording an outage factor of 7.2 percent. This is attributable to the high forced outage factor of oil-based plants at 27.6 percent and geothermal plants at 18.5 percent. Planned outage factor came next at 4.2 percent, with coal plants recording the highest planned outage factor at 8.5 percent. Maintenance outage factor was posted at 1.3 percent this month, while outage factor related to deactivated shutdown remained at 0.5 percent.

**Figure 4. Outage Factor (by Plant Type), October 2018, September 2018, October 2017**



**Figure 5. Outage Factor (by Outage Type), October 2018, September 2018, October 2017**



**Table 4. Outage Factor, October 2018, September 2018, October 2017**

Plant Type	Total Outage Factor			Forced Outage Factor			Maintenance Outage Factor			Planned Outage Factor			D/S Outage Factor		
	Oct 2018	Sept 2018	Oct 2017	Oct 2018	Sept 2018	Oct 2017	Oct 2018	Sept 2018	Oct 2017	Oct 2018	Sept 2018	Oct 2017	Oct 2018	Sept 2018	Oct 2017
BAT															
BIOF															
COAL	13.9	16.1	21.6	3.6	5.7	15.8	1.8	2.1	0.4	8.5	8.2	5.4			0.0
GEO	25.6	24.0	16.3	18.5	16.0	9.0	1.0	2.3	1.1	0.6	0.2	0.6	5.5	5.5	5.6
HYD	6.6	3.5	8.8	3.6	1.2	3.8	0.5	0.0	1.2	2.5	2.3	3.8			0.0
NATG	0.6	4.0	13.5	0.5	1.3	4.3	0.1	1.9	1.2	0.0	0.8	8.0			0.0
OIL	33.2	29.3	17.7	27.6	25.0	16.3	3.0		0.4	2.6	4.3	1.0			0.0
SOLR															
WIND															
<b>Total</b>	<b>13.0</b>	<b>14.0</b>	<b>15.9</b>	<b>7.1</b>	<b>7.6</b>	<b>10.4</b>	<b>1.3</b>	<b>1.6</b>	<b>0.7</b>	<b>4.1</b>	<b>4.3</b>	<b>4.3</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>

### III. Demand and Supply Situation

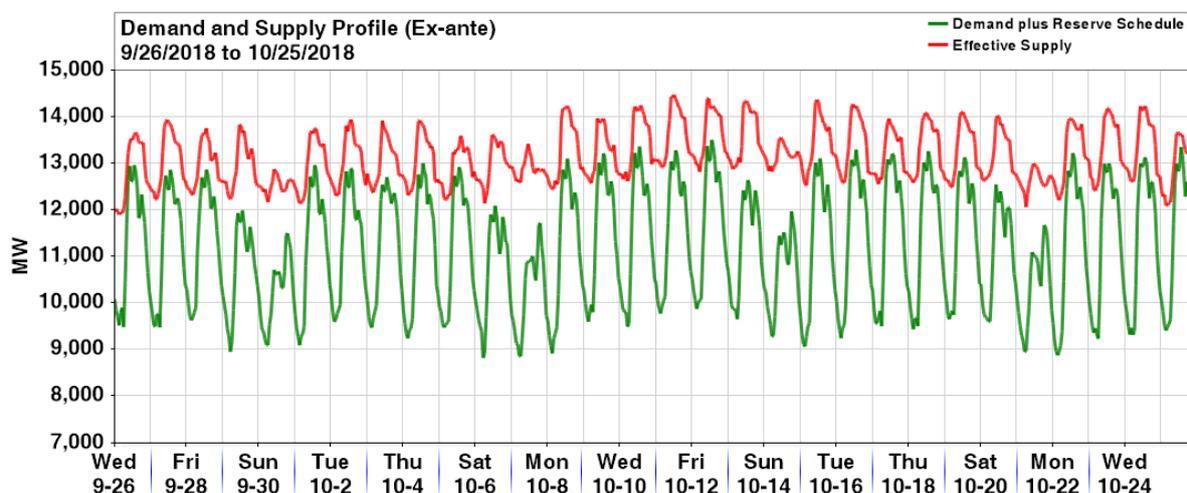
System demand<sup>2</sup> recorded an average of 10,119 MW this month, 5.9 percent higher than previous month's 9,559 MW due to the higher temperatures and lower level of precipitation in October than September. Weekly average system demand ranged from 9,979 MW (1 to 7 Oct) to 10,307 MW (8 to 14 Oct). Year-on-year, a 9.5 percent increase in average demand was observed from previous year's 9,242 MW.

For this period, the reserve schedule averaged at 1,078 MW. Consequently, the demand plus reserve schedule averaged at 11,196 MW, demonstrating a 7.2 percent increase from last month's 10,444 MW and 11.1 percent increase from last year's 10,082 MW.

Similarly, effective supply<sup>3</sup> posted a higher average this month at 13,160 MW from previous month's 12,570 MW attributable to the higher level of offered capacity. Weekly average effective supply ranged from 12,878 MW (26 to 30 September) up to 13,429 MW (8 to 14 October). This year's average was likewise higher than previous year's 11,786 MW.

Driven by the higher rate of increase in demand when compared with the effective supply, supply margin<sup>4</sup> narrowed by 7.7 percent this month at 1,963 MW coming from previous month's 2,126 MW. It was noted that 25 October was marked by a low level of supply margin reaching a low of 241 MW at 1400H. Notwithstanding, this month's average supply margin was higher when compared to previous year's 1,704 MW.

**Figure 6. Demand and Effective Supply (Ex-ante), October 2018**



**Table 5. Demand and Supply Summary (Ex-ante), October 2018, September 2018 and October 2017**

	October 2018 (In MW)			September 2018 (In MW)			October 2017 (In MW)			% M-on-M Change (Sep 2018 - Oct 2018)			% Y-on-Y Change (Oct 2017 - Oct 2018)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Demand	12,249	7,812	10,119	11,932	6,443	9,559	11,245	6,657	9,242	2.7	21.2	5.9	8.9	17.3	9.5
Reserve Schedule	1,446	760	1,078	1,184	615	885	1,034	237	840	22.1	23.6	21.8	39.8	221.3	28.3
Demand plus R/S	13,505	8,832	11,196	12,975	7,143	10,444	12,088	7,582	10,082	4.1	23.6	7.2	11.7	16.5	11.1
Effective Supply	14,472	11,908	13,160	14,418	10,859	12,570	13,235	10,143	11,786	0.4	9.7	4.7	9.3	17.4	11.7
Supply Margin	3,732	241	1,963	4,606	405	2,126	3,775	1	1,704	(19.0)	(40.5)	(7.7)	(1.2)	18,880.3	15.2

Note: The derived values were non-coincident.

<sup>2</sup> Demand is equal to the total scheduled MW of all load resources in Luzon and Visayas plus losses.

<sup>3</sup>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 effective supply. Likewise included is the scheduled output of Malaya plant when it is called to run as Must Run Unit (MRU).

<sup>4</sup>The supply margin is equal to the effective supply less system demand requirement plus reserve schedule.

**Table 6. Weekly Demand and Supply Summary (Ex-ante), October 2018**

	26 to 30 Sep 2018 (in MW)			1 to 7 Oct 2018 (in MW)			8 to 14 Oct 2018 (in MW)			15 to 21 Oct 2018 (in MW)			22 to 25 Oct 2018 (in MW)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
<b>Demand</b>	11,915	8,084	10,008	11,832	7,812	9,979	12,249	8,017	10,307	12,076	8,027	10,095	11,982	7,944	10,213
<b>Reserve Schedule</b>	1,191	760	985	1,293	825	1,055	1,370	831	1,068	1,446	893	1,146	1,426	869	1,131
<b>Demand plus R/S</b>	12,962	8,959	10,993	13,004	8,832	11,034	13,505	8,926	11,375	13,294	8,960	11,241	13,352	8,885	11,344
<b>Effective Supply</b>	13,936	11,908	12,878	13,941	12,144	12,999	14,472	12,454	13,429	14,365	12,066	13,227	14,232	12,099	13,201
<b>Supply Margin</b>	3,279	503	1,885	3,732	438	1,965	3,602	654	2,055	3,587	530	1,986	3,442	241	1,858

#### IV. Market Price Outcome<sup>5</sup>

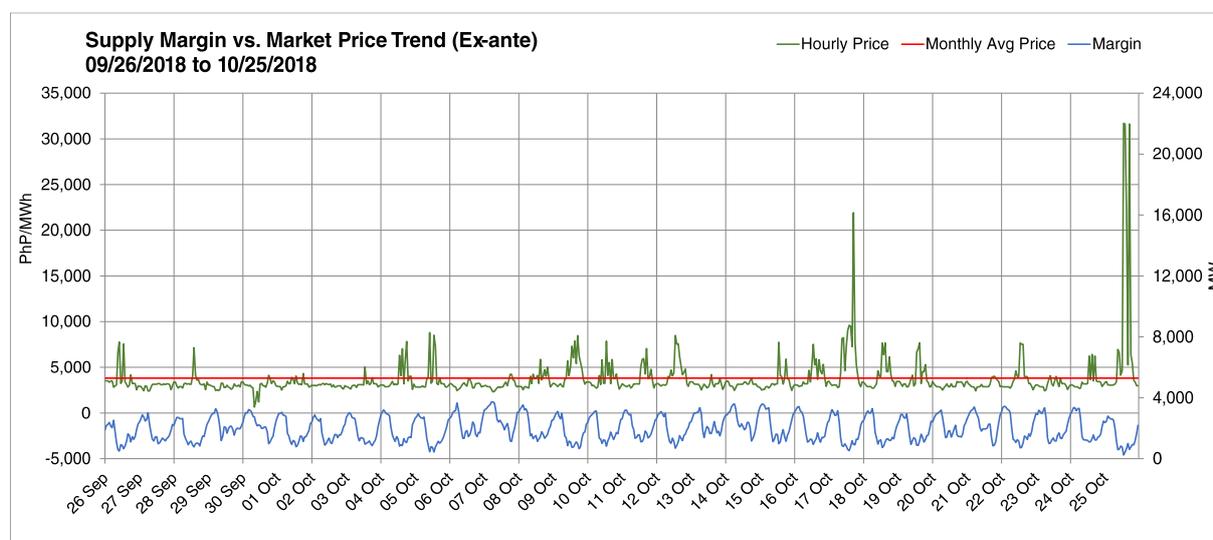
##### A. Market Prices

Market prices averaged at PhP3,819/MWh this month, demonstrating a 28.8 percent increase from previous month's PhP2,966/MWh following this month's tighter supply margin. On the other hand, year-on-year comparison showed a decrease in average price from previous year's PhP3,960/MWh with the above discussed improved supply and demand condition this month compared with the October 2017 billing month.

Prices were generally below PhP9,000/MWh throughout the billing month except on 17 and 25 October. Relatively tight supply margin was observed on 17 October related to a high level of outage involving coal plants namely Sual CFTPP unit 1 (647 MW), SLTEC CFTPP unit 2 (123 MW), and Masinloc CFTPP unit 1 (315 MW). On a similar note, coal plants Sual CFTPP unit 1 (647 MW), SLTEC CFTPP unit 2 (123 MW) as well as natural gas plant Sta. Rita NGPP unit 2 (255.7 MW) were on outage on 25 October. These outages drove the tighter supply margin during said days resulting in a price spike on 17 October at 1800H at PhP21,917/MWh and a series of price spikes on 25 October from 1400H to 1600H and 1800H ranging from PhP22,056/MWh up to PhP31,707/MWh.

The weekly average prices increased towards the end of the billing month from an average of PhP3,218/MWh from 26 to 30 September up to PhP4,927/MWh from 22 to 25 September.

**Figure 7. Market Price Trend vs. Supply Margin, October 2018**



<sup>5</sup>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.

**Table 7. Market Price Summary, October 2018, September 2018 and October 2017**

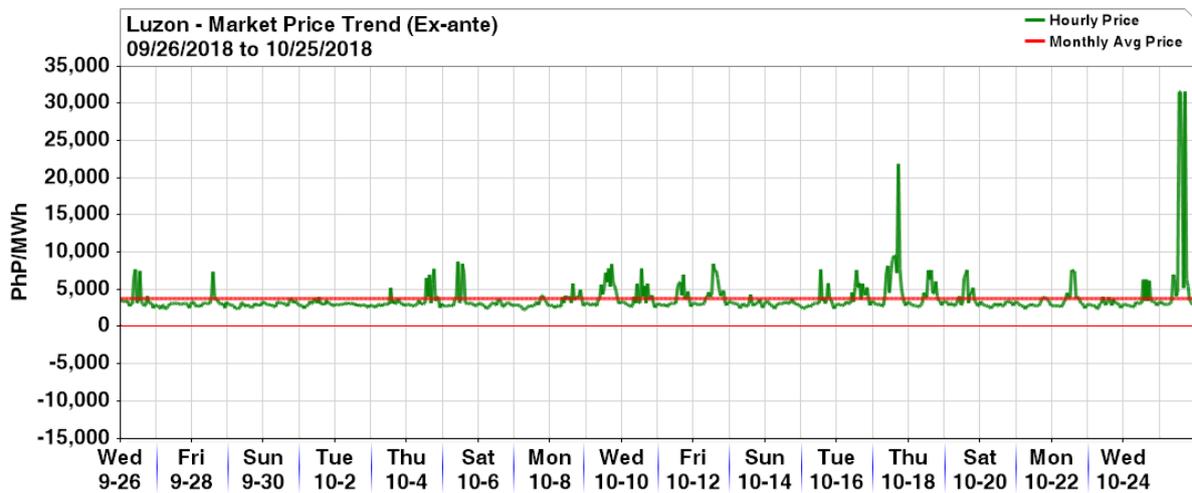
	October 2018 (In PhP/MWh)			September 2018 (In PhP/MWh)			October 2017 (In PhP/MWh)			% M-on-M Change (Sep 2018 - Oct 2018)			% Y-on-Y Change (Oct 2017 - Oct 2018)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Luz-Vis	31,707	654	3,819	21,453	-1,023	2,966	33,347	0	3,960	47.8	(163.9)	28.8	(4.9)		(3.5)
Luzon	31,635	2,316	3,822	21,453	-1,023	2,945	33,798	0	3,963	47.5	(326.3)	29.8	(6.4)		(3.6)
Visayas	32,187	-10,702	3,808	21,453	-1,023	3,083	33,348	-444	3,943	50.0	(945.7)	23.5	(3.5)	(2,311.4)	(3.4)

**Table 8. Weekly Market Price Summary, October 2018**

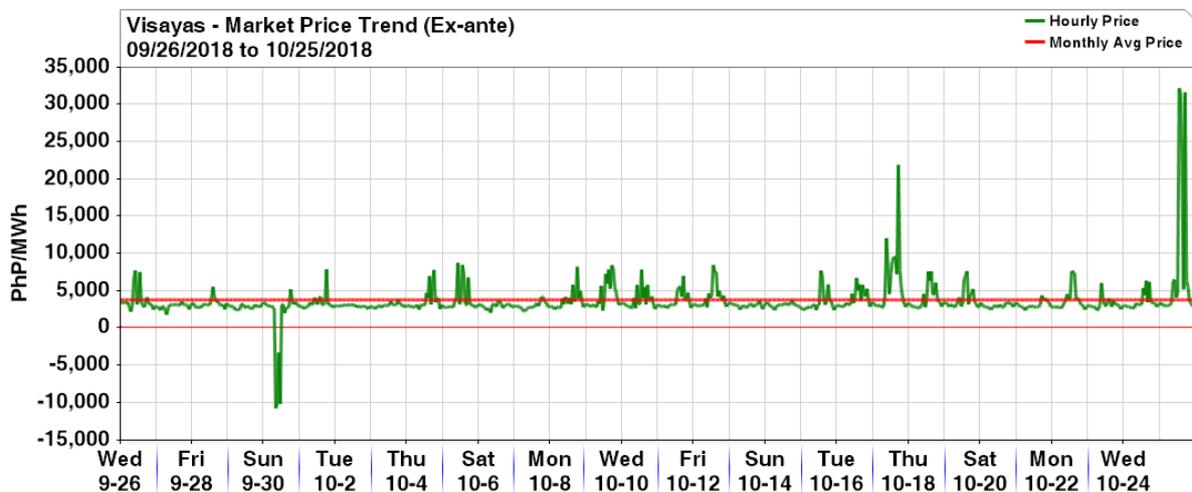
	26 to 30 Sep 2018 (in PhP/MWh)			1 to 7 Oct 2018 (in PhP/MWh)			8 to 14 Oct 2018 (in PhP/MWh)			15 to 21 Oct 2018 (in PhP/MWh)			22 to 25 Oct 2018 (in PhP/MWh)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Luz-Vis	7,769	654	3,218	8,799	2,316	3,346	8,491	2,461	3,838	21,917	2,413	4,053	31,707	2,423	4,927

The market prices in Luzon averaged at PhP3,822/MWh, higher by 0.4 percent than the PhP3,808/MWh recorded in the Visayas region.

