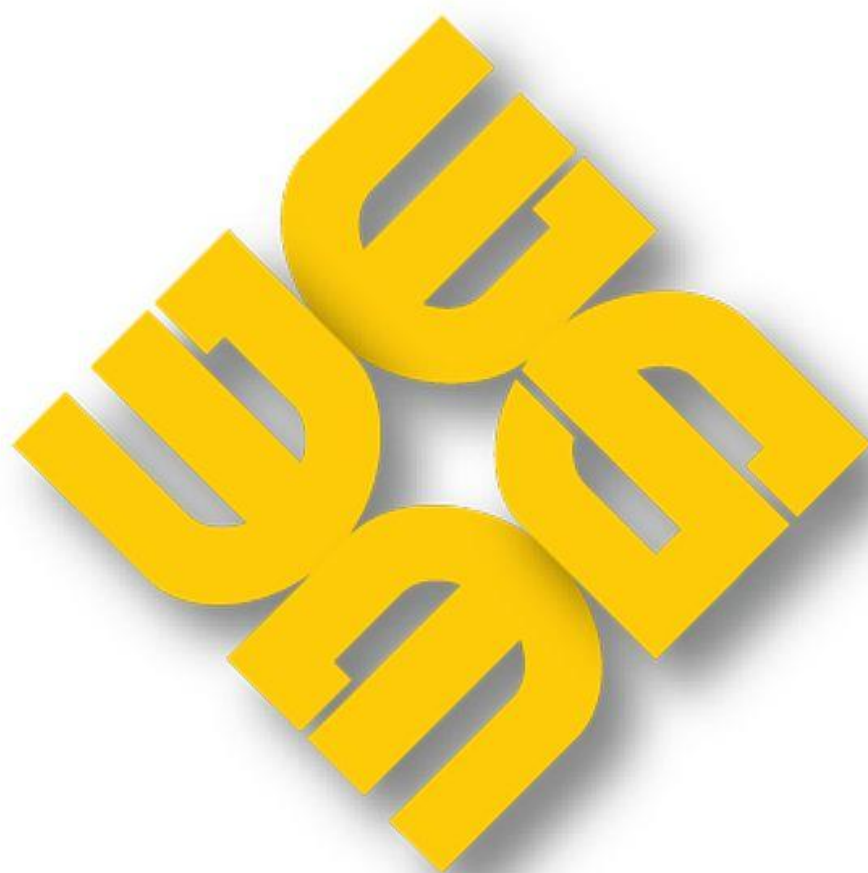


MAG-MMAR-2018-11

MONTHLY MARKET ASSESSMENT REPORT

For the Billing Period 26 October to 25 November 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 November 2018 billing period (26 October to 25 November 2018) and how the market performed compared with the previous month and year. The market prices averaged at PhP3,324/MWh this month, a decrease by 13 percent from previous month's PhP3,819/MWh following the wider supply margin observed this month. However, when this is compared to last year's November billing month, there is a slight increase of 0.8 percent from PhP3,298/MWh.

The WESM registered capacity remained at 18,882 MW by the end of November. Of said registered capacity, about 68 percent or an average of 12,911 MW was offered in the market during the month. Outage capacity (10 percent) posted a lower average this month at 1,914 MW from 2,456 MW in the previous month. This was mainly due to the resumption of operations of coal plants particularly Sual CFTPP unit 1 (with plant capacity of 647 MW), Pagbilao CFTPP units 1 and 2 (382 MW) and Masinloc CFTPP unit 1 (315 MW). Meanwhile, 13 percent was attributable to capacity not offered in the market that averaged at 2,378 MW, likewise showing an increase from last month's 1,992 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 1.6 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 lower this month by 1.2 percent at an average of 13,002 MW from previous month's 13,160 MW.

On the other hand, system demand recorded an average of 9,658 MW this month, 4.5 percent lower than previous month's 10,119 MW due to the lower temperatures and higher level of precipitation in November than October. The reserve schedule averaged at 1,071 MW. Consequently, the demand plus reserve schedule averaged at 10,729 MW, demonstrating a 4.2 percent decrease from last month's 11,196 MW.

Driven by the higher rate of decrease in demand, the supply margin was observed wider this month at 2,273 MW (15.8 percent) coming from previous month's 1,963 MW. Furthermore, this was also wider by 29.9 percent when compared with last year's supply margin of 1,750 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 November 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 453 trading intervals (61 percent) of the time and concentrated market for the remaining 291 trading intervals (39 percent) during the November billing month.

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MONTHLY MARKET ASSESSMENT REPORT

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

I. Capacity Profile

The WESM registered capacity remained at 18,882 MW by the end of the November billing month. Of the total registered capacity, about 68 percent or an average of 12,790 MW (previous month's 12,911 MW) was offered in the market during the month. Outage capacity (10 percent) posted a lower average this month at 1,914 MW from 2,456 MW in the previous month. Meanwhile, capacity not offered (13 percent) in the market increased from previous month's average at 1,992 MW to current month's 2,378 MW.

On the other hand, preferential¹ 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 1.6 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), November 2018

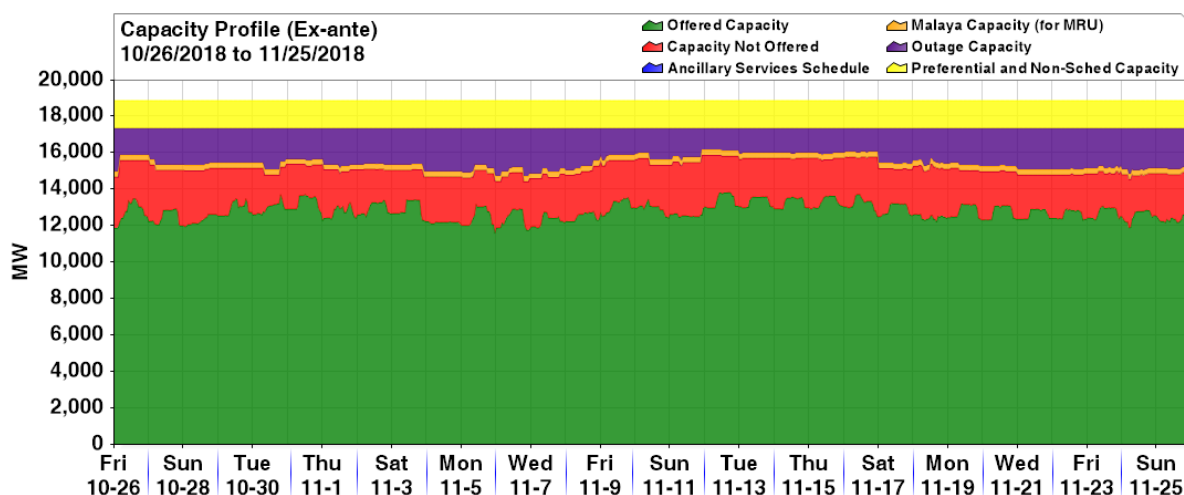


Table 1. Capacity Profile (Ex-ante), November 2018, October 2018 and November 2017

	November 2018 (In MW)		October 2018 (In MW)		November 2017 (In MW)		% M-on-M Change (Oct 2018 - Nov 2018)	% Y-on-Y Change (Nov 2017 - Nov 2018)
	Avg MW	% of RegCap	Avg MW	% of RegCap	Avg MW	% of RegCap		
Registered Capacity (end of month)	18,882				18,377		0.0	2.7
Offered Capacity	12,790	68	12,911	68	11,694	64	(0.9)	9.4
Outage Capacity	1,914	10	2,456	13	2,589	14	(22.1)	(26.1)
Capacity Not Offered	2,378	13	1,992	11	1,995	11	19.4	19.2
Malaya Capacity for MRU	300	1.6	300	0.1	590	3	0.0	(49.1)
Preferential and Non-Scheduled Capacity	1,500	8	1,500	8	1,407	8	0.0	6.6

¹ 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 averaged at 1,914 MW this month, lower by 22.1 percent from previous month's 2,456 MW. This decrease was driven by the lower outage capacity involving coal plants from 1,055 MW in October to 552 MW this month attributable to the resumption of operations of Sual CFTPP unit 1 (647 MW) on 26 October from its planned outage since 31 August and Malaya TPP unit 1 on 23 October from its forced outage since 3 September.

Despite the decreases in their month-on-month averages, coal and oil-based plants accounted for the highest portion of outage capacity at 29 percent and 28 percent, respectively. This month's outage capacity from coal plants was mainly attributable to the maintenance outage of Sual CFTPP unit 2 (647 MW) from 16 November and SLTEC CFTPP unit 2 (122.9 MW) since 18 June. Meanwhile, oil-based plants' outage capacity was attributable to the forced outage of Malaya TPP unit 2 (350 MW) since 19 May. These plants have not resumed operations until the end of the billing month.

Geothermal plants likewise recorded a lower outage capacity averaging at 399 MW (previous month's 450 MW) mainly related to the forced outage of units of Tiwi GPP A (59 MW) and Makban GPP A (63 MW) on top of the deactivated shutdown of Makban GPP C (55 MW) and Tiwi GPP B (44 MW). It was noted that one unit of Makban GPP C (55 MW) resumed its operations on 1 November from its forced outage since 12 March 2017.

Meanwhile, natural gas plants observed a higher outage capacity this month which averaged at 219 MW from a mere 19 MW in October. Noted this month were the outages of Ilijan NGPP Block A (190 MW) from 5 November until the end of the billing month as well as the maintenance outages of San Lorenzo NGPP unit 2 (261.8 MW) from 27 October to 8 November and San Lorenzo NGPP unit 1 (264.8 MW) from 27 October to 7 November.

Similarly, hydro plants recorded an increase in its average outage capacity from previous month's 164 MW to current month's 200 MW related to the planned outages of Kalayaan PSPP units 1, 2, and 3 during the month.

Year-on-year, this month's outage was 26.1 percent at an average of 1,915 MW lower compared to previous year's average at 2,589 MW.

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

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

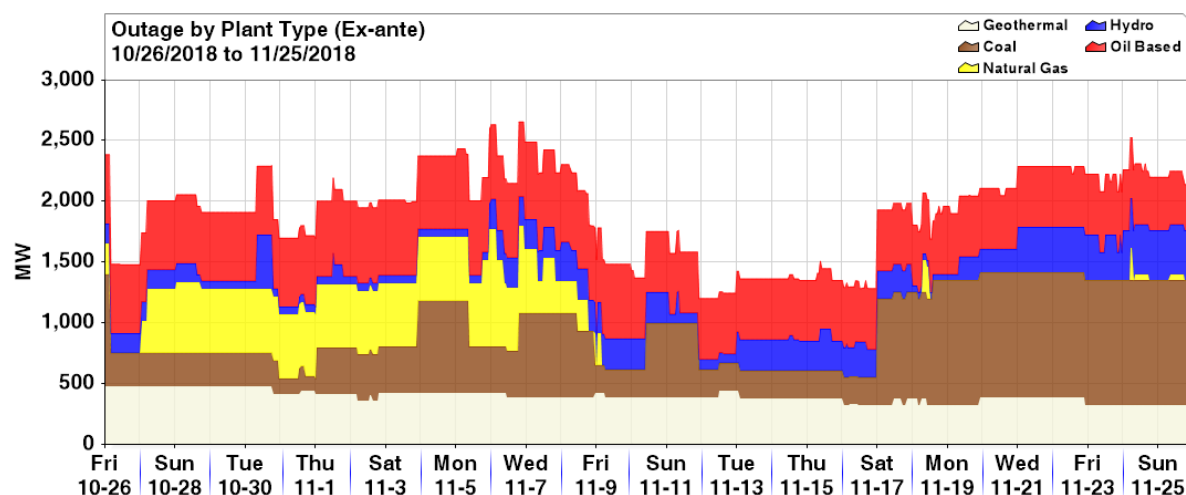


Table 2. Outage Summary (Ex-ante), November 2018, October 2018 and November 2017

Resource Type	November 2018 (In MW)			October 2018 (In MW)			November 2017 (In MW)			% M-on-M Change (Oct 2018 - Nov 2018)			% Y-on-Y Change (Nov 2017 - Nov 2018)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Coal	1,023	123	552	1,611	770	1,055	2,713	232	1,644	(36.5)	(84.0)	(47.7)	(62.3)	(47.0)	(66.4)
Natural Gas	974	0	219	266	0	19	862	0	334	266.8		1,035.4	13.0		(34.3)
Geothermal	482	328	399	530	386	450	533	258	338	(9.1)	(15.0)	(11.4)	(9.7)	27.2	18.2
Hydro	444	50	200	472	50	164	459	0	92	(5.8)	0.0	22.1	(3.3)		116.5
Oil Based	661	381	545	859	520	769	494	4	182	(23.0)	(26.7)	(29.1)	33.8	8,971.4	199.4
TOTAL	2,657	1,202	1,914	2,964	1,912	2,456	4,004	1,042	2,589	(10.4)	(37.1)	(22.1)	(33.6)	15.4	(26.1)

B. Outage Capacity by Category

Majority of the outages this month were due to forced outages, accounting for about 49 percent of the outage capacity at 949 MW. This, however, was a 29.5 percent decline from last month's 1,367 MW. Major coal plants that were on short-duration forced outages in November were Pagbilao CFTPP units 1 and 2, Masinloc CFTPP unit 1 and natural gas plant San Lorenzo NGPP units 1 and 2, Sta. Rita NGPP units 1 and 2 while SMC unit 1 (150 MW) was on forced outage started on 18 November and SLTEC CFTPP unit 2 (122.9 MW) on 18 June 2018, respectively. Oil-based plants Malaya TPP unit 2 (350 MW) was still on its forced outage that started on 19 May 2018.

Planned outage capacity was also lower this month, averaging at 367 MW from the 780 MW in October. This decrease was driven by the lower outage capacity involving coal plants from 1,055 MW in October to 552 MW this month attributable to the resumption of operations of Sual CFTPP unit 1 (647 MW) on 26 October 2018 from its planned outage since 31 August 2018. Also, Limay CCGT unit 3 (60 MW) resumed its operation on 11 November from its planned outage since 22 June and TMO DPP unit 4 (46.8 MW) on 05 November from its forced outage since 25 October. Notwithstanding, a considerable 19 percent of the total outage capacity was attributable to planned outages, mainly due to Sta. Rita NGPP unit 4 (264 MW), Kalayaan HEP units 1, 2, 3 and 4 (180 MW each), San Roque HEP unit 3 (145 MW), Kepco Salcon CFTPP unit 1 (103 MW), Makban GPP unit 4 (63 MW), Angat HEP unit 3 (50 MW), Leyte GPP Unit 3 (36 MW), Botocan HEP units 1 and 2 (10 MW).

Maintenance outage capacity averaged at 510 MW, likewise recording an increase from 239 MW in the previous month. This was mainly due to the maintenance outages recorded by coal plant Sual CFTPP unit 2 (with plant capacity of 647 MW) started on 16 November and San Lorenzo NGPP units 1 and 2 (264.8 MW and 261.8 MW) started on 27 October to 07 November 2018, respectively.

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), November 2018

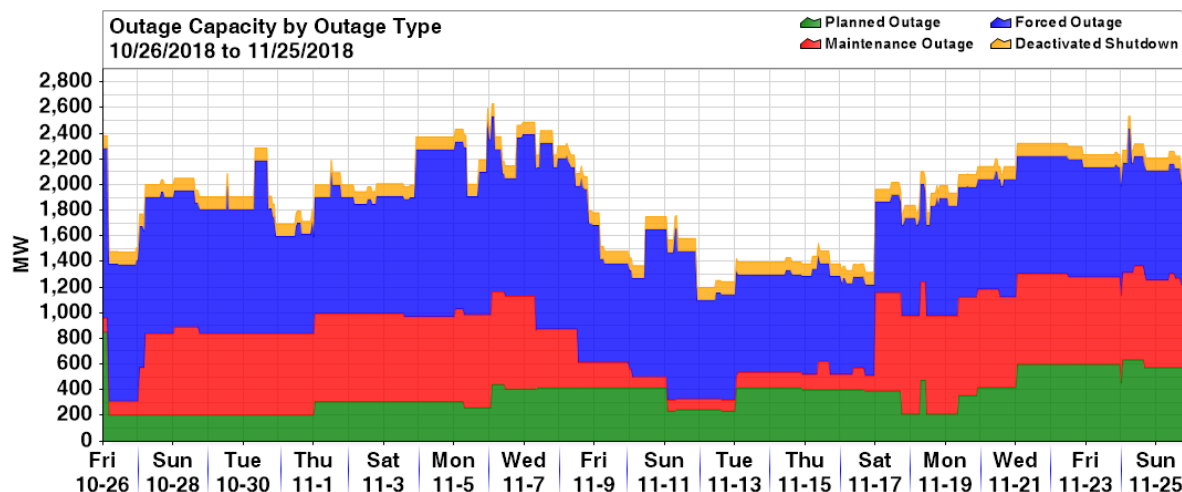


Table 3. Outage Summary, by Outage Category, November 2018 and October 2018

Resource Type	November 2018 (In MW)			October 2018 (In MW)			% M-on-M Change (Oct 2018 - Nov 2018)			% Y-on-Y Change (Nov 2017 - Nov 2018)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Planned	854	207	367	807	757	780	5.8	(72.7)	(52.9)	(19.1)	16.2	(45.0)
Maintenance	768	85	510	585	60	239	31.3	41.7	113.6	(11.3)	(15.0)	74.4
Forced	1,513	708	949	1,762	945	1,346	(14.1)	(25.1)	(29.5)	(41.8)	83.5	(38.2)
Deactivated Shutdown	99	99	99	99	99	99	0.0	0.0	(0.0)	0.0	0.0	0.0