**Figure 8. Market Price Trend - Luzon, October 2018**



**Figure 9. Market Price Trend - Visayas, October 2018**



**Table 9. Regional Price Summary – October 2018, September 2018 and October 2017**

	Luzon (In PhP/MWh)			Visayas (In PhP/MWh)			% Difference		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
October 2018	31,635	2,316	3,822	32,187	-10,702	3,808	(1.7)	(121.6)	0.4
September 2018	21,453	-1,023	2,945	21,453	-1,023	3,083	0.0	0.0	(4.5)
October 2017	33,798	0	3,963	33,348	-444	3,943	1.3	(100.0)	0.5

**B. Price Distribution**

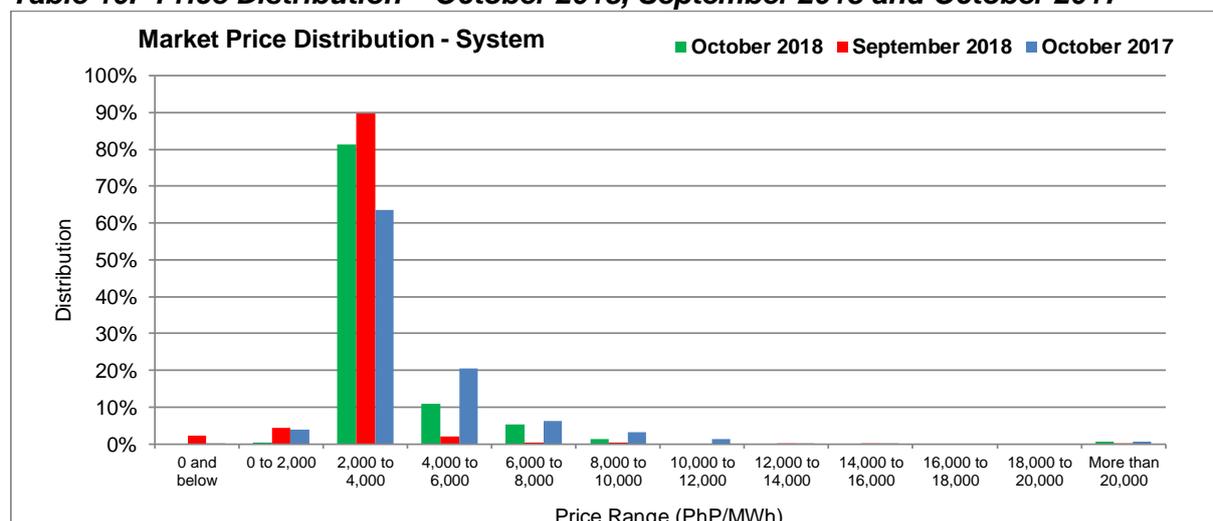
Consistent with the month-on-month increase in average price, higher frequency of prices above PhP4,000/MWh up to PhP10,000/MWh was noted this month at 17.5 percent from 3.1 percent in the previous month and at above PhP20,000/MWh at 0.7 percent this month from 0.3 percent in the previous month. In particular, prices ranging from PhP4,000/MWh up to PhP6,000/MWh increased from 2.2 percent to 11 percent.

In addition, lower frequency of prices at PhP4,000/MWh and below from previous month's 96.2 percent to current month's 81.8 percent.

**Figure 10. Price Distribution, October 2018, September 2018 and October 2017**

Price Range (PhP/MWh)	% Distribution		
	October 2018	September 2018	October 2017
0 and below	0.0	2.3	0.1
0 to 2,000	0.4	4.3	4.0
2,000 to 4,000	81.4	89.7	63.6
4,000 to 6,000	11.0	2.2	20.4
6,000 to 8,000	5.3	0.5	6.3
8,000 to 10,000	1.3	0.4	3.2
10,000 to 12,000	0.0	0.0	1.4
12,000 to 14,000	0.0	0.1	0.3
14,000 to 16,000	0.0	0.3	0.1
16,000 to 18,000	0.0	0.0	0.0
18,000 to 20,000	0.0	0.0	0.0
More than 20,000	0.7	0.3	0.6

**Table 10. Price Distribution – October 2018, September 2018 and October 2017**

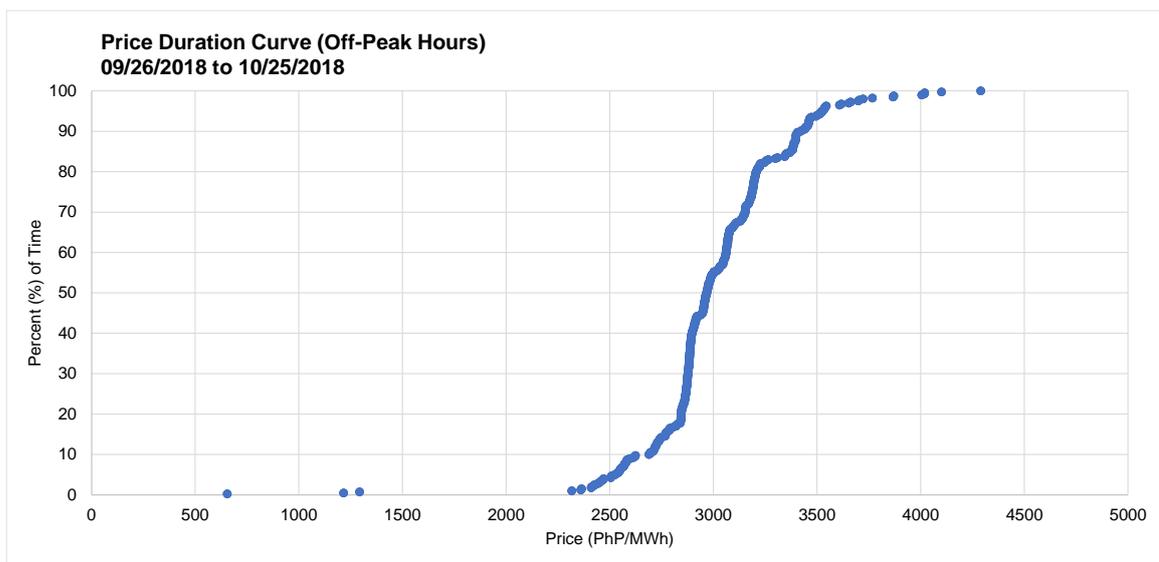


### C. Price Duration Curve

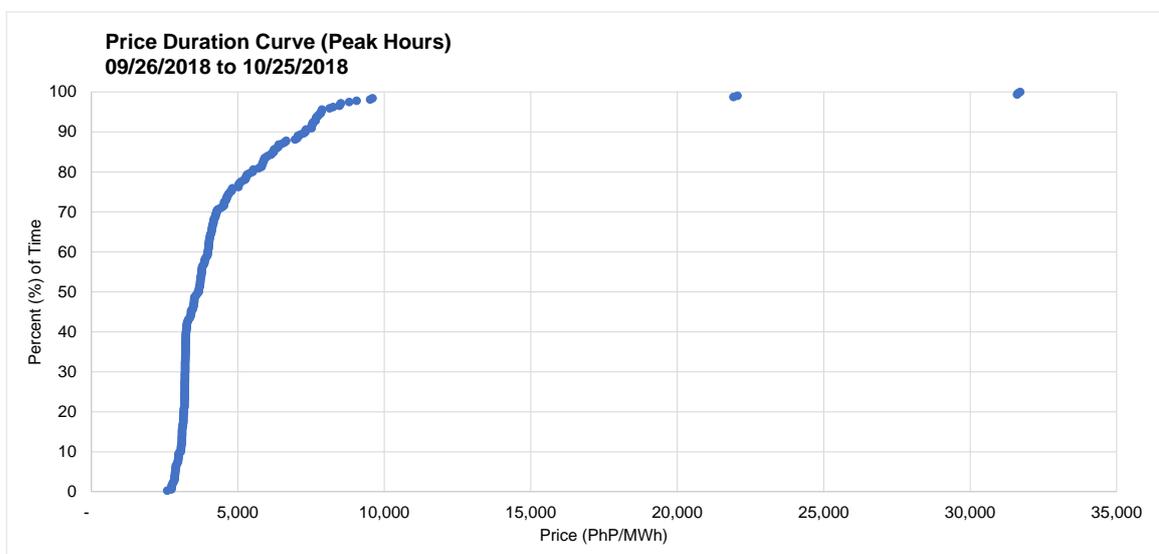
The price duration curves for both the off-peak<sup>6</sup> and peak<sup>7</sup> hours demonstrate that market prices during the peak hours were higher when compared with off-peak hours.

Majority of the prices during off-peak hours (98 percent) were above PhP2,000/MWh to PhP4,000/MWh. On the other hand, while a considerable portion of the prices during peak hours were likewise above PhP2,000/MWh to PhP4,000/MWh (60.6 percent), the remaining market prices were notably higher. As shown in Figure 12, 23.1 percent of the prices during peak hours ranged above PhP4,000/MWh to PhP6,000/MWh. Meanwhile, another 11.9 percent were above PhP6,000/MWh to PhP8,000/MWh, while 2.8 percent ranged above PhP8,000/MWh to PhP10,000/MWh. The remaining 1.6 percent were above PhP20,000/MWh, denoting the occurrence of higher prices in five (5) trading intervals during the month.

**Figure 11. Price Duration Curve (Off-Peak Period), October 2018**



**Figure 12. Price Duration Curve (Peak Period), October 2018**



<sup>6</sup>Off-peak hours include 0100H to 0900H and 2200H to 2400H from Mondays to Sundays and 0100H to 1800H and 2100H to 2400H on Sundays and Holidays

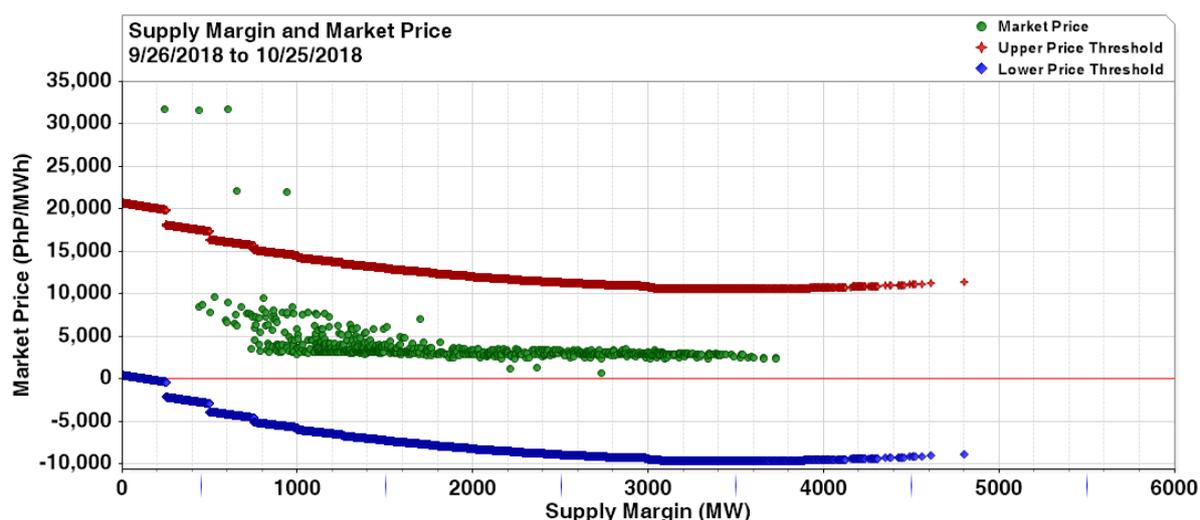
<sup>7</sup>Peak hours include 1000H-2100H from Mondays to Sundays and 1900H-2000H on Sundays and Holidays

## D. Interesting Pricing Event

Interesting pricing events refer to intervals determined to have price outliers based on the relationship of market price and supply margin. 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”. Annex A provides details on the MSC-approved methodology in determining interesting pricing events.

The market price on 17 October at 1800H as well as the market prices on 25 October at 1400H, 1500H, 1600H and 1800H were interesting pricing events. Low supply margin levels were observed, following the increase in the demand as well as in the capacity not offered during the affected trading intervals. High outage capacity that prevailed during the trading dates was likewise noted.

**Figure 13. Supply Margin and Market Price, October 2018**



**Table 11. Interesting Pricing Events – October 2018**

Date	Hour	Market Price (PhP/MWh)	Supply Margin (MW)	Reference Price Threshold (PhP/MWh)
10/17/2018	18	21,917	940	14,717
10/25/2018	14	31,707	241	19,950
10/25/2018	15	31,600	441	17,568
10/25/2018	16	22,056	658	15,981
10/25/2018	18	31,635	603	16,132

## V. Pricing Errors and Market Intervention

System-wide non-congestion pricing errors affected 43 trading intervals or 6 percent of the time in the ex-ante and 35 trading intervals or 4.9 percent of the time in the ex-post during the October billing month, related to inappropriate input data which affected the generation of prices and schedules. This posted an increase from previous month’s non-congestion pricing error occurrences that affected 16 trading intervals or 2.2 percent of the time during the ex-ante and 10 trading intervals or 1.3 percent of the time during the ex-post.