C. Outage Factor

10.3 percent of the total registered capacity went on outage in the November billing month, a decrease from last month's 13.2 percent and last year's 14.3 percent. Oil-based plants (23.4 percent), geothermal plants (23.2 percent) and hydro plants (7.9 percent) demonstrated the highest outage factors in November, while biomass and coal plants contributed 9.8 percent and 7.3 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 5.1 percent. This is attributable to the high forced outage factor of oil-based plants at 15.8 percent and geothermal plants at 15.4 percent. Maintenance outage factor came next at 2.7 percent, with oil based plants recording the highest planned outage factor at 4.5 percent. Planned outage factor was posted at 1.9 percent this month, while outage factor related to deactivated shutdown remained at 0.5 percent.

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

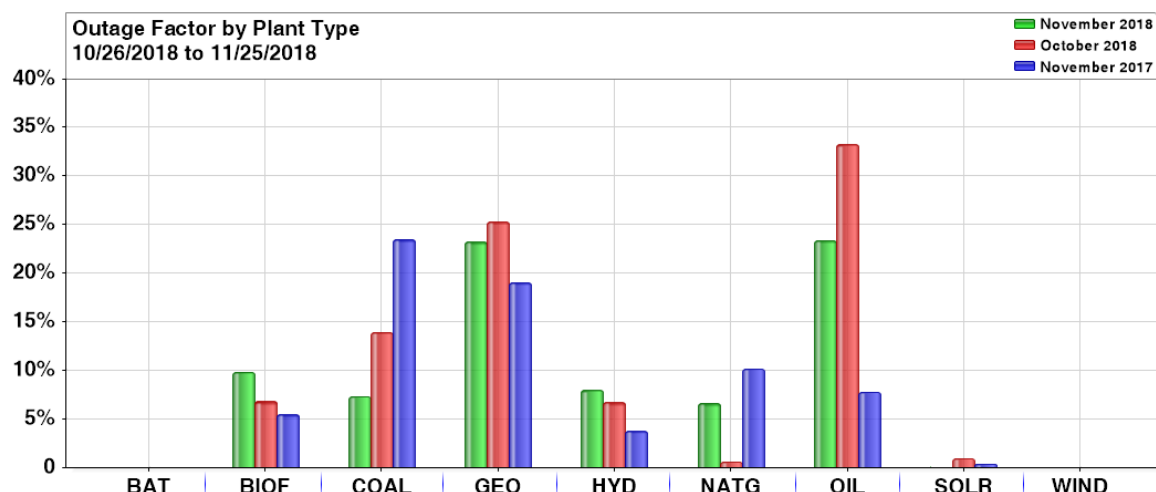


Figure 5. Outage Factor (by Outage Type), November 2018, October 2018, November 2017

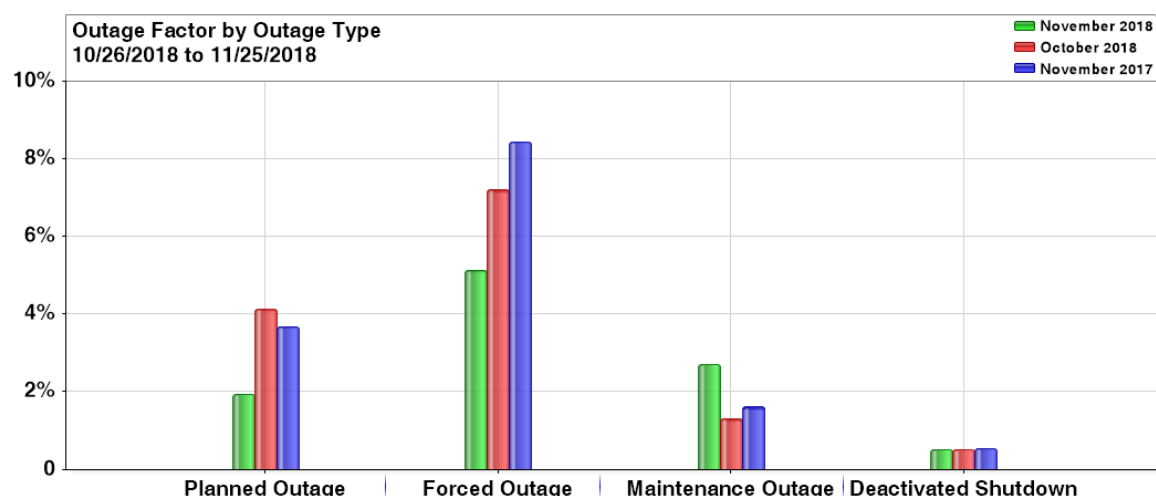


Table 4. Outage Factor, November 2018, October 2018, November 2017

Plant Type	Total Outage Factor			Forced Outage Factor			Maintenance Outage Factor			Planned Outage Factor			D/S Outage Factor		
	Nov 2018	Oct 2018	Nov 2017	Nov 2018	Oct 2018	Nov 2017	Nov 2018	Oct 2018	Nov 2017	Nov 2018	Oct 2018	Nov 2017	Nov 2018	Oct 2018	Nov 2017
BAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BIOF	9.8	6.8	5.5	8.4	6.2	2.1	1.4	0.6	0.8	0	0	2.5	0	0	0
COAL	7.3	13.9	23.5	3.7	3.6	17.7	2.5	1.8	0.9	1.1	8.5	4.9	0	0	0
GEO	23.2	25.4	19	15.4	18.2	9.7	0.8	1	2.6	1.4	0.6	1.1	5.5	5.5	5.6
HYD	7.9	6.7	3.7	0.6	3.7	0.9	0.1	0.5	1.6	7.2	2.5	1.3	0	0	0
NATG	6.6	0.6	10.2	0.4	0.5	0.1	6.2	0.1	2.5	0	0	7.6	0	0	0
OIL	23.4	33.2	7.8	15.8	27.6	4.1	4.5	3	2.7	3.2	2.6	1	0	0	0
SOLR	0.1	0.9	0.4	0.1	0.2	0.4	0	0.7	0	0	0	0	0	0	0
WIND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	10.3	13.2	14.3	5.1	7.2	8.4	2.7	1.3	1.6	1.9	4.1	3.7	0.5	0.5	0.5

III. Demand and Supply Situation

System demand² posted a 4.5 percent decrease this month to an average of 9,658 MW from previous month's 10,119 MW brought about by the lower temperatures and observance of holidays from 1 and 2 November. Weekly average system demand ranged from 9,055 MW (29

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

Oct to 4 Nov) to 9,964 MW (12 to 18 Nov). Year-on-year, this year's average demand was 6.5 percent higher than previous year's 9,066 MW.

For this period, the reserve schedule averaged at 1,071 MW. Consequently, the demand plus reserve schedule averaged at 10,729 MW, demonstrating a 4.2 percent decrease from last month's 11,196 MW and 7.4 percent increase from last year's 9,993 MW.

Average effective supply³ likewise observed a 1.2 percent decrease this month at 13,002 MW from previous month's 13,160 MW attributable to the lower level of capacity offered in the market. Weekly average effective supply ranged from 12,808 MW (26 to 28 October) up to 13,320 MW (12 to 18 November). Similar with the year-on-year comparison of average demand, this year's average effective supply was higher than previous year's 11,743 MW.

Driven by the higher rate of decrease in demand, supply margin⁴ increased by 15.8 percent this month at 2,273 MW coming from previous month's 1,963 MW. On a similar note, this month's average supply margin was higher when compared to previous year's 1,750 MW.