In Luzon, the frequency of issuances of non-congestion pricing errors affected 39 trading intervals or 5.4 percent of the time in the ex-ante and two (2) trading intervals or 0.3 percent of the time in the ex-post, which were mostly related to the localized contingency constraint violation on Paco transformer. This month's ex-ante figure was higher than previous month's nine (9) trading intervals or 1.2 percent of the time. The ex-post figures were the same for September and October.

In Visayas, non-congestion pricing errors affected four (4) trading intervals or 0.6 percent of the time, lower than last month's 8 trading intervals or 1.1 percent of the time in the ex-ante and four (4) trading intervals or 0.6 percent of the time were affected in the ex-post, almost same with last month's four (4) trading intervals or 0.5 percent of the time. These were mainly on account of the localized constraint violation on Naga and Mandaue transformers.

Meanwhile, an increase in the system-wide application of Price Substitution Methodology (PSM) was observed this month, affecting a total of 125 trading intervals or 17.4 percent of the time (previous month's 61 trading intervals or 8.2 percent of the time) in the ex-ante and 78 trading intervals or 10.8 percent of the time (previous month's 45 trading intervals or 6 percent of the time) in the ex-post. PSM application this month was mainly due to the constraint on Samboan-Amlan Line 1 (Cebu-Negros submarine cable) and New Naga-Samboan line 1.

**Table 12. PEN, PSM and MI Summary, October 2018**

	Luz-Vis		Luzon		Visayas		Total	
	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time
<b>PEN (RTD)</b>	43	6.0	39	5.4	4	0.6	86	11.9
<b>PEN (RTX)</b>	35	4.9	2	0.3	4	0.6	41	5.7
<b>PSM (RTD)</b>	125	17.4	1	0.1	-	-	126	17.5
<b>PSM (RTX)</b>	78	10.8	1	0.1	2	0.3	81	11.3

Note: The column "Total" refers to the total number of trading intervals with PEN, PSM or MI (system-wide or regional)

Shown in Table 13 below are the non-congestion pricing errors by type during the month. The system-wide non-congestion pricing errors, affecting a total of 43 trading intervals in the ex-ante and 35 trading intervals in the ex-post were all related to inappropriate input data.

In Luzon, pricing errors due to base case constraint affected 36 trading intervals in the ex-ante while pricing errors due to load shedding affected three (3) trading intervals in the ex-ante and two (2) trading intervals in the ex-post.

On the other hand, pricing errors due to load shedding affected two (2) trading intervals in the Visayas during the ex-ante and one (1) trading interval during the ex-post. Also, pricing error due to base case constraint and over-generation effected 1 trading interval each in the ex-ante. Meanwhile, pricing error due to base case constraint and over-generation affected two (2) trading intervals and one (1) trading interval, respectively, in the ex-post.

**Table 13. PEN Type Summary, October 2018**

	Luz-Vis		Luzon		Visayas		Total	
	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time
<b>PEN (RTD)</b>	<b>43</b>	<b>6.0</b>	<b>39</b>	<b>5.4</b>	<b>4</b>	<b>0.6</b>	<b>86</b>	<b>11.9</b>
Contingency		-		-		-		-
Base Case		-	36	5.0	1	0.1	37	5.1
Over-generation		-		-	1	0.1	1	0.1
VoLL		-	3	0.4	2	0.3	5	0.7
Inappropriate Input Data	43	6.0		-		-	43	6.0
<b>PEN (RTX)</b>	<b>35</b>	<b>4.9</b>	<b>2</b>	<b>0.3</b>	<b>4</b>	<b>0.6</b>	<b>41</b>	<b>5.7</b>
Contingency	-	-	-	-	-	-	-	-
Base Case	-	-	-	-	2	0.3	2	0.3
Over-generation	-	-	-	-	1	0.1	1	0.1
VoLL	-	-	2	0.3	1	0.1	3	0.4
Inappropriate Input Data	35	4.9	-	-	-	-	35	4.9

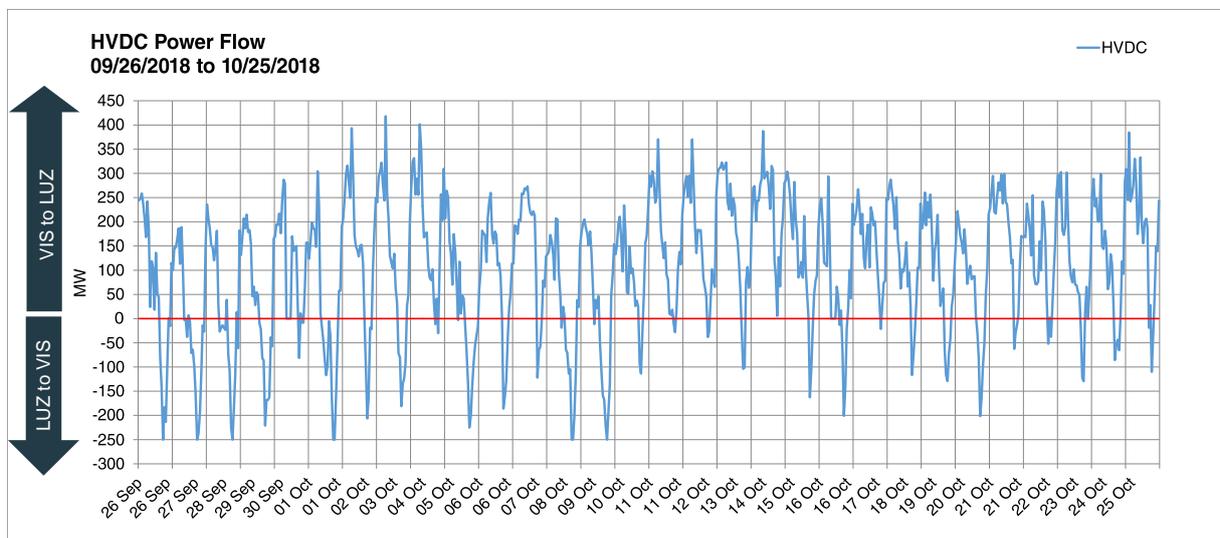
## VI. HVDC Scheduling

Power flow through the HVDC Interconnection was generally directed towards the Luzon region for 555 trading intervals in the ex-ante during the billing month, with schedules ranging from 0.2 MW to 418 MW.

On the other hand, the HVDC power flow was directed towards the Visayas for 157 trading intervals in the ex-ante during the billing month, with schedules ranging from 1 MW to 250 MW. It was noted that the 250-MW limit was maximized for seven (7) trading intervals during the billing month.

Moreover, no power flowed in the HVDC link on 30 September from 0900H to 1200H due to security limit, and on 16 October from 0900H to 1200H, due to opening of breaker while Naga-Tayabas line was on outage.

**Figure 14. Summary of HVDC Limits Imposed by NGCP-SO, October 2018**



**Table 14. Summary of HVDC Limits Imposed by NGCP-SO and Results of HVDC Schedules (Ex-ante and Ex-post), October 2018**

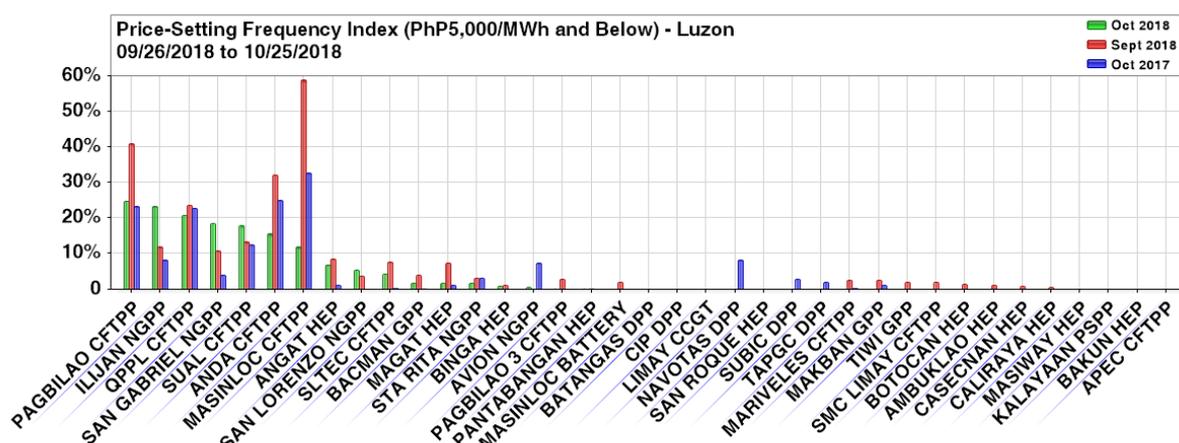
Results of HVDC Scheduling	HVDC Limit during Ex-ante (Visayas/Luzon)								HVDC Limit during Ex-post (Visayas/Luzon)							
	(No. of Trading Intervals)	Percent of Time	(No. of Trading Intervals)	Percent of Time	(No. of Trading Intervals)	Percent of Time	(No. of Trading Intervals)	Percent of Time	(No. of Trading Intervals)	Percent of Time	(No. of Trading Intervals)	Percent of Time	(No. of Trading Intervals)	Percent of Time		
	0/0	250/400	250/420	Total		0/0	250/400	250/420	Total							
<b>Visayas to Luzon</b>	-		53	7%	502	70%	555	77%	-		60	8%	502	70%	562	78%
Limit Not Maximized			53	7%	502	70%	555	77%			60	8%	501	70%	561	78%
Limit Maximized <sup>11</sup>							-						1	0%	1	0%
<b>Luzon to Visayas</b>	-		43	6%	114	16%	157	22%	-		36	5%	115	16%	151	21%
Limit Not Maximized			40	6%	110	15%	150	21%			32	4%	113	16%	145	20%
Limit Maximized <sup>11</sup>			3	0%	4	1%	7	1%			4	1%	2	0%	6	1%
<b>No Flow <sup>11</sup></b>	4	1%			4	1%	8	1%	4	1%			3	0%	7	1%
<b>TOTAL</b>	4	1%	96	13%	620	86%	720	100%	4	1%	96	13%	620	86%	720	100%

## VII. Price Setting Plants<sup>8</sup>

About 89 percent of the market prices in October were below PhP5,000/MWh. Coal and natural gas plants figured as the top frequent price-setters in Luzon, with Pagbilao CFTPP setting the price in 24.9 percent of the time during the month, followed by Ilijan NGPP at 23.2 percent, QPPL CFTPP at 20.8 percent, San Gabriel NGPP at 18.6 percent, Sual CFTPP at 18.1 percent and Anda CFTPP at 15.6 percent and Masinloc CFTPP at 11.8 percent.

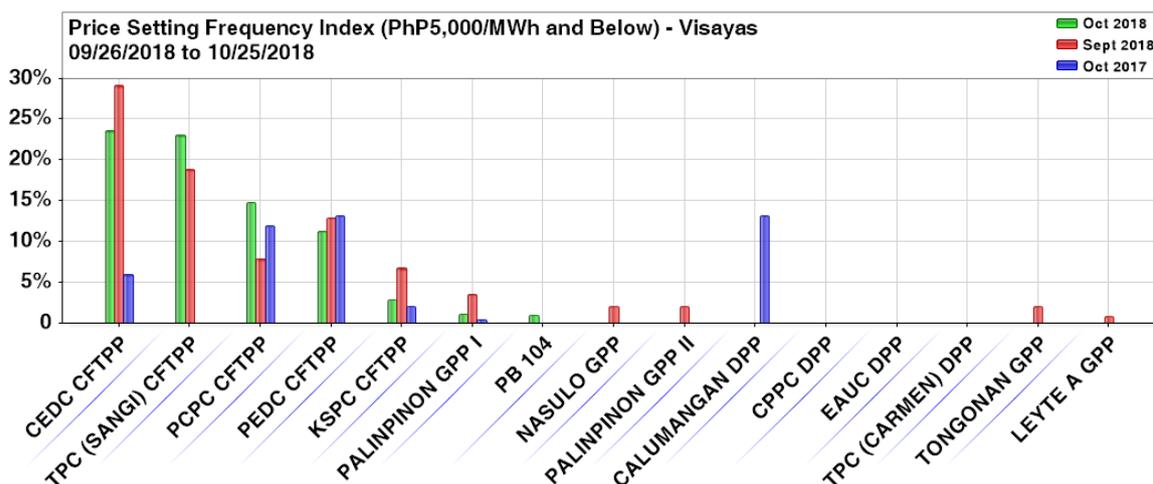
In the Visayas, coal plants CEDC CFTPP, TPC (Sangi) CFTPP, PCPC CFTPP and PEDC CFTPP were the most frequent price-setters at below PhP5,000/MWh, setting the price at 23.6 percent, 23.1 percent, 14.9 percent and 11.3 percent of the time, respectively, during the month.

**Figure 15. Price Setting Frequency Index (PhP5,000/MWh and Below) - Luzon, October 2018, September 2018 and October 2017**



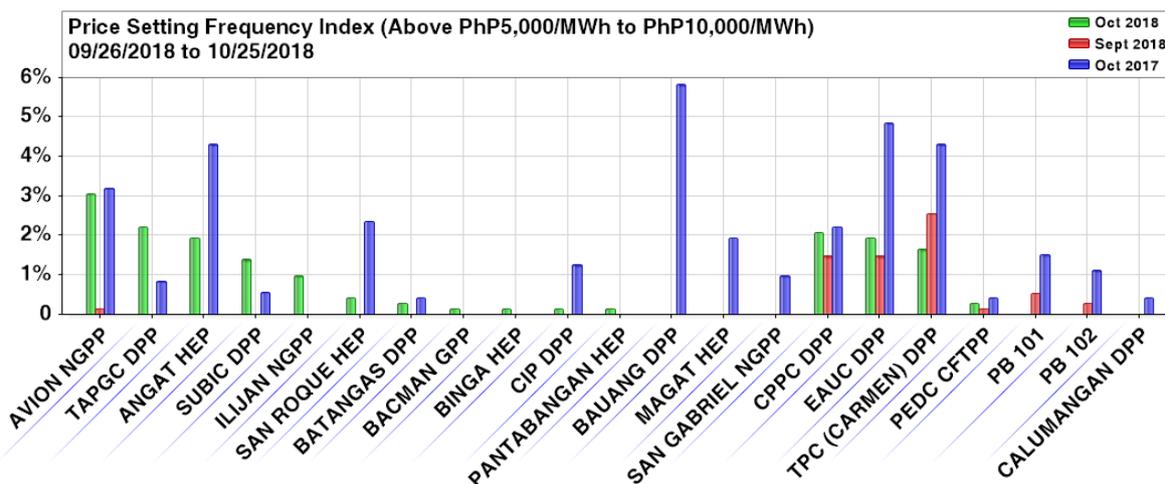
<sup>8</sup> A generator trading node is considered as a price setter when its last accepted offer price is between 95% to 100% of its nodal price. A generating plant is considered as price setter if at least one of its trading nodes was price setter in a given trading hour. The determination of the price setter/s in a trading interval factors in the prevailing pricing condition for the same. The price setters are determined from: (i) ex-ante for trading intervals without pricing error during ex-ante, (ii) ex-post with pricing error during ex-ante but without pricing error during ex-post, (iii) market re-run results for trading intervals with pricing error both in ex-ante and ex-post, and (iv) trading intervals where the price substitution methodology (PSM) was applied. For trading intervals affected by PSM, the unconstrained marginal plants are considered price setters. Further, in instances of regional price separation, price setters are determined separately for each region.