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

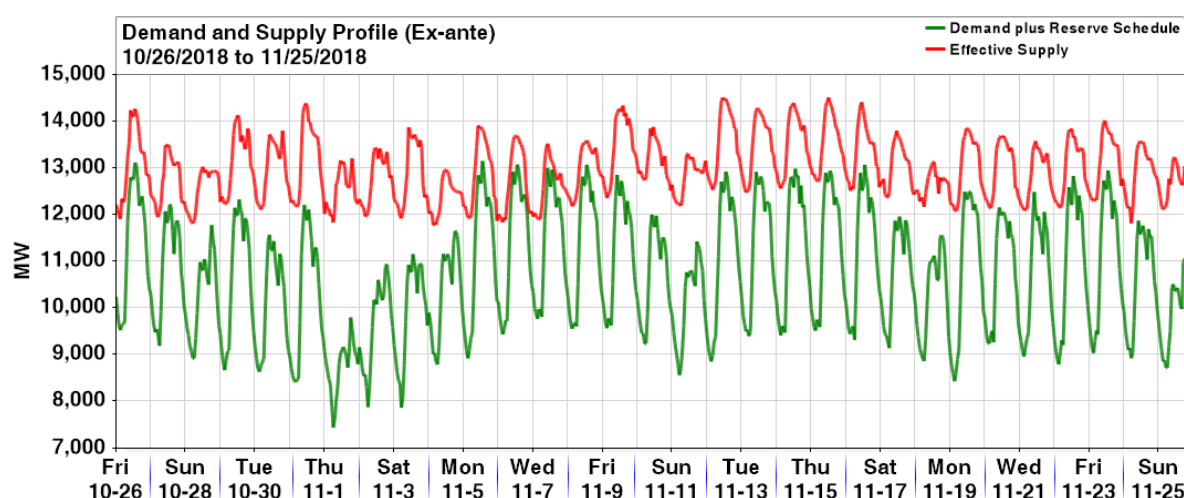


Table 5. Demand and Supply Summary (Ex-ante), November 2018, October 2018 and November 2017

	November 2018 (in MW)			October 2018 (in MW)			November 2017 (in MW)			% M-on-M Change (Oct 2018 - Nov 2018)			% Y-on-Y Change (Nov 2017 - Nov 2018)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Demand	11,957	6,851	9,658	12,249	7,812	10,119	11,365	5,986	9,066	(2.4)	(12.3)	(4.5)	5.2	14.4	6.5
Reserve Schedule	1,498	592	1,071	1,446	760	1,078	1,202	631	926	3.5	(22.1)	(0.7)	24.6	(6.1)	15.6
Demand plus R/S	13,152	7,443	10,729	13,505	8,832	11,196	12,395	6,888	9,993	(2.6)	(15.7)	(4.2)	6.1	8.1	7.4
Effective Supply	14,510	11,776	13,002	14,472	11,908	13,160	13,872	10,058	11,743	0.3	(1.1)	(1.2)	4.6	17.1	10.7
Supply Margin	4,655	176	2,273	3,732	241	1,963	3,434	284	1,750	24.8	(27.1)	15.8	35.6	(38.2)	29.9

Note: The derived values were non-coincident.

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

	26 to 28 Oct 2018 (in MW)			29 Oct to 4 Nov 2018 (in MW)			5 to 11 Nov 2018 (in MW)			12 to 18 Nov 2018 (in MW)			19 to 25 Nov 2018 (in MW)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Demand	11,957	8,076	9,867	11,053	6,851	9,055	11,801	7,538	9,941	11,848	7,798	9,964	11,579	7,426	9,585
Reserve Schedule	1,388	683	989	1,322	592	924	1,498	839	1,144	1,319	879	1,116	1,436	884	1,135
Demand plus R/S	13,113	8,926	10,855	12,328	7,443	9,978	13,152	8,568	11,085	13,072	8,860	11,079	12,948	8,437	10,720
Effective Supply	14,268	11,818	12,808	14,386	11,776	12,852	14,339	11,841	12,963	14,510	12,168	13,320	14,015	11,819	12,956
Supply Margin	3,122	932	1,953	4,655	867	2,874	3,672	176	1,878	3,759	976	2,241	3,651	822	2,237

³The 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).

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

IV. Market Price Outcome⁵

A. Market Prices

Market prices recorded an average of PhP3,324/MWh this month, lower by 13 percent from previous month's PhP3,819/MWh following the wider supply margin observed this month. Year-on-year, a slight increase of 0.8 percent was observed in average price from previous year's PhP3,298/MWh.

Prices were generally below PhP8,000/MWh throughout the billing month except from 5 to 7 November. Relatively tight supply margin was observed during the three days which averaged at 1,400MW compared to 2,367 MW in the other days of the month. High level of outage was observed during the period averaging at 2,330 MW (1,870 MW average during the other days of the month) attributable to the outages of SLTEC CFTPP unit 2 (123 MW), SLPGC CFTPP unit 1 (150 MW) and Pagbilao CFTPP unit 1 (382 MW), San Lorenzo NGPP units 1 (264.8 MW) and unit 2 (261.8 MW), Ilijan NGPP Block A (190 MW), and Sta. Rita NGPP unit 1 (257.3 MW) and Kalayaan PSPP unit 2 (180 MW). As a result, prices averaged at PhP6,512/MWh and reached as high as PhP32,077/MWh on 7 November at 1900H.

The weekly average prices ranged from PhP2,803/MWh from 29 October to 4 November up to PhP4,566/MWh from 5 to 11 November.

Figure 7. Market Price Trend, November 2018

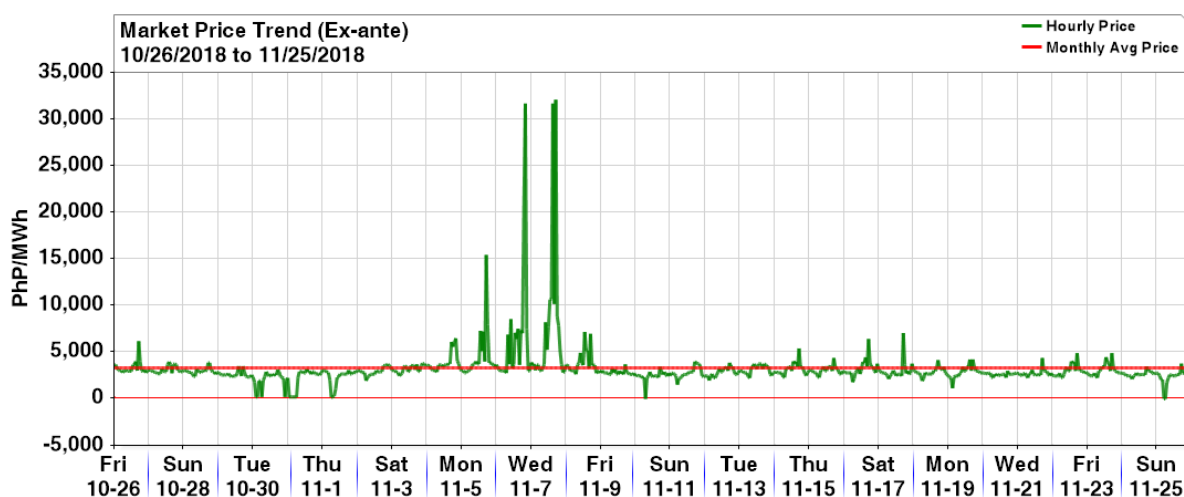


Table 7. Market Price Summary, November 2018, October 2018 and November 2017

	November 2018 (In PhP/MWh)			October 2018 (In PhP/MWh)			November 2017 (In PhP/MWh)			% M-on-M Change (Oct 2018 - Nov 2018)			% Y-on-Y Change (Nov 2017 - Nov 2018)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Luz-Vis	32,077	0	3,324	31,707	654	3,819	12,490	0	3,298	1.2	(100.0)	(13.0)	156.8		0.8
Luzon	32,493	0	3,322	31,635	2,316	3,822	12,490	0	3,318	2.7	(100.0)	(13.1)	160.2		0.1
Visayas	31,664	0	3,336	32,187	-10,702	3,808	12,490	-9,143	3,192	(1.6)	(100.0)	(12.4)	153.5	(100.0)	4.5

⁵The 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 8. Weekly Market Price Summary, November 2018

	26 to 28 Oct 2018 (in PhP/MWh)			29 Oct to 4 Nov 2018 (in PhP/MWh)			5 to 11 Nov 2018 (in PhP/MWh)			12 to 18 Nov 2018 (in PhP/MWh)			19 to 25 Nov 2018 (in PhP/MWh)		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Luz-Vis	6,188	2,411	3,171	6,496	191	2,803	32,077	0	4,566	7,062	1,794	3,102	4,903	0	2,826

The market prices in Luzon averaged at PhP3,322/MWh, higher by 0.4 percent than the PhP3,336/MWh recorded in the Visayas region.

Figure 8. Market Price Trend - Luzon, November 2018

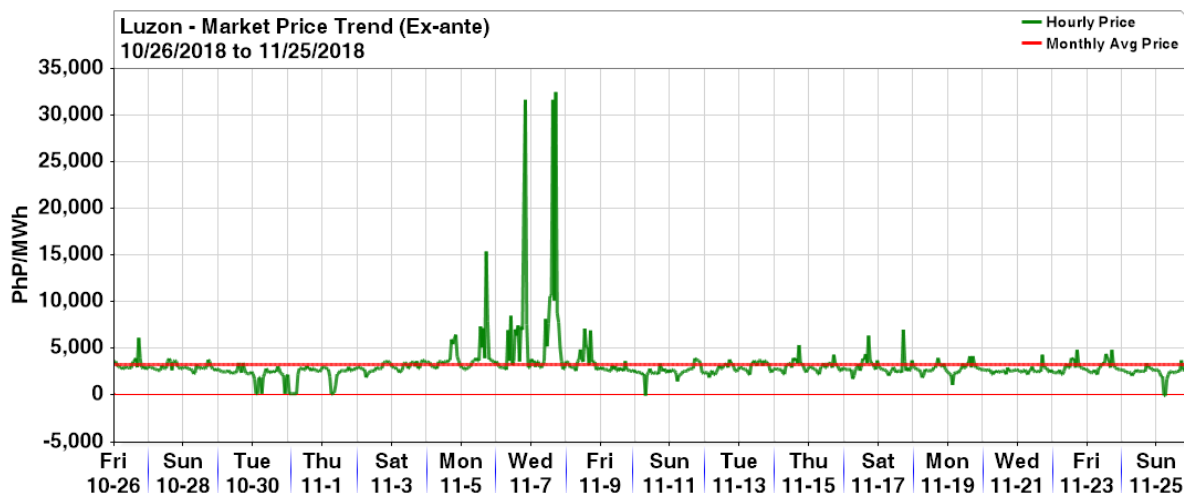


Figure 9. Market Price Trend - Visayas, November 2018

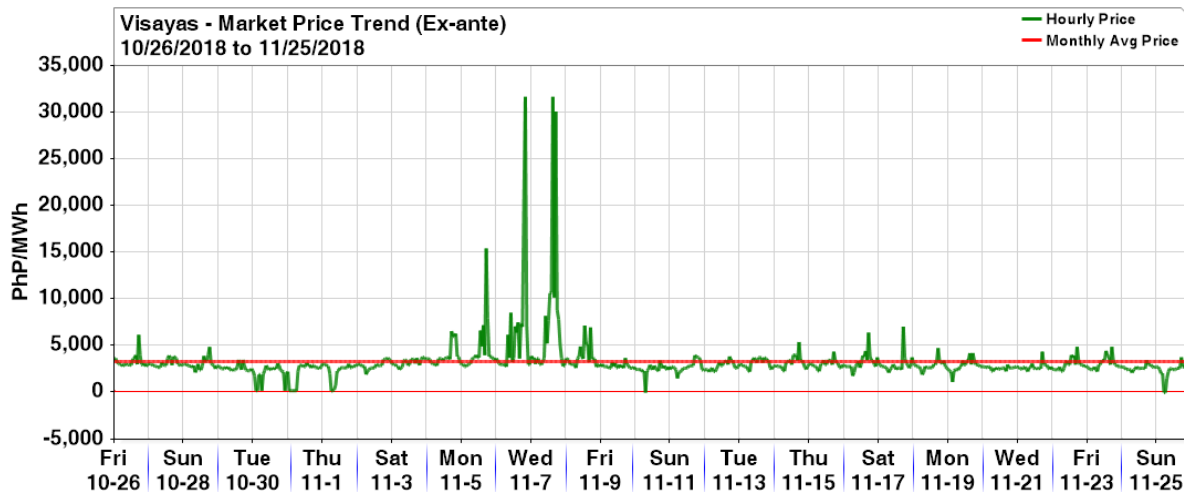


Table 9. Regional Price Summary – November 2018, October 2018 and November 2017

	Luzon (In PhP/MWh)			Visayas (In PhP/MWh)			% Difference		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
November 2018	32,493	0	3,322	31,664	0	3,336	2.6		(0.4)
October 2018	31,635	2,316	3,822	32,187	-10,702	3,808	(1.7)	(121.6)	0.4
November 2017	12,490	0	3,318	12,490	-9,143	3,192	(0.0)	(100.0)	4.0

B. Price Distribution

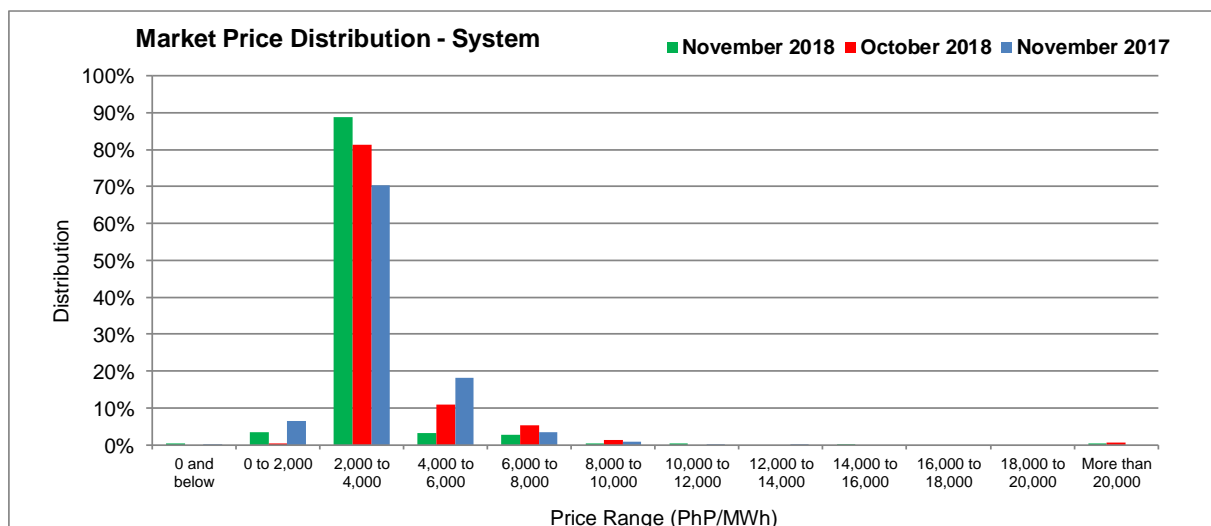
Consistent with the decrease in month-on-month average prices, higher frequency of prices below PhP4,000/MWh was noted this month at 92.6 percent from 81.8 percent in the previous month. Also, lower frequent was recorded at above PhP20,000/MWh from 0.7 percent in October to 0.5 percent this November.

In addition, lower frequency of prices at PhP4,000/MWh up to PhP16,000/MWh from previous month's 17.5 percent to current month's 6.9 percent.

Figure 10. Price Distribution, November 2018, October 2018 and November 2017

Price Range (PhP/MWh)	% Distribution		
	November 2018	October 2018	November 2017
0 and below	0.4	0.0	0.1
0 to 2,000	3.5	0.4	6.5
2,000 to 4,000	88.7	81.4	70.3
4,000 to 6,000	3.2	11.0	18.1
6,000 to 8,000	2.7	5.3	3.5
8,000 to 10,000	0.4	1.3	0.9
10,000 to 12,000	0.4	0.0	0.3
12,000 to 14,000	0.0	0.0	0.3
14,000 to 16,000	0.1	0.0	0.0
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	0.5	0.7	0.0

Table 10. Price Distribution – November 2018, October 2018 and November 2017



C. Price Duration Curve

The price duration curves for both the off-peak⁶ and peak⁷ hours demonstrate that market prices during the peak hours were higher when compared with off-peak hours.