**Figure 16. Price Setting Frequency Index (PhP5,000/MWh and Below) - Visayas, October 2018, September 2018 and October 2017**



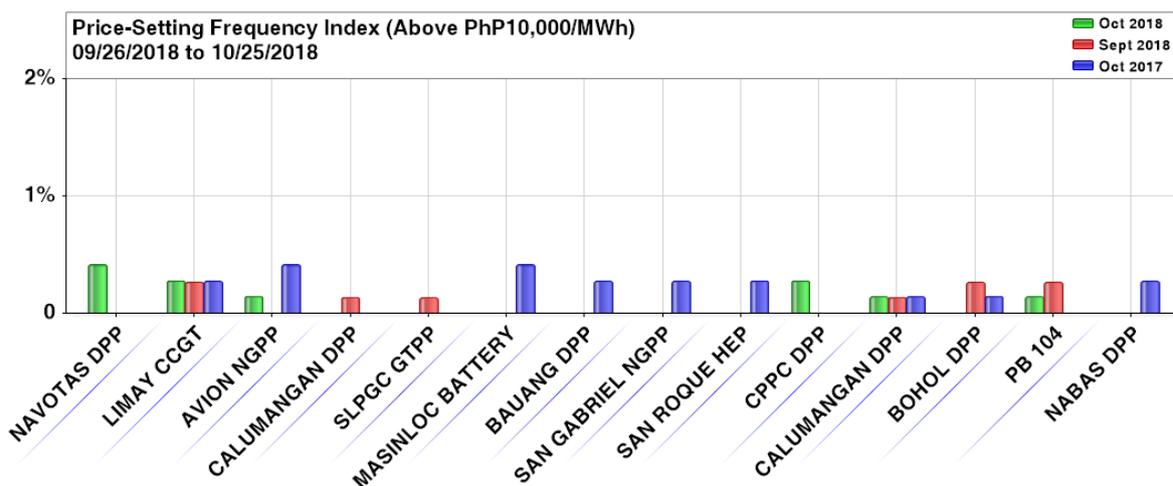
Market prices ranged above PhP5,000/MWh to PhP10,000/MWh at 10 percent of the time during the month, a marked increase from last month's 0.9 percent. Oil-based, hydro and natural gas plants obtained the highest frequencies in setting the prices at this level, topped by Avion NGPP at 3.1 percent, TAPGC DPP at 2.2 percent, CPPC DPP at 2.1 percent, EAUC DPP and Angat HEP at 1.9 percent each, TPC (Carmen) DPP at 1.7 percent, Subic DPP at 1.4 percent and Ilijan NGPP at 1 percent.

**Figure 17. Price Setting Frequency Index (Above PhP5,000/MWh to PhP10,000/MWh), October 2018, September 2018 and October 2017**



Market prices above PhP10,000/MWh were noted in 10 trading intervals (1.4 percent of the time) during the billing month. The most frequent price-setters are mostly oil-based plants, topped by Navotas DPP, which set the price at this level at 0.4 percent. Oil-based plants Limay CCGT and CPPC DPP were next on the list at 0.3 percent, followed by natural gas plant Avion NGPP, Calumangan DPP and PB 104, at 0.1 percent each.

**Figure 18. Price Setting Frequency Index (Above PhP10,000/MWh), October 2018, September 2018 and October 2017**

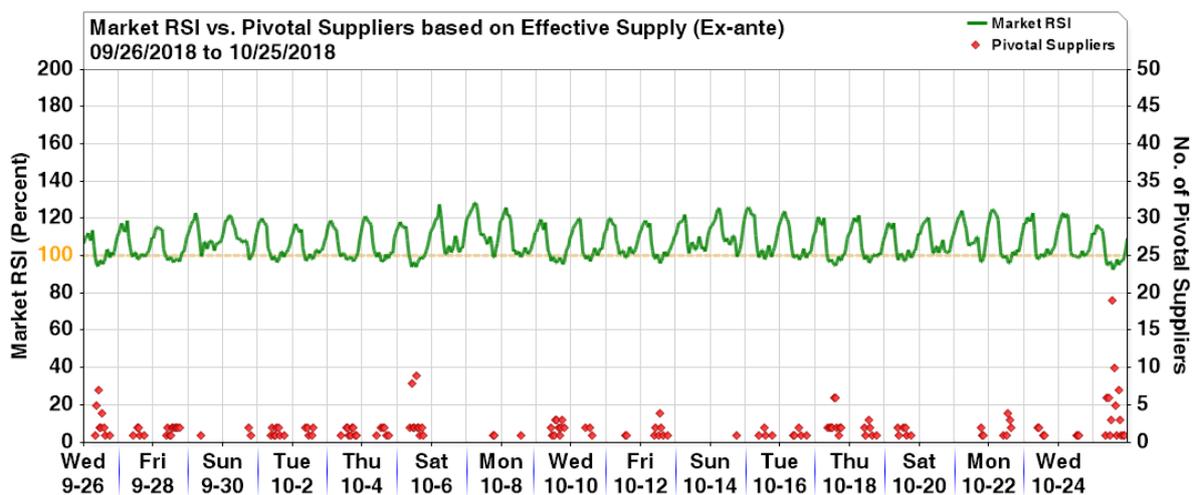


### VIII. Residual Supply

The succeeding figure below shows the hourly trend of the Market Residual Supply Index (Market RSI)<sup>9</sup> plotted against the number of pivotal supplier/s.

Consistent with the tighter month-on-month average supply margin, the market RSI at above the 100 percent mark decreased to 79 percent of the time or in 569 trading intervals (previous month's 86 percent or 643 trading intervals). Still, this indicated that there were no pivotal suppliers for the majority of the trading intervals during the billing month.

**Figure 19. Market RSI vs. Pivotal Suppliers (Ex-Ante), October 2018**

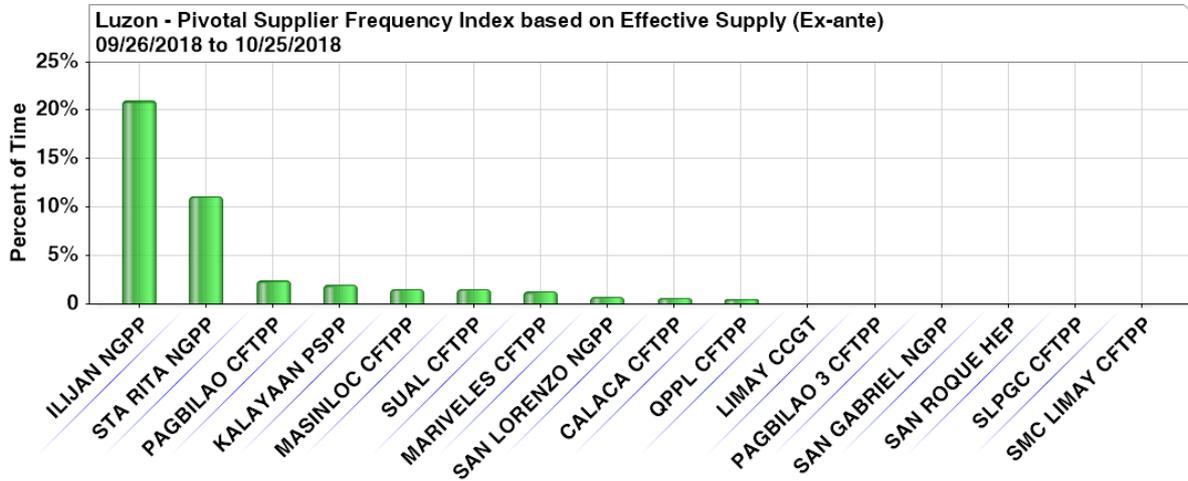


<sup>9</sup> For a generator, the Residual Supply Index (RSI) is a dynamic continuous index measured as ratio of the available generation without that generator to the total generation required to supply the demand. The Market RSI is measured as the lowest RSI among all generators in the market. A Market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

## IX. Pivotal Suppliers<sup>10</sup>

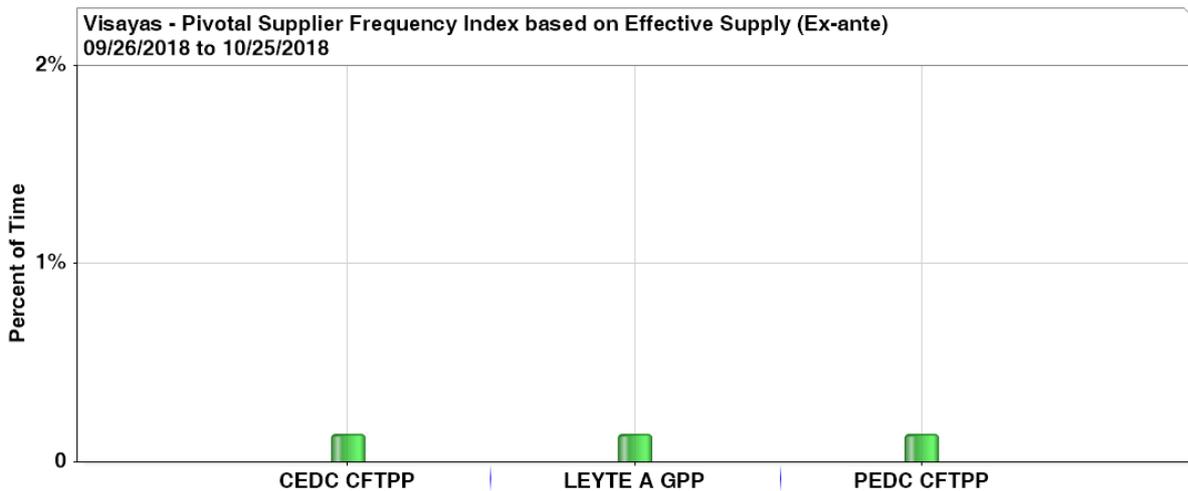
Sixteen (16) Luzon plants emerged as pivotal suppliers during the October billing month, led by natural gas plants Ilijan NGPP, having been pivotal for 21 percent of the time and Sta. Rita NGPP for 11.1 percent. Other Luzon plants were also pivotal in October. These are: Pagbilao CFTPP, Kalayaan PSPP, Masinloc CFTPP, and Sual CFTPP.

**Figure 20. Pivotal Supplier Frequency Index - Luzon, October 2018**



On the other hand, three (3) Visayas plants were pivotal suppliers in the current month at 0.1 percent of the time. As shown in the Figure below, these are CEDC CFTPP, Leyte A GPP, and PEDC CFTPP.

**Figure 21. Pivotal Supplier Frequency Index - Visayas, October 2018**

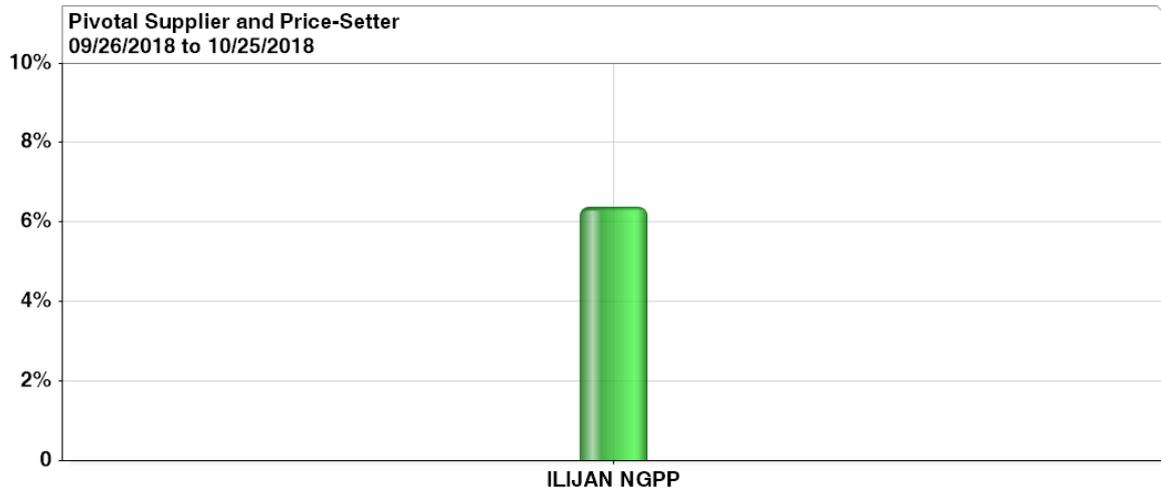


<sup>10</sup> The Pivotal Supply Index (PSI) measures how critical a particular generator is in meeting the total demand at a particular time. It is a binary variable (1 for pivotal and 0 for not pivotal) which measures the frequency that a generating is pivotal for a particular period.

## X. Price-Setters and Pivotal Plants

Only natural gas plant Ilijan NGPP became price setter at the same time that it was pivotal for 6.4 percent of the time during the October billing month.

**Figure 22. PSI vs. PSFI, October 2018**



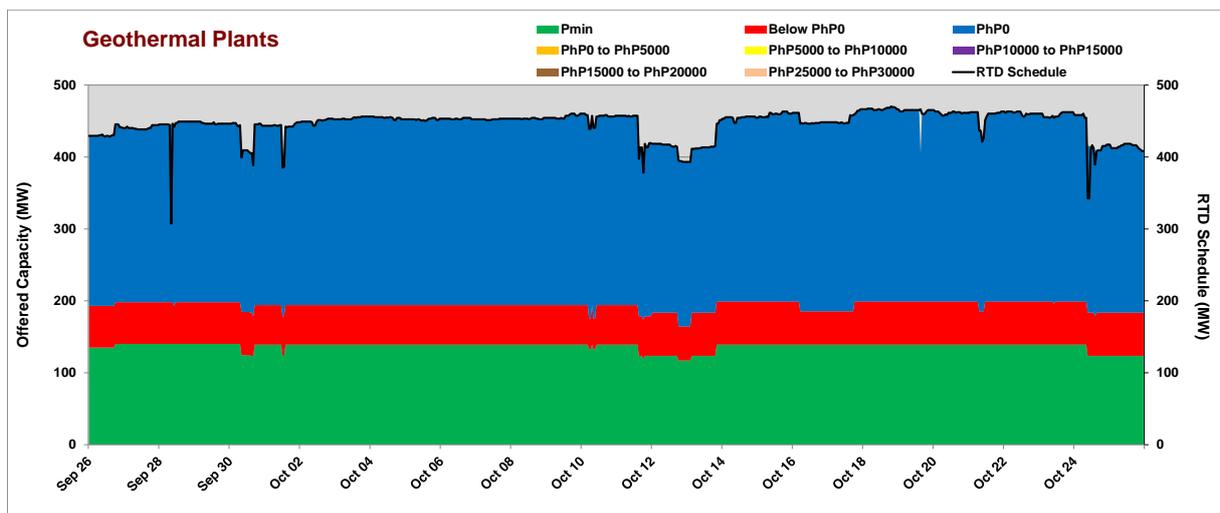
## XI. Generator Offer Pattern

Geothermal plants in Luzon submitted almost its entire capacity (99.9 percent) at PhP0/MWh and below. About 56.6 percent of the offer prices were at exactly PhP0/MWh, while the remaining 43.3 percent were at below PhP0/MWh. The remaining 0.1 percent of the offers were at prices above PhP0/MWh to PhP5,000/MWh.

Considering the low offer prices of Luzon geothermal plants, all of its submitted capacity offers, at 99.9 percent, were scheduled for dispatch in the market during the billing month.

Dips in the offered capacity of Luzon geothermal plants were observed on 11 to 13 October and 24 to 25 October, as shown in Figure 23 below. This followed the forced outages of Makban GPP unit 2 (63 MW) on said trading dates.

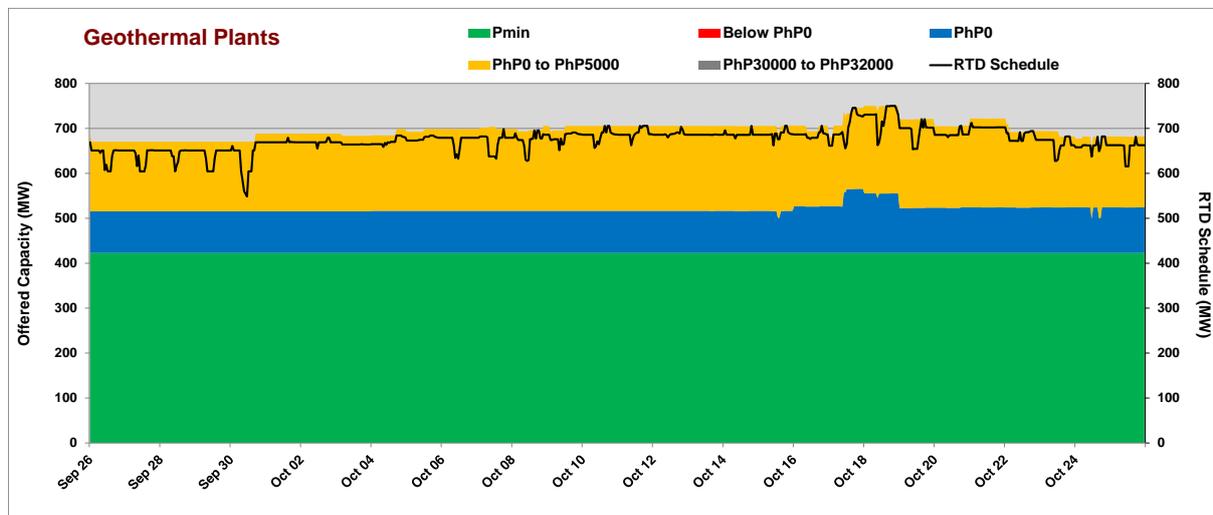
**Figure 23. Geothermal Plants Offer Pattern, Luzon – October 2018**



Geothermal plants in the Visayas demonstrated slightly higher-priced offers compared with the geothermal plants in Luzon. While about 74.7 percent of its capacity offers were priced at PhP0/MWh and below, the remaining 25.3 percent were priced higher at above PhP0/MWh to PhP5,000/MWh.

Accordingly, 96.8 percent of the offers submitted by the Visayas geothermal plants were scheduled for dispatch during the month.

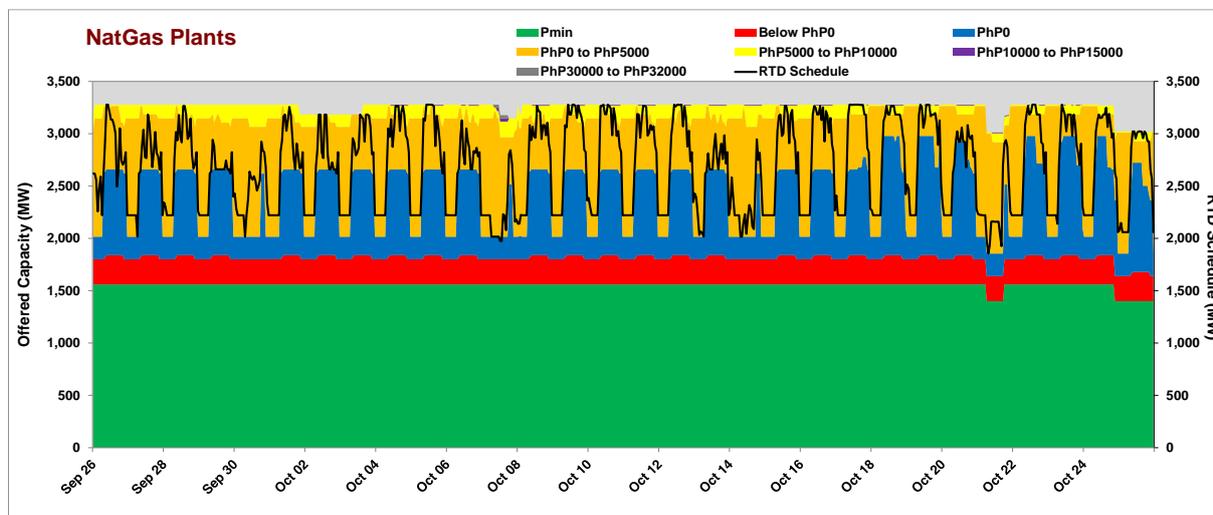
**Figure 24. Geothermal Plants Offer Pattern, Visayas – October 2018**



Natural gas plants offered 74.1 percent of its capacity at PhP0/MWh and below. The remaining 22.8 percent comprised of higher offer prices ranging above PhP0/MWh to PhP5,000/MWh, while another 3 percent were offers priced above PhP5,000/MWh to PhP10,000/MWh.

Correspondingly, 82.4 percent of the offers submitted by natural gas plants were scheduled for dispatch during the month.

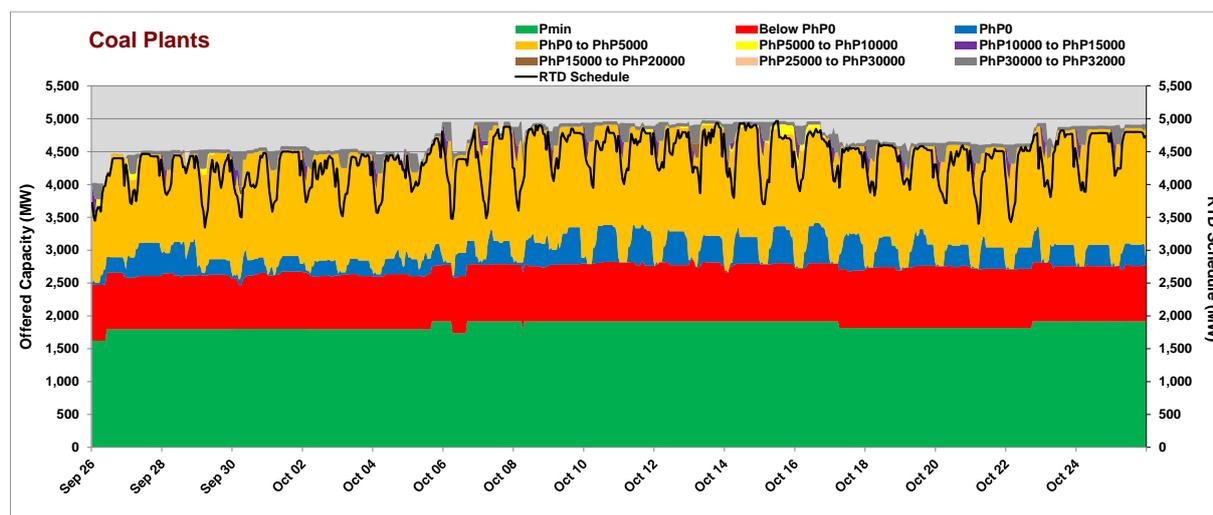
**Figure 25. Natural Gas Plants Offer Pattern, Luzon – October 2018**



Luzon coal plants offered 63.5 percent of its capacity at PhP0/MWh and below, and a considerable portion (33.3 percent) at prices ranging above PhP0/MWh to PhP5,000/MWh. The remaining capacity was offered at higher prices. 0.8 percent were distributed to prices above PhP5,000/MWh to PhP15,000/MWh, while another 2.4 percent of the offers were priced above PhP30,000/MWh to PhP32,000/MWh. This indicates that offer prices of Luzon coal plants was higher on a month-on-month comparison, having offered only 0.7 percent of its capacity at this price range in September.

Despite the slight month-on-month increase in its offer prices, 92.7 percent of the offered capacity of Luzon coal plants was scheduled for dispatch during the month, an increase from last month's 83.6 percent.

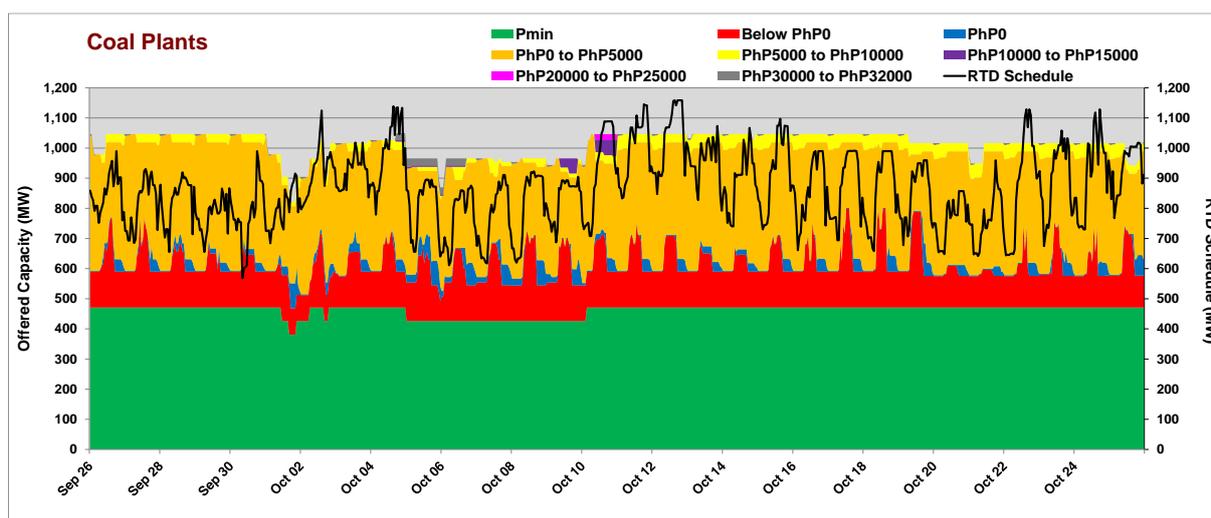
**Figure 26. Coal Plants Offer Pattern – Luzon, October 2018**



On the other hand, Visayas coal plants submitted 62.3 percent of its capacity offers at PhP0/MWh and below. Another 34.7 percent comprised of offers priced above PhP0/MWh to PhP5,000/MWh. Similar with the offer pattern exhibited by Luzon coal plants, the Visayas coal plants likewise offered at higher prices during the month. It is observed that 2.6 percent of its offers were priced above PhP5,000/MWh to PhP10,000/MWh (from last month's 2 percent) and another 0.4 percent at above PhP10,000/MWh (from last month's 0.2 percent).

85.5 percent of its total offered capacity was scheduled for dispatch in the market during the October billing month, higher than last month's 80.3 percent.

**Figure 27. Coal Plants Offer Pattern, Visayas – October 2018**

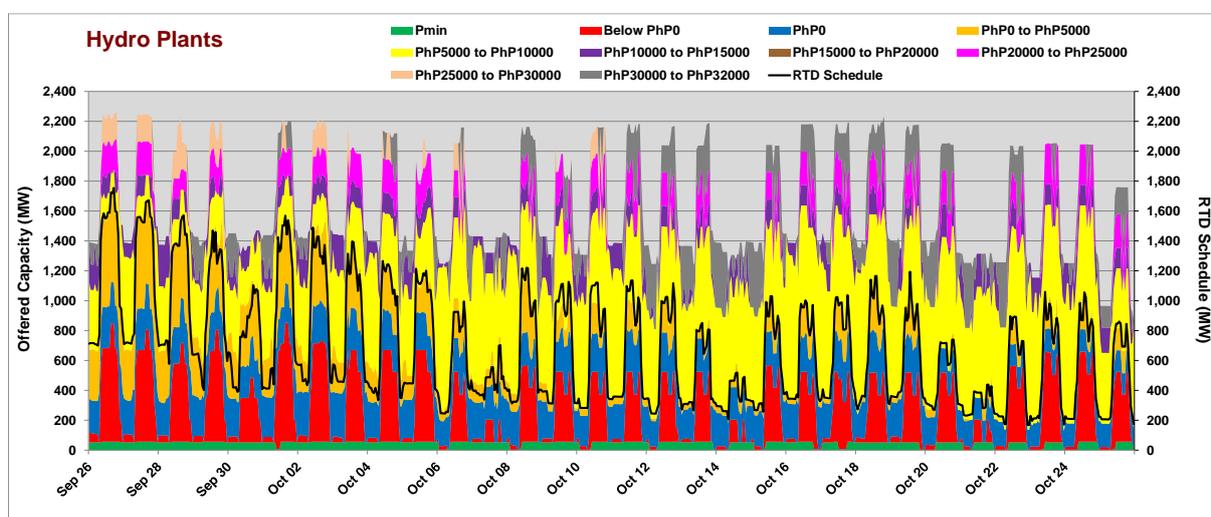


Luzon hydro plans submitted 31.4 percent of its offers at PhP0/MWh and below, 11.5 percent at above PhP0/MWh to PhP5,000/MWh, and a considerable portion (35.2 percent) at higher prices ranging above PhP5,000/MWh to PhP10,000/MWh.