⁶Off-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

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

Majority of the prices during off-peak hours (92 percent) were above PhP2,000/MWh to PhP4,000/MWh. On the other hand, while a higher portion of the prices during peak hours were likewise above PhP2,000/MWh to PhP4,000/MWh (83.7 percent), the remaining market prices were above PhP6,000/MWh to PhP21,000/MWh (16.2 percent). As shown in Figure 12, 83.7 percent of the prices during peak hours ranged above PhP2,000/MWh to PhP4,000/MWh. Meanwhile, another 7.3 percent were above PhP6,000/MWh to PhP8,000/MWh, while 5.3 percent ranged above PhP8,000/MWh to PhP10,000/MWh. The remaining 2.3 percent were above PhP10,000/MWh and above.

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

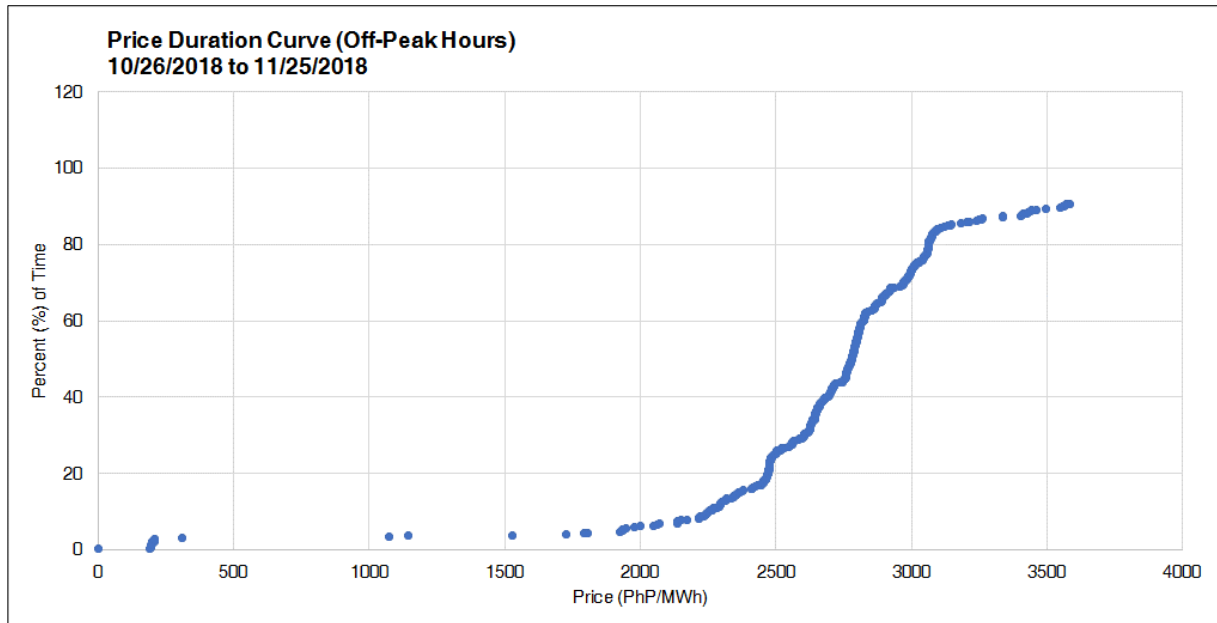
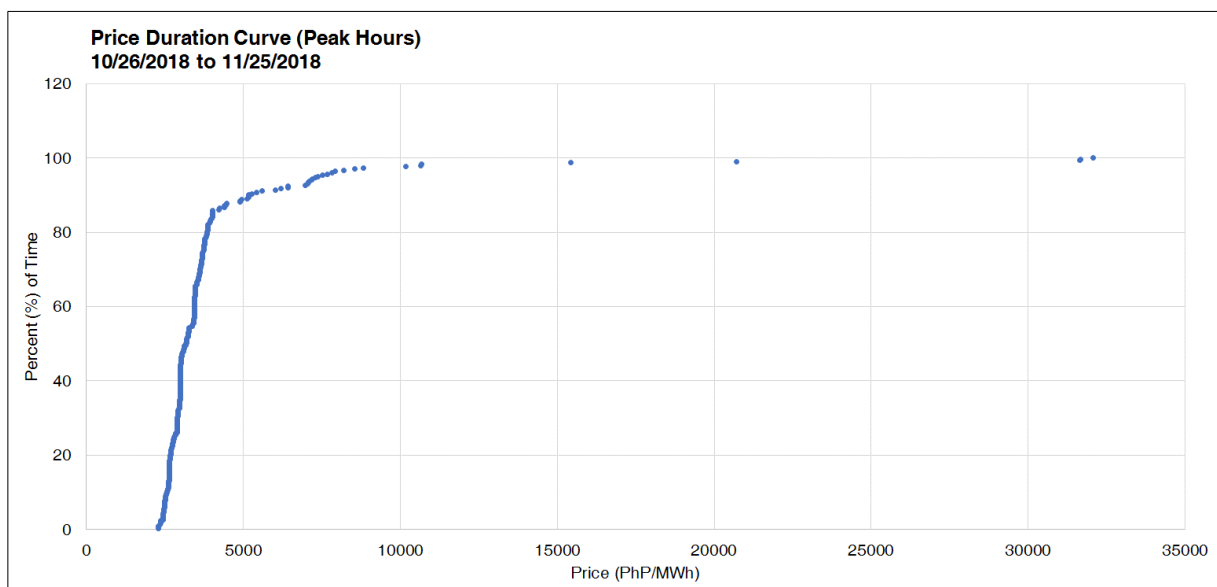


Figure 12. Price Duration Curve (Peak Period), November 2018



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.

Out of the 744 trading intervals, five (5) intervals have market prices above the upper reference price thresholds, and are therefore tagged as interesting pricing events. On the other hand, no interval has a price below the lower price threshold. Moreover, the secondary price cap was not imposed during the billing period. The market prices on 05 November at 1800H, 06 November at 2000H and 2100H as well as the market prices on 07 November at 1600H and 1800H were interesting pricing events.

Figure 13. Supply Margin and Market Price, November 2018

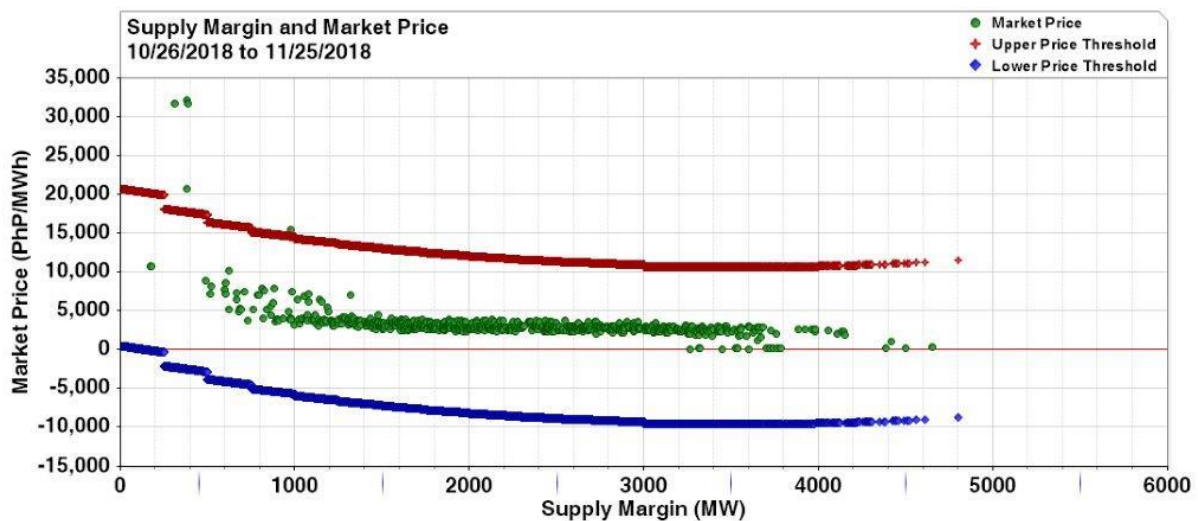


Table 11. Interesting Pricing Events – November 2018

Date	Hour	Market Price (Php/MWh)	Supply Margin (MW)	Reference Price Threshold (Php/MWh)
11/05/2018	18	15,433	977	14,625
11/06/2018	20	20,716	381	17,746
11/06/2018	21	31,664	311	17,957
11/07/2018	18	32,077	385	17,734
11/07/2018	16	31,652	390	17,718

V. Pricing Errors and Market Intervention

System-wide non-congestion pricing errors affected 68 trading intervals or 9.1 percent of the time in the ex-ante and 14 trading intervals or 1.9 percent of the time in the ex-post during the November billing month, related to load shedding. This posted a decrease from previous month’s non-congestion pricing error occurrences that affected 86 trading intervals or 11.9 percent of the time during the ex-ante and 41 trading intervals or 5.7 percent of the time during the ex-post.