21.9 percent were priced even higher at above PhP10,000/MWh. Of which, 6.4 percent comprised of offer prices distributed above PhP10,000/MWh to PhP15,000/MWh, 5.3 percent of prices above PhP20,000/MWh to PhP25,000/MWh, and 1.5 percent above PhP25,000/MWh to PhP30,000/MWh. The remaining 8.7 percent were offer prices ranging above PhP30,000/MWh to PhP32,000/MWh. It is noted that Luzon hydro plants submitted higher offer prices this month when compared with the previous billing month which recorded only 9.3 percent of its offer prices at above PhP10,000/MWh.

Accordingly, 41.7 percent of the offered capacity of Luzon hydro plants was scheduled for dispatch, notably lower than the 71 percent posted in September.

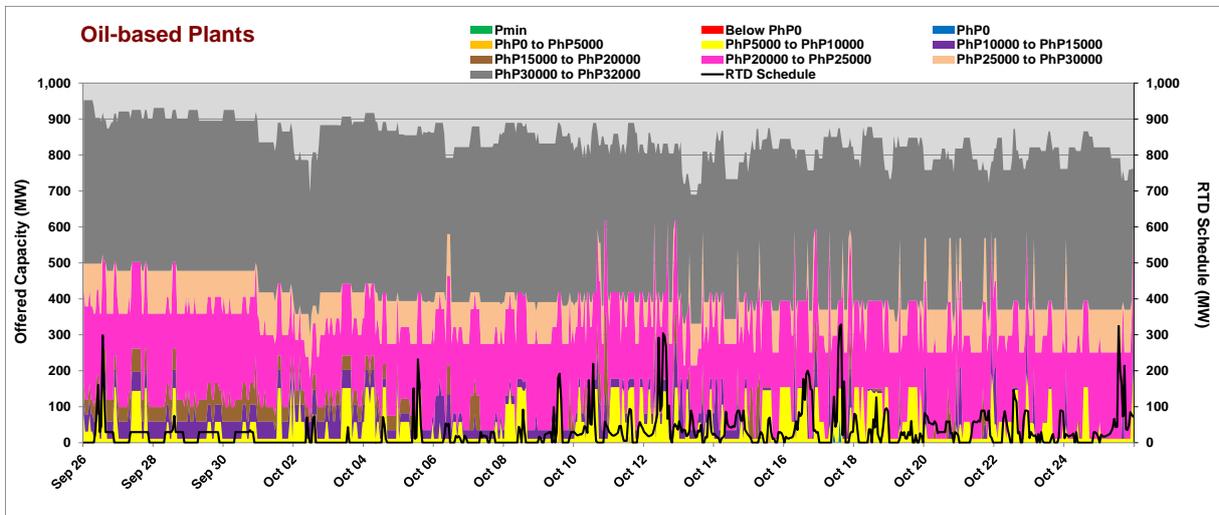
**Figure 28. Hydro Plants Offer Pattern, Luzon – October 2018**



Luzon oil-based plants submitted the highest offer prices this month with bulk of their offers, at 50.4 percent, priced above PhP30,000/MWh to PhP32,000/MWh. Meanwhile, 43 percent were priced above PhP10,000/MWh to PhP30,000/MWh. Only 6.5 percent were offered above PhP5,000/MWh to PhP10,000/MWh.

Correspondingly, 3.5 percent of the offers were scheduled for dispatch in the market, an increase from 2.7 percent posted in the previous month.

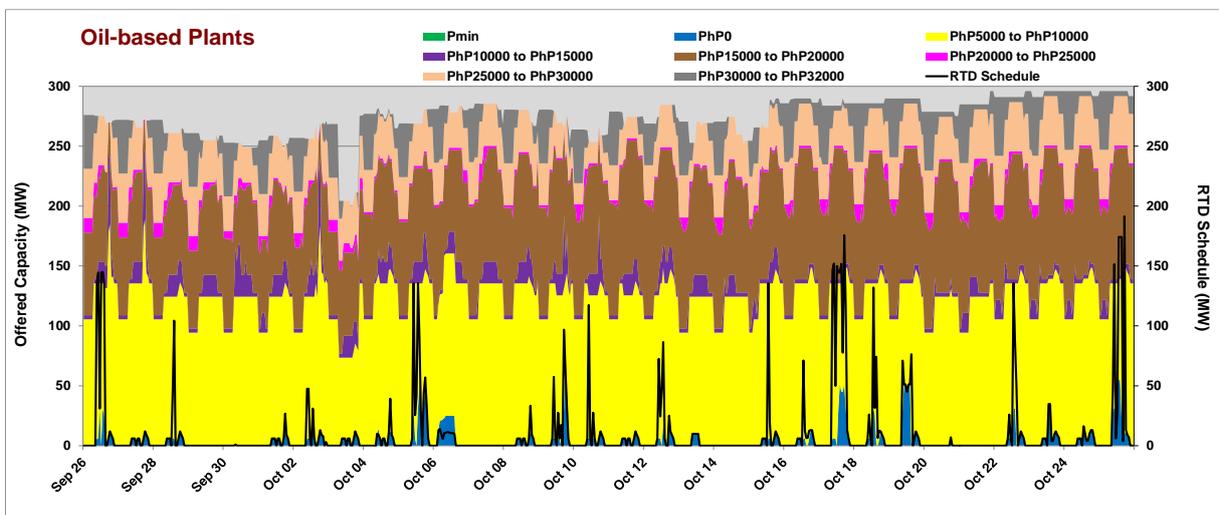
**Figure 29. Oil-based Plants Offer Pattern, Luzon – October 2018**



When compared with other plant types, Visayas oil-based plants offered their capacities at relatively higher prices. Majority of its offers were submitted at prices above PhP10,000/MWh (55 percent) and the remaining 43.5 percent were prices above PhP5,000/MWh to PhP10,000/MWh. A small portion, at 1.5 percent, were offer prices at PhP0/MWh.

3.5 percent of the capacity offered by Visayas oil-based plants were scheduled for dispatch during the billing month. This was higher than last month's 2.5 percent.

**Figure 30. Oil-based Plants Offer Pattern, Visayas – October 2018**



## XII. Capacity Factor

### Luzon

In terms of registered capacity, natural gas plants recorded the highest capacity factor among the Luzon resource types at 81 percent, followed by coal plants at 66.7 percent, geothermal plants at 46.1 percent, hydro plants at 29.5 percent and oil-based plants at 2 percent.

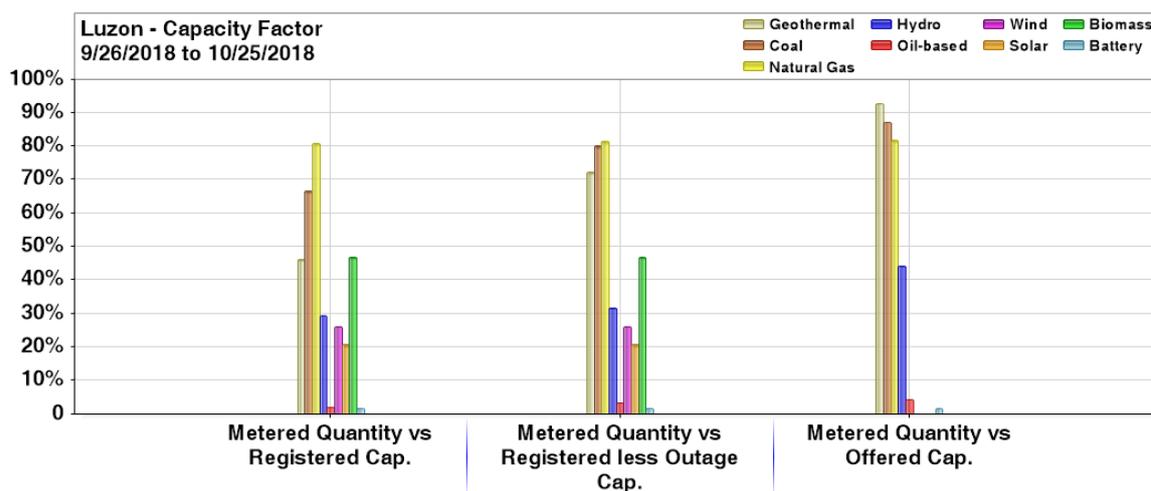
Natural gas plants likewise obtained the highest utilization when measured in terms of registered capacity net of outage, at 81.5 percent. Coal plants came next at 80.1 percent, geothermal plants at 72.3 percent, hydro plants at 31.6 percent, and oil-based plants at 3.4 percent.

Utilization among lower-priced plants was highest when measured based on offered capacity. This demonstrates that offered capacities of lower-priced plants are generally scheduled for dispatch in the market. Geothermal plants posted the highest capacity factor at 92.7 percent. Coal and natural gas plants followed with 87.3 percent and 72.3 percent, respectively. Lower utilization levels were recorded by hydro plants at 44.2 percent and by oil-based plants at only 4.4 percent.

Meanwhile, the capacity factors of preferential dispatch plants – wind, solar and biomass, are posted at 26.1 percent, 20.8 percent and 46.8 percent, respectively, in terms of registered capacity and registered capacity net of outage.

The sole battery energy storage facility in the WESM – Masinloc Battery, posted a capacity factor of 1.6 percent each when measured in terms of registered capacity, registered capacity net of outage, and offered capacity.

**Figure 31. Capacity Factor – Luzon Plants, October 2018**



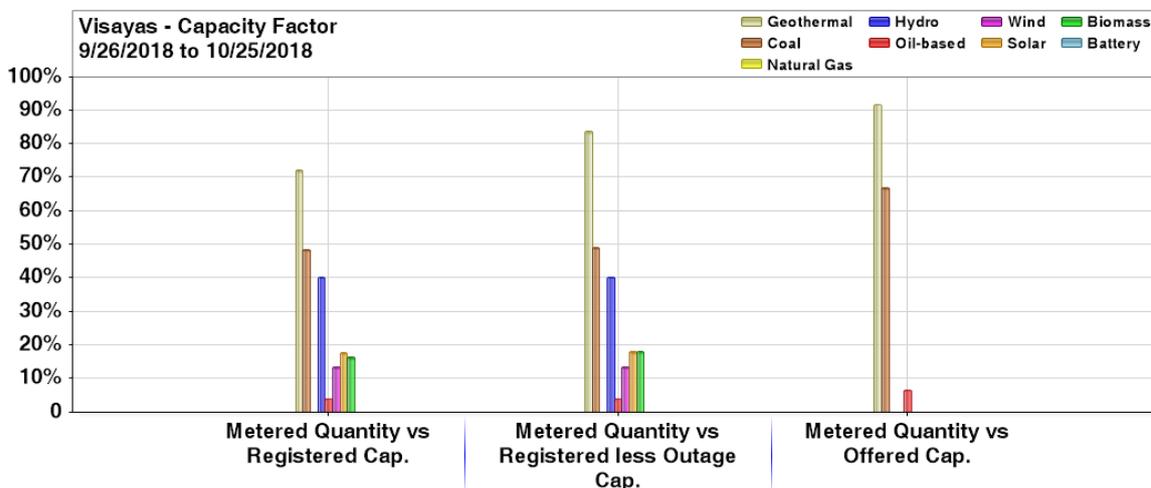
Geothermal plants posted the highest utilization among the resource types in the Visayas. In terms of registered capacity, the Visayas geothermal plants were utilized at 72.2 percent, followed by coal plants at 48.4 percent, hydro plants at 40.3 percent and oil-based plants at 3.9 percent.

Similarly, it was the Visayas geothermal plants which topped the list in terms of utilization based on registered less outage capacity at 83.9 percent, followed by coal plants at 49.1 percent, hydro at 40.3 percent and oil-based plants at 3.9 percent.

Higher utilization levels were obtained based on offered capacity, with geothermal plants recording 91.9 percent, coal plants at 67 percent and oil-based plants at 6.6 percent.

Wind plants' capacity factors based on registered capacity and based on registered capacity net of outage were posted at 13.5 percent while solar plants recorded the same at 17.8 percent and 18 percent, respectively. Biomass plant recorded a capacity factor of 16.4 percent when measured in terms of registered capacity and 18.2 percent when measured in terms of registered capacity net of outage.

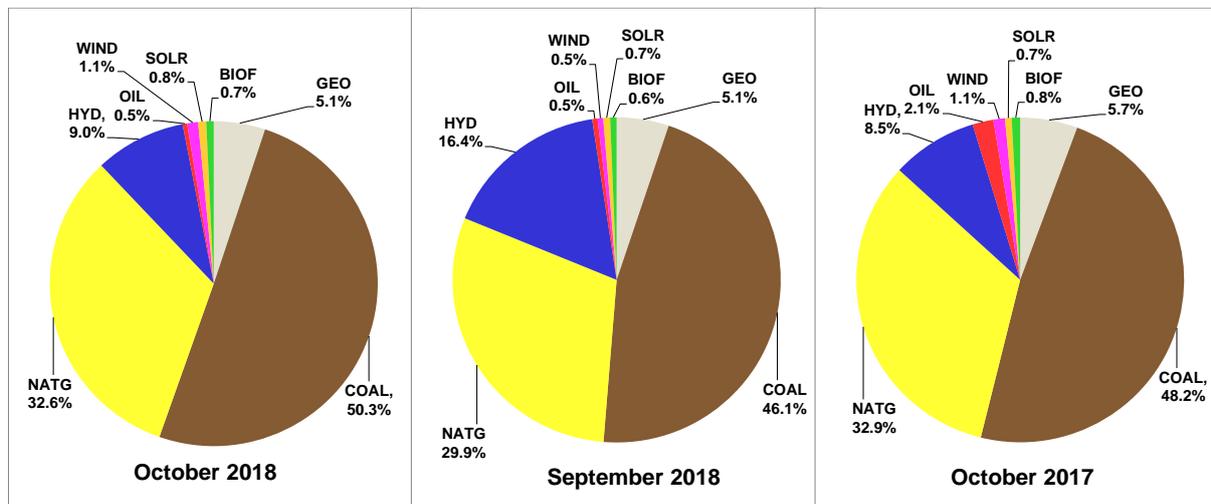
**Figure 32. Capacity Factor, Visayas Plants – October 2018**



### XIII. Generation Mix

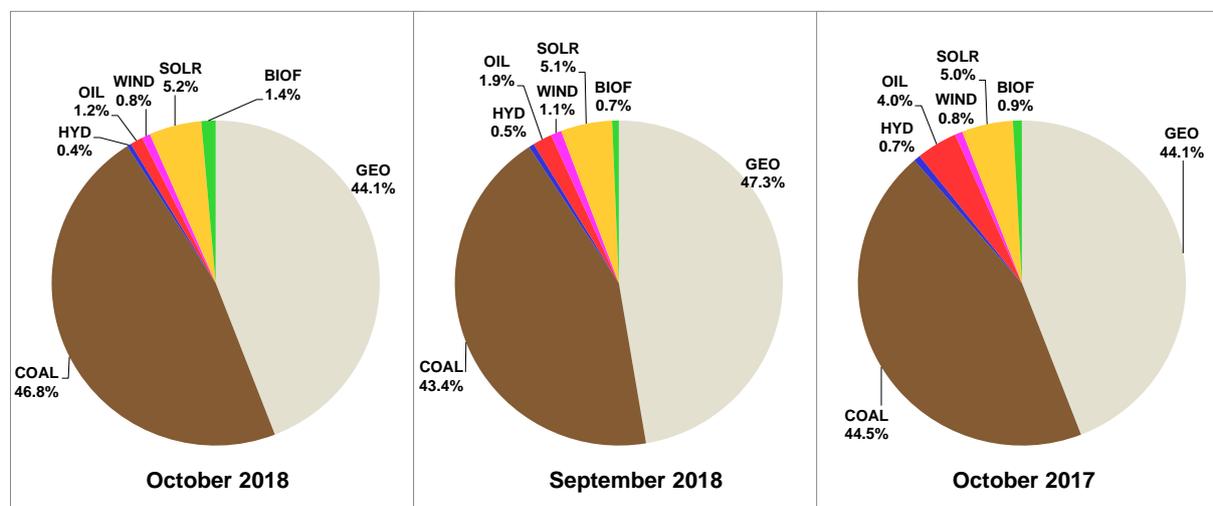
Coal plants held the largest portion of the total metered quantity in Luzon at 50.3 percent (from previous month's 46.1 percent), followed by natural gas plants at 32.6 percent (previous month's 29.9 percent), hydro plants at 9 percent, geothermal plants at 5.1 percent and oil-based plants at 0.5 percent. Meanwhile, the contribution of preferential and must-dispatch generating units was recorded at 2.6 percent.

**Figure 33. Generation Mix (Based on Metered Quantity) – Luzon, October 2018, September 2018 and October 2017**



Coal plants had the highest contribution to the Visayas generation mix at 46.8 percent (from previous month's 43.4 percent) followed by geothermal plants at 44.1 percent (previous month's 47.3 percent). Oil-based and hydro plants came next with 1.9 percent and 0.5 percent, respectively. Meanwhile, solar plants' contribution was at 5.2 percent, wind plants at 0.8 percent and biomass at 1.4 percent.

**Figure 34. Generation Mix (Based on Metered Quantity), Visayas – October 2018, September 2018 and October 2017**



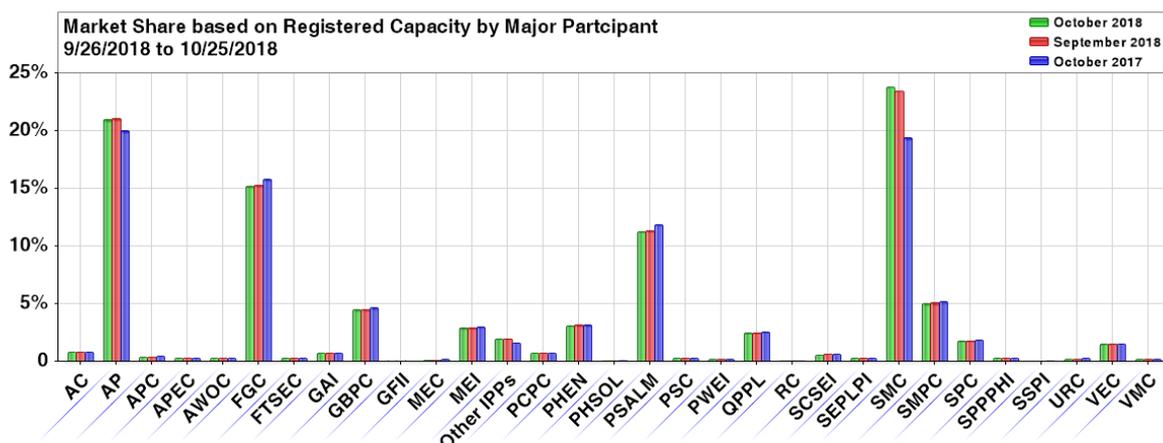
#### XIV. Market Concentration

##### a. Market Share

San Miguel Corporation (SMC), Aboitiz Power (AP), First Gen Corporation (FGC) and Power Sector Asset and Liabilities Management (PSALM) continued to dominate the market with a combined market share of 71.1 percent based on registered capacity during the October billing month. SMC held the top spot at 23.8 percent followed by AP (20.9 percent), FGC (15.2 percent) and PSALM (11.2 percent).

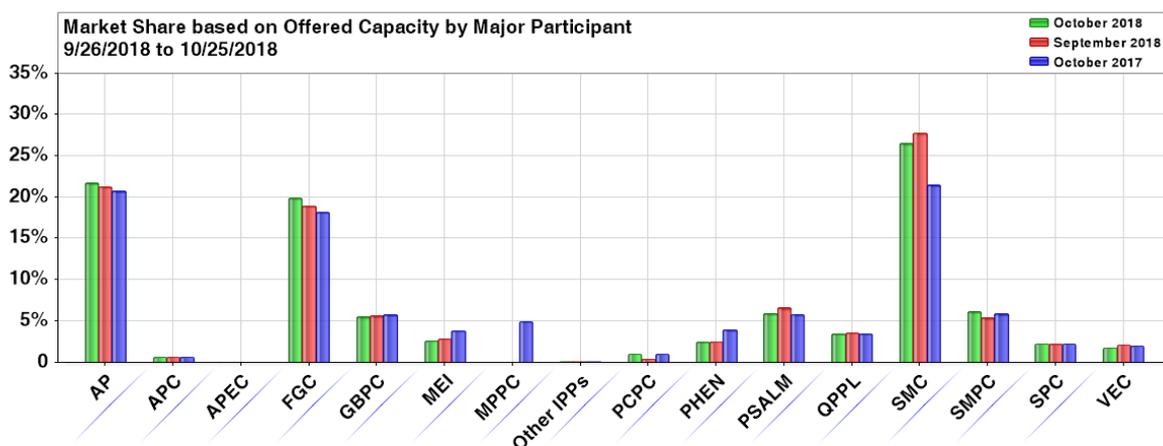
Semirara Mining Power Corporation (SMPC) and Global Business Power Corporation (GBPC) distantly followed at 5 percent and 4.5 percent, respectively.

**Figure 35. Market Share by Major Participant Group based on Registered Capacity October 2018, September 2018, and October 2017**



SMC likewise held the largest share of the market at 26.5 percent based on offered capacity. AP held the second largest share at 21.7 percent followed by FGC at 19.9 percent. In distant fourth is SMPC at 6.2 percent followed by PSALM at 5.9 percent and GBPC at 5.5 percent.

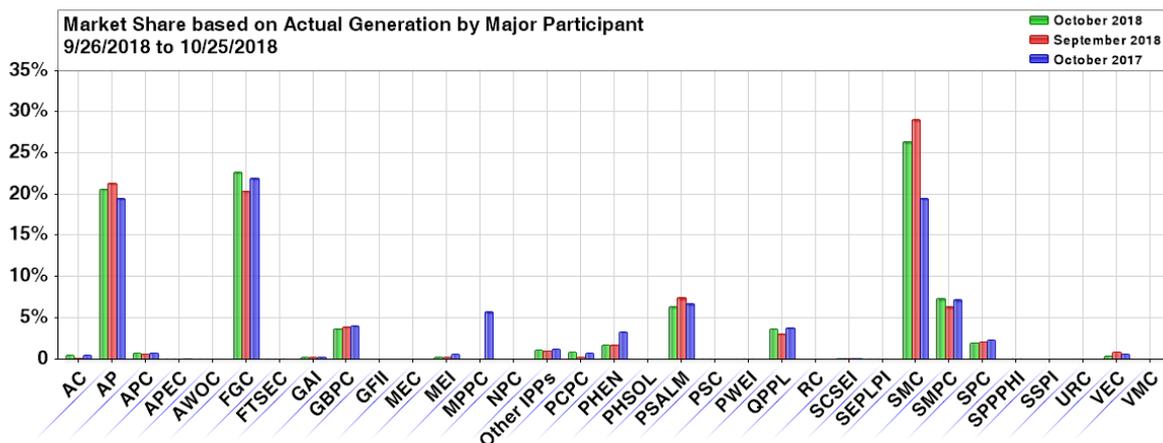
**Figure 36. Market Share by Major Participant Group based on Offered Capacity, October 2018, September 2018, October 2017**



Market share calculated based on actual generation also showed the SMC group with the largest market share at 26.4 percent. FGC and AP then followed at 22.7 percent and 20.7 percent, respectively.

SMPC and PSALM were also among the highest market shareholders 7.4 percent and 6.4 percent of the actual generation, respectively.

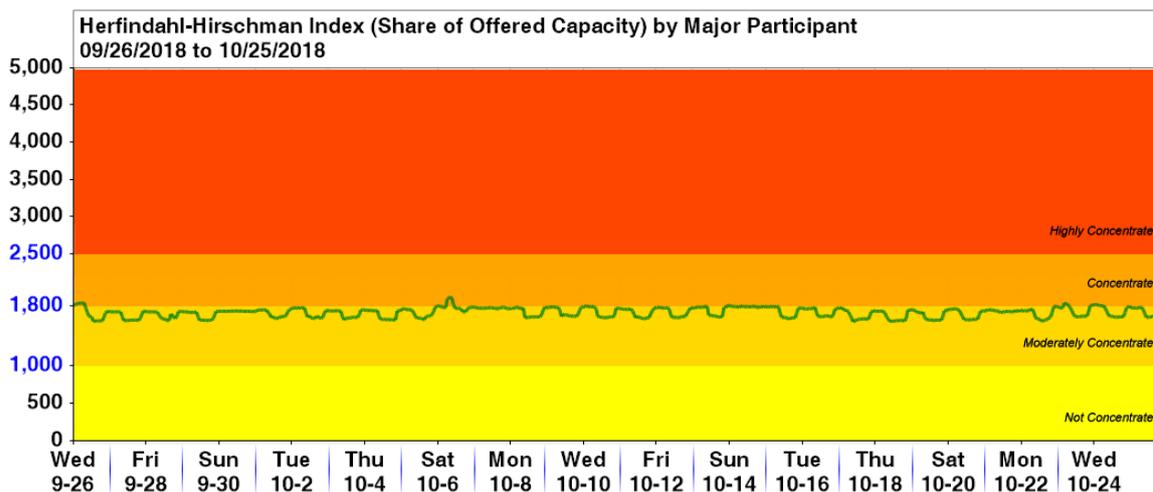
**Figure 37. Market Share by Major Participant Group based on Actual Generation, October 2018, September 2018 and October 2017**



**b. Herfindahl-Hirschman Index (HHI)**

The Herfindahl-Hirschman Index (HHI)<sup>11</sup> calculated based on offered capacity by major participants' grouping indicated a moderately concentrated market for 661 trading intervals (92 percent) of the time and concentrated market for the remaining 59 trading intervals (8 percent) during the October billing month.

**Figure 38. Hourly HHI based by Major Participant Grouping, October 2018**

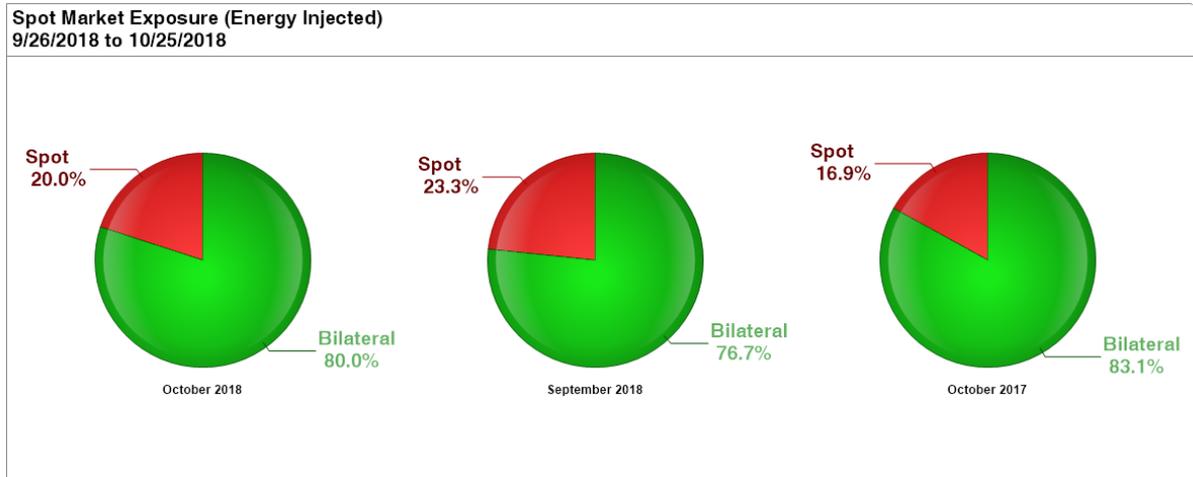


<sup>11</sup> The HHI measures the degree of market concentration, taking into account the relative size and distribution of participants in the monitored market. It is calculated as the sum of squares of the participant's market share. The following are the widely-used HHI screening numbers: the HHI 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.

## XV. Spot Exposure

The spot market exposure of generator-trading participants comprised about 20 percent of the total energy transaction in the WESM. This was higher than previous month's 21.7 percent and previous year's 16.9 percent. Still, majority of the total energy injected into the grid was covered by bilateral contracts.