In Luzon, the frequency of issuances of non-congestion pricing errors affected 58 trading intervals or 7.8 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 39 trading intervals or 5.4 percent of the time. The ex-post figures were the same for September and October.

In Visayas, non-congestion pricing errors affected three (3) trading intervals or 0.4 percent of the time, lower than last month's 4 trading intervals or 0.6 percent of the time in the ex-ante and five (5) trading intervals or 0.7 percent of the time were affected in the ex-post, higher than last month's four (4) trading intervals or 0.6 percent of the time.

Meanwhile, a decrease in the system-wide application of Price Substitution Methodology (PSM) was observed this month, affecting a total of 111 trading intervals or 14.9 percent of the time (previous month's 126 trading intervals or 17.5 percent of the time) in the ex-ante and 118 trading intervals or 15.9 percent of the time (previous month's 81 trading intervals or 11.3 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).

Table 12. PEN, PSM and MI Summary, November 2018

	Luz-Vis		Luzon		Visayas		Total	
	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time
PEN (RTD)	7	0.9	58	7.8	3	0.4	68	9.1
PEN (RTX)	7	0.9	2	0.3	5	0.7	14	1.9
PSM (RTD)	111	14.9	-	-	-	-	111	14.9
PSM (RTX)	117	15.7	-	-	1	0.1	118	15.9

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 58 trading intervals in the ex-ante were related to base case and 14 trading intervals in the ex-post were related to load shedding and 7 trading intervals related inappropriate input data.

In Luzon, pricing errors due to base case constraint affected 55 trading intervals in the ex-ante while pricing errors due to load shedding affected eleven (11) trading intervals in the ex-ante and nine (9) trading intervals in the ex-post.

On the other hand, pricing errors due to base case affected three (3) trading intervals in the Visayas during the ex-ante and pricing errors due to load shedding affected five (5) trading intervals during the ex-post.

Table 13. PEN Type Summary, November 2018

	Luz-Vis		Luzon		Visayas		Total	
	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time	Freq.	% of Time
PEN (RTD)	7	0.9	66	8.9	3	0.4	76	10.2
Contingency	-	-	-	-	-	-	-	-
Base Case	-	-	55	7.4	3	0.4	58	7.8
Over-generation	-	-	-	-	-	-	-	-
VoLL	-	-	11	1.5	-	-	11	1.5
Inappropriate Input Data	7	0.9	-	-	-	-	7	0.9
PEN (RTX)	7	0.9	9	1.2	5	0.7	21	2.8
Contingency	-	-	-	-	-	-	-	-
Base Case	-	-	-	-	-	-	-	-
Over-generation	-	-	-	-	-	-	-	-
VoLL	-	-	9	1.2	5	0.7	14	1.9
Inappropriate Input Data	7	0.9	-	-	-	-	7	0.9

VI. HVDC Scheduling

Power flow through the HVDC Interconnection was generally directed towards the Luzon region for 577 trading intervals in the ex-ante during the billing month.

On the other hand, the HVDC power flow was directed towards the Visayas for 143 trading intervals in the ex-ante during the billing month, with schedules ranging from 1 MW to 250 MW. It was noted that the 420-MW limit was maximized for two (2) trading intervals during the billing month.

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

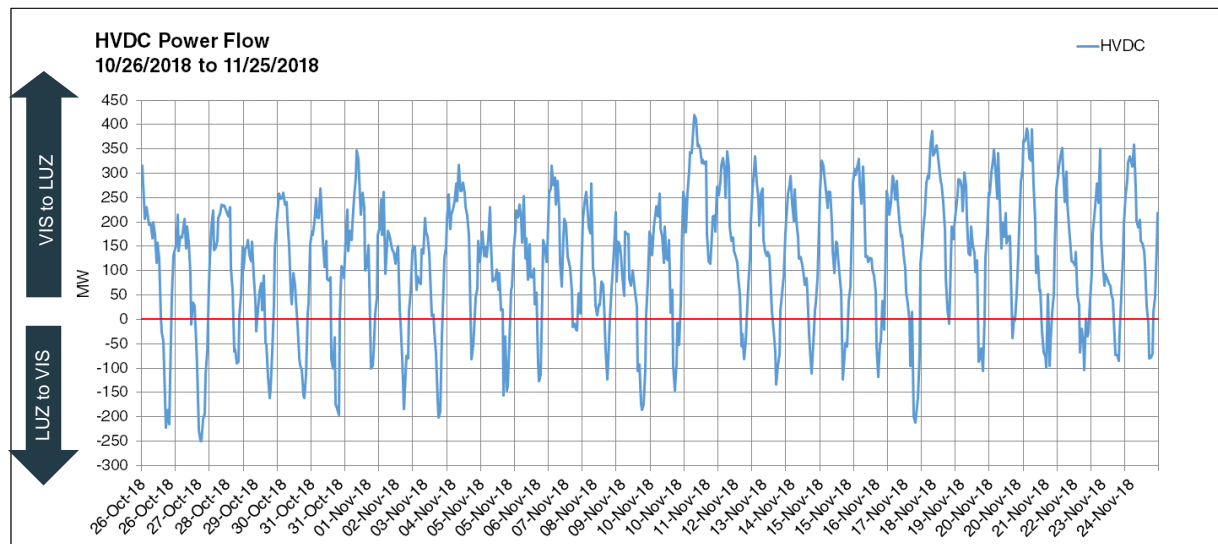


Table 14. Summary of HVDC Limits Imposed by NGCP-SO and Results of HVDC Schedules (Ex-ante and Ex-post), November 2018

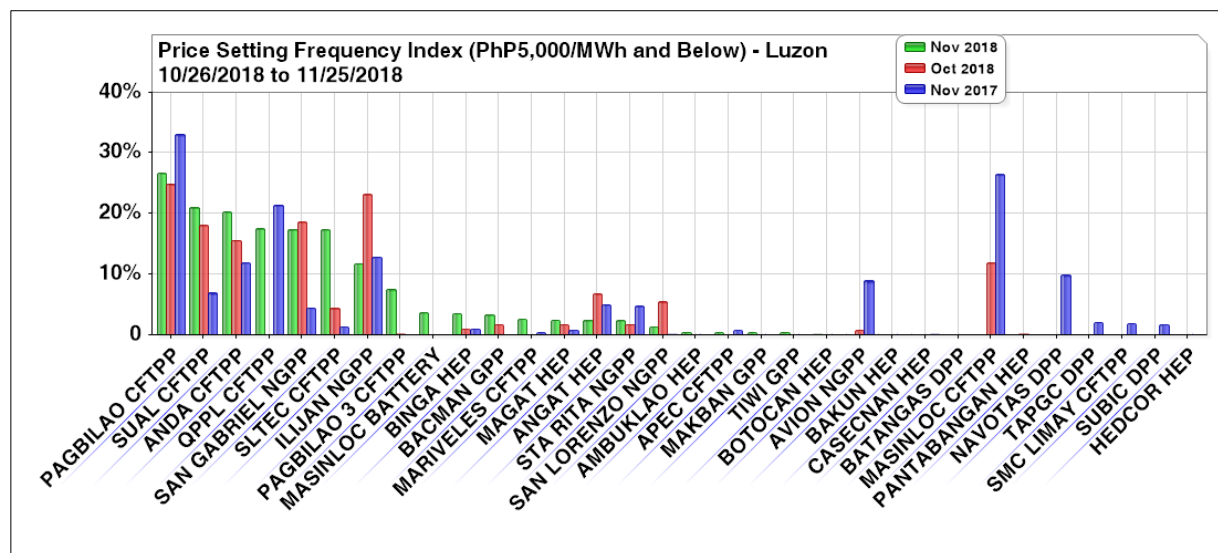
Results of HVDC Scheduling	HVDC Limit during Ex-ante (Visayas/Luzon)			HVDC Limit during Ex-post (Visayas/Luzon)		
	(No. of Trading Intervals)			(No. of Trading Intervals)		
	250/420	250/400	Total	250/420	250/400	Total
Visayas to Luzon	577	24	601	580	24	604
Limit Not Maximized	577	23	600	579	24	603
Limit Maximized ^{†1}		1	1	1		1
Luzon to Visayas	143	-	143	140	-	140
Limit Not Maximized	141		141	139		139
Limit Maximized ^{†1}	2		2	1		1
No Flow ^{†1}			-			-
TOTAL	720	24	744	720	24	744

VII. Price Setting Plants⁸

About 94.9 percent of the market prices in November 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 26.7 percent of the time during the month, followed by Sual CFTPP at 21.0 percent, Anda CFTPP at 20.3 percent, QPPL CFTPP at 17.5 percent, San Gabriel NGPP and SLTEC CFTPP both at 17.3 percent.