**Figure 39. Spot Market Exposure, October 2018, September 2018, and October 2017**



## Appendix A. Major Plant Outages

Region	Plant Type	Plant/ Unit Name	Capacity (MW)	Date Out	Date In	Duration (Days)	Outage Type	Remarks
LUZON	GEO	Tiwi 3	43.7	10/23/2005 13:26			Deactivated Shutdown	Tiwi 3 decommissioned since May 26 2009
LUZON	GEO	Makban 6	55	4/11/2013 22:44			Deactivated Shutdown	Conducted gas compressor test
VISAYAS	GEO	PGPP2 Unit 4	20	6/27/2014 6:07			Forced Outage	Steam being utilized by Nasulo plant
LUZON	GEO	Makban 5	55	3/12/2017 1:55			Forced Outage	High turbine vibration
LUZON	HYD	Angat M 3	50	1/29/2018 0:01			Planned Outage	Annual overhauling until 29 July 2018
LUZON	OIL	Malaya 2	350	5/19/2018 13:01			Forced Outage	Burn air heater 2A
LUZON	COAL	SLTEC 2	122.9	6/18/2018 6:14			Forced Outage	Isolated due to tripping Calaca-Salong Line
LUZON	OIL	Limay 3	60	6/22/2018 8:01			Planned Outage	Maintenance outage until 23 October 2018
LUZON	GEO	Tiwi 1	59	8/12/2018 11:11			Forced Outage	Low steam supply
VISAYAS	GEO	Leyte 1	35	8/29/2018 1:09			Maintenance Outage	PMS
LUZON	GEO	Makban 1	63	8/30/2018 12:08			Forced Outage	Busted bushing at high side phase A of Makban Unit 1 transformer
LUZON	GEO	Makban 9	20	8/30/2018 19:19			Forced Outage	On reserve shutdown pending availability of steam supply
LUZON	COAL	Sual 1	647	8/31/2018 23:48			Planned Outage	On maintenance until 30 October 2018
VISAYAS	GEO	Upper Mahiao 1	32	9/3/2018 6:01			Forced Outage	Tripped
VISAYAS	GEO	Upper Mahiao 2	32	9/3/2018 6:01			Forced Outage	Tripped
LUZON	OIL	Malaya 1	300	9/3/2018 15:05	10/16/2018 12:33	42.89	Forced Outage	Tripping of two condensate pumps A and B
LUZON	GEO	Makban 7	20	9/21/2018 7:39	9/30/2018 7:11	8.98	Planned Outage	Affected by pre arranged shutdown of Makban CD 230 kV tie line
LUZON	HYD	Casencan 1	82.5	9/21/2018 22:25			Forced Outage	Turbine bearing vibration
LUZON	COAL	Pagbilao 1	382	9/22/2018 8:15	10/5/2018 13:36	13.22	Maintenance Outage	Maintenance outage until 6 October 2018
VISAYAS	GEO	Upper Mahiao 4	32	9/24/2018 18:05	9/30/2018 21:14	6.13	Forced Outage	125 VDC and 48 VDC failure
LUZON	COAL	QPPL	459	9/25/2018 20:24	9/26/2018 9:04	0.53	Forced Outage	Emergency shutdown due to main turbine control valve #1 trouble
LUZON	GEO	Makban 8	20	9/25/2018 20:35	9/26/2018 17:38	0.88	Forced Outage	Auto tripped due to over frequency relay caused by auto tripping of 230 kV breaker protection
VISAYAS	GEO	Upper Mahiao 3	32	9/27/2018 10:09	9/27/2018 19:02	0.37	Forced Outage	Affected by the tripping of OEC31 & 32 during the load transfer of power supply in the 480 Volts manual transfer switch from Bus 1 to Bus 2
LUZON	HYD	Bakun 1	38	9/28/2018 21:39	9/28/2018 23:17	0.07	Forced Outage	Tripped due to turbine trouble
LUZON	GEO	Magat 2	95	9/29/2018 13:32	9/29/2018 16:53	0.14	Forced Outage	Generator differential protection actuated
LUZON	GEO	Makban 2	63	9/30/2018 8:30	9/30/2018 16:31	0.33	Maintenance Outage	Maintenance outage
LUZON	GEO	Makban Ormat	12	9/30/2018 9:30			Forced Outage	Loss of power supply of PGPC injection pump
LUZON	GEO	Makban 8	20	9/30/2018 16:58			Forced Outage	Put on reserve shutdown pending availability of steam supply (steam optimization)
LUZON	OIL	Limay 7	60	10/1/2018 0:01			Maintenance Outage	Maintenance outage until 15 October 2018
LUZON	HYD	Caliraya 2	14	10/1/2018 0:01			Planned Outage	Planned outage until 14 November 2018
VISAYAS	COAL	TPC Sangi 2	85	10/1/2018 9:12			Forced Outage	Affected by tripping of Dascon L 1 and 2 and Carcon L 1 and 2
VISAYAS	COAL	TPC Sangi 1	60	10/1/2018 9:12			Forced Outage	Affected by tripping of Dascon L 1 and 2 and Carcon L 1 and 2
VISAYAS	COAL	PEDC 2	83.7	10/1/2018 14:58			Forced Outage	Loss of condenser vacuum
LUZON	NATG	Avion 1	50.3	10/1/2018 19:27	10/3/2018 14:00	1.77	Forced Outage	Affected by the Avion San Lorenzo 230 kV line emergency shutdown. Leak oil at Avion side
LUZON	NATG	Avion 2	50.3	10/1/2018 19:27	10/3/2018 14:00	1.77	Forced Outage	Affected by the Avion San Lorenzo 230 kV line emergency shutdown. Leak oil at Avion side
LUZON	OIL	Limay 2	60	10/2/2018 0:01	10/2/2018 17:35	0.73	Maintenance Outage	Maintenance outage until October 5 2018
LUZON	HYD	Kalayaan 2	180	10/3/2018 9:55	10/3/2018 22:45	0.53	Forced Outage	Tripped due to misaligned wicket gate
LUZON	HYD	Binga 1	35	10/4/2018 6:04	10/4/2018 22:39	0.69	Forced Outage	Unit Transformer 1 Tripped. As RR
LUZON	HYD	Binga 2	33	10/4/2018 6:04	10/4/2018 23:15	0.72	Forced Outage	Unit Transformer 2 Tripped. As RR
LUZON	OIL	SLPGC 4	25	10/4/2018 9:01			Forced Outage	Generator breaker problem
VISAYAS	COAL	PEDC 2	83.7	10/5/2018 0:43	10/10/2018 1:37	5.04	Maintenance Outage	To conduct repair of windback and high pressure heater
LUZON	HYD	Angat M 1	50	10/5/2018 0:46	10/5/2018 14:29	0.57	Forced Outage	Affected by the outage of Angat Transformer 1 with Bucholz indication
LUZON	HYD	Angat M 2	50	10/5/2018 0:46	10/5/2018 14:29	0.57	Forced Outage	Affected by the outage of Angat Transformer 1 with Bucholz indication
LUZON	COAL	QPPL	459	10/6/2018 5:32	10/6/2018 15:27	0.41	Forced Outage	Turbine bearing high vibration
LUZON	HYD	Ambuklao 3	35	10/6/2018 8:06	10/6/2018 15:47	0.32	Maintenance Outage	Maintenance outage for trash rack cleaning
LUZON	HYD	Ambuklao 2	35	10/6/2018 8:07	10/6/2018 15:47	0.32	Maintenance Outage	Maintenance outage for trash rack cleaning
LUZON	HYD	Ambuklao 1	35	10/6/2018 8:08	10/6/2018 15:47	0.32	Maintenance Outage	Maintenance outage for trash rack cleaning
LUZON	HYD	Ambuklao 1	35	10/7/2018 8:06	10/7/2018 15:45	0.32	Maintenance Outage	Trash rack cleaning
LUZON	HYD	Ambuklao 2	35	10/7/2018 8:43	10/7/2018 15:45	0.29	Maintenance Outage	Trash rack cleaning
LUZON	HYD	Ambuklao 3	35	10/7/2018 8:43	10/7/2018 15:45	0.29	Maintenance Outage	Trash rack cleaning
VISAYAS	GEO	Leyte 1	35	10/8/2018 0:01	10/24/2018 11:52	16.49	Forced Outage	Extended GOMP to Oct 18 2018 per VSO PUSSR-2018-069
LUZON	COAL	SMC 4	150	10/8/2018 19:38	10/13/2018 15:47	4.84	Forced Outage	Primary Air Fan trouble On Commissioning Test
LUZON	HYD	Binga 2	35	10/8/2018 20:11	10/8/2018 21:21	0.05	Forced Outage	Hot spot correction of Unit Transformers for 1 and 2
LUZON	HYD	Kalayaan 1	180	10/9/2018 9:01	10/10/2018 14:32	1.23	Forced Outage	Delayed completion of intake gate inspection.
LUZON	HYD	San Roque 1	145	10/9/2018 15:01	10/9/2018 19:52	0.20	Forced Outage	Maintenance Outage
LUZON	GEO	MGPP 1	20	10/10/2018 1:43	10/10/2018 8:27	0.28	Forced Outage	Tripped at 20MW load
LUZON	GEO	Makban 2	63	10/11/2018 14:47	10/13/2018 20:39	2.24	Forced Outage	Oil leak at Main Transformer Bushing phase A
LUZON	GEO	Makban 7	20	10/11/2018 17:37	10/11/2018 19:40	0.09	Forced Outage	Affected by tripping of B-C 230kV Tie Line
LUZON	GEO	Makban 8	20	10/11/2018 17:37	10/11/2018 20:03	0.10	Forced Outage	Affected by tripping of B-C 230kV Tie Line
LUZON	HYD	Binga 1	35	10/12/2018 8:13	10/12/2018 15:58	0.32	Maintenance Outage	Total Plant shutdown for correction works at 13.8kV power cable phase A
LUZON	HYD	Binga 2	35	10/12/2018 8:13	10/12/2018 15:58	0.32	Maintenance Outage	Total Plant shutdown for correction works at 13.8kV power cable phase A
LUZON	HYD	Binga 3	35	10/12/2018 8:13	10/12/2018 15:58	0.32	Maintenance Outage	Total Plant shutdown for correction works at 13.8kV power cable phase A
LUZON	HYD	Binga 4	35	10/12/2018 8:13	10/12/2018 15:58	0.32	Maintenance Outage	Total Plant shutdown for correction works at 13.8kV power cable phase A
LUZON	GEO	MGPP 1	20	10/12/2018 15:37	10/13/2018 13:44	0.92	Forced Outage	Aux. cooling water system failure. RECLASSIFIED FROM FORCE. OMC OUTAGE
LUZON	OIL	Limay 2	60	10/12/2018 23:58			Forced Outage	Unavailable due to Flame Off starting failure
LUZON	HYD	Binga 1	35	10/13/2018 8:02	10/13/2018 15:58	0.33	Maintenance Outage	Not available due to trash rack cleaning at power intake.
LUZON	HYD	Binga 2	35	10/13/2018 8:02	10/13/2018 15:58	0.33	Maintenance Outage	Not available due to trash rack cleaning at power intake.
LUZON	HYD	Binga 3	35	10/13/2018 8:02	10/13/2018 15:58	0.33	Maintenance Outage	Not available due to trash rack cleaning at power intake.
LUZON	HYD	Binga 4	35	10/13/2018 8:02	10/13/2018 15:58	0.33	Maintenance Outage	Not available due to trash rack cleaning at power intake.
LUZON	HYD	Binga 1	35	10/14/2018 8:10	10/14/2018 15:16	0.30	Maintenance Outage	Not available due to trash rack cleaning at power intake.
LUZON	HYD	Binga 2	35	10/14/2018 8:11	10/14/2018 15:16	0.30	Maintenance Outage	Not available due to trash rack cleaning at power intake.
LUZON	HYD	Binga 3	35	10/14/2018 8:11	10/14/2018 15:16	0.30	Maintenance Outage	Not available due to trash rack cleaning at power intake.
LUZON	HYD	Binga 4	35	10/14/2018 8:11	10/14/2018 15:16	0.30	Maintenance Outage	Not available due to trash rack cleaning at power intake.
LUZON	OIL	SLPGC 4	25	10/15/2018 0:01			Maintenance Outage	Maintenance Outage until 11032018
LUZON	OIL	SLPGC 3	23	10/15/2018 0:01			Maintenance Outage	Maintenance Outage until 11032018
LUZON	GEO	Tiwi 6	57	10/15/2018 5:04	10/17/2018 14:05	2.38	Maintenance Outage	Maintenance outage
LUZON	HYD	Binga 1	35	10/15/2018 8:07	10/15/2018 15:20	0.30	Maintenance Outage	Not available due to trash rack cleaning at power intake.
LUZON	HYD	Binga 2	35	10/15/2018 8:07	10/15/2018 15:20	0.30	Maintenance Outage	Not available due to trash rack cleaning at power intake.
LUZON	HYD	Binga 3	35	10/15/2018 8:07	10/15/2018 15:20	0.30	Maintenance Outage	Not available due to trash rack cleaning at power intake.
LUZON	HYD	Binga 4	35	10/15/2018 8:07	10/15/2018 15:20	0.30	Maintenance Outage	Not available due to trash rack cleaning at power intake.
LUZON	COAL	SMC 4	150	10/15/2018 14:13			Forced Outage	On Commissioning Test.
VISAYAS	GEO	Upper Mahiao 3	32	10/16/2018 14:11	10/17/2018 1:51	0.49	Forced Outage	Tripped
LUZON	OIL	Malaya 1	300	10/16/2018 19:03	10/23/2018 14:00	6.79	Forced Outage	Emergency shutdown low vacuum and excessive leak at turbine side
LUZON	COAL	Masinloc 1	315	10/17/2018 6:51	10/22/2018 15:58	5.38	Forced Outage	Air and Gas flow restriction
VISAYAS	GEO	Leyte 3	36	10/19/2018 2:15			Planned Outage	PMS
LUZON	HYD	Magat 2	95	10/19/2018 23:34	10/20/2018 2:46	0.13	Forced Outage	Tripped by generator Differential Relay actuation. As CR-nonfirm
LUZON	GEO	Tiwi 6	57	10/21/2018 5:14	10/21/2018 8:03	0.17	Forced Outage	Tripped at 32 MW load
LUZON	GEO	Tiwi 2	59	10/21/2018 5:18	10/21/2018 6:55	0.07	Forced Outage	Tripped at 22 MW load
LUZON	NATG	Sta. Rita 3	265.5	10/21/2018 6:36	10/21/2018 17:29	0.45	Maintenance Outage	Offline compressor washing
LUZON	GEO	Tiwi 5	57	10/21/2018 6:40	10/21/2018 9:10	0.10	Forced Outage	Tripped due to low condenser vacuum
LUZON	GEO	Tiwi 2	59	10/24/2018 8:17	10/24/2018 12:32	0.18	Forced Outage	Affected by tripping of Unit 2 Main Transformer
LUZON	GEO	Makban 2	63	10/24/2018 9:21			Forced Outage	Emergency Shutdown due to unit 2 Main Transformer Oil
VISAYAS	GEO	Leyte 1	35	10/24/2018 11:52	10/24/2018 16:29	0.19	Forced Outage	Extended GOMP to Oct 18 2018 per VSO PUSSR-2018-069
LUZON	GEO	Makban 7	20	10/24/2018 12:34	10/24/2018 14:51	0.10	Forced Outage	Tripped due to low condenser vacuum.
LUZON	NATG	Sta. Rita 2	255.7	10/24/2018 21:59			Forced Outage	Steam leak at condensate pre-heater pipe.
LUZON	OIL	TMO Unit 4	46.8	10/25/2018 23:23			Planned Outage	Scheduled maintenance outage

## Methodology in Determining Interesting Pricing Events

Supply margin is defined as the MW difference between the system effective supply<sup>1</sup> and demand requirement plus reserve schedules<sup>2</sup>.

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<sup>3</sup>. 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  $\pm 3$  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.

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”.

<sup>1</sup> 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).

<sup>2</sup> 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.

<sup>3</sup> 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](http://www.albertamsa.ca).