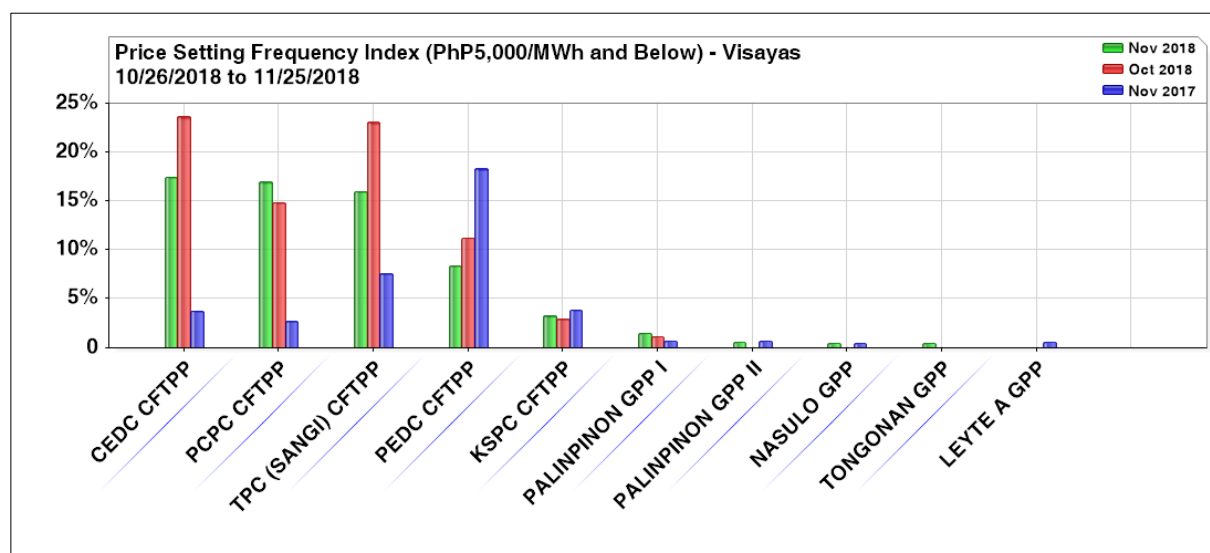
In the Visayas, coal plants CEDC CFTPP, PCPC CFTPP, TPC (Sangi) CFTPP, and PEDC CFTPP were the most frequent price-setters at below PhP5,000/MWh, setting the price at 17.5 percent, 16.9 percent, 16.0 percent and 8.3 percent of the time, respectively, during the month.

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



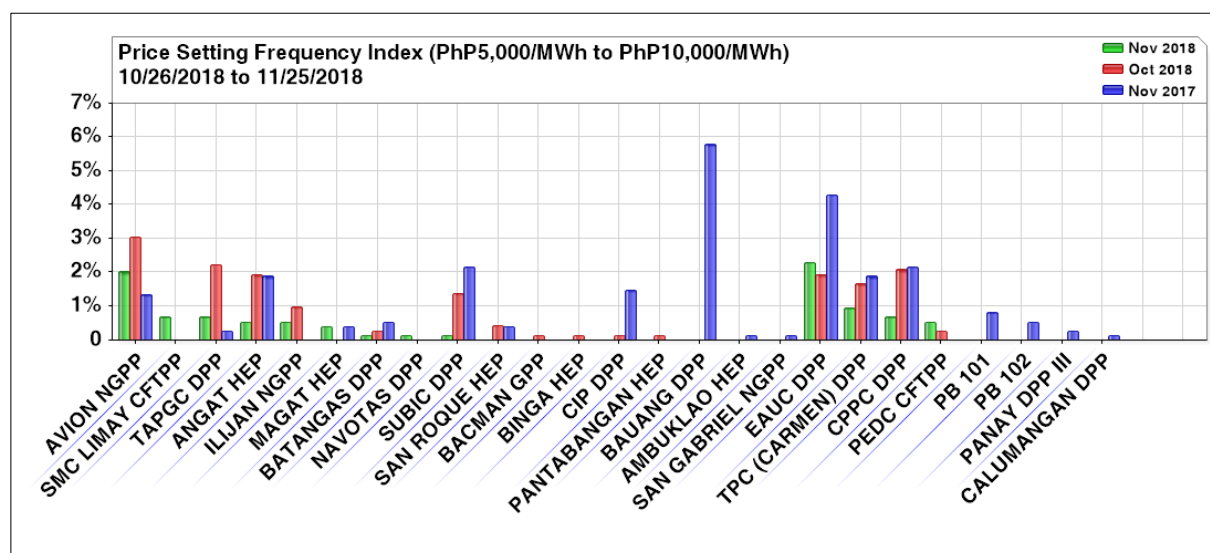
⁸ A generator trading node is considered as a price setter when its last accepted offer price is between 95% to 100% of its nodal price. A generating plant is considered as price setter if at least one of its trading nodes was price setter in a given trading hour. The determination of the price setter/s 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, November 2018, October 2018 and November 2017



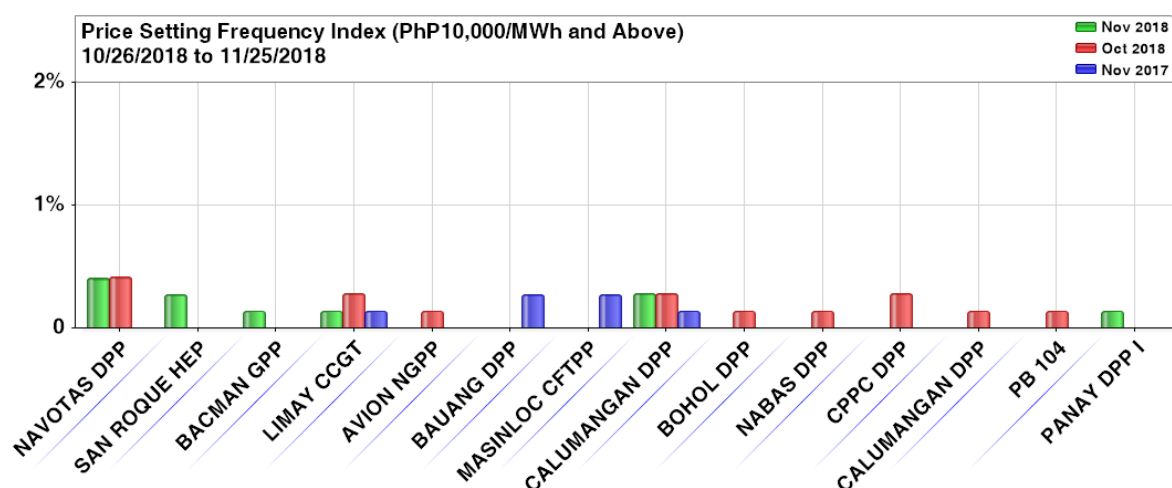
Market prices ranged above PhP5,000/MWh to PhP10,000/MWh at 4.03 percent of the time during the month, a marked decrease from last month's 10 percent. Oil-based, coal and natural gas plants obtained the highest frequencies in setting the prices at this level, topped by EAUC DPP at 2.3 percent, Avion NGPP at 2.0 percent, TPC (Carmen) DPP at 0.9 percent, SMC Limay CFTPP, TAPGC DPP and CPPC DPP at 0.7 percent each, Angat HEP, Ilijan NGPP and PEDC CFTPP also at 0.5 percent, Magat HEP at 0.4, Batangas DPP, Navotas DPP and Subic DPP at 0.1 percent.

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



Market prices above PhP10,000/MWh were noted at 1.07 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. San Roque HEP and Calumangan DPP were next on the list at 0.3 percent, followed by Bacman GPP, Limay CCGT and Panay DPP I at 0.1 percent each.

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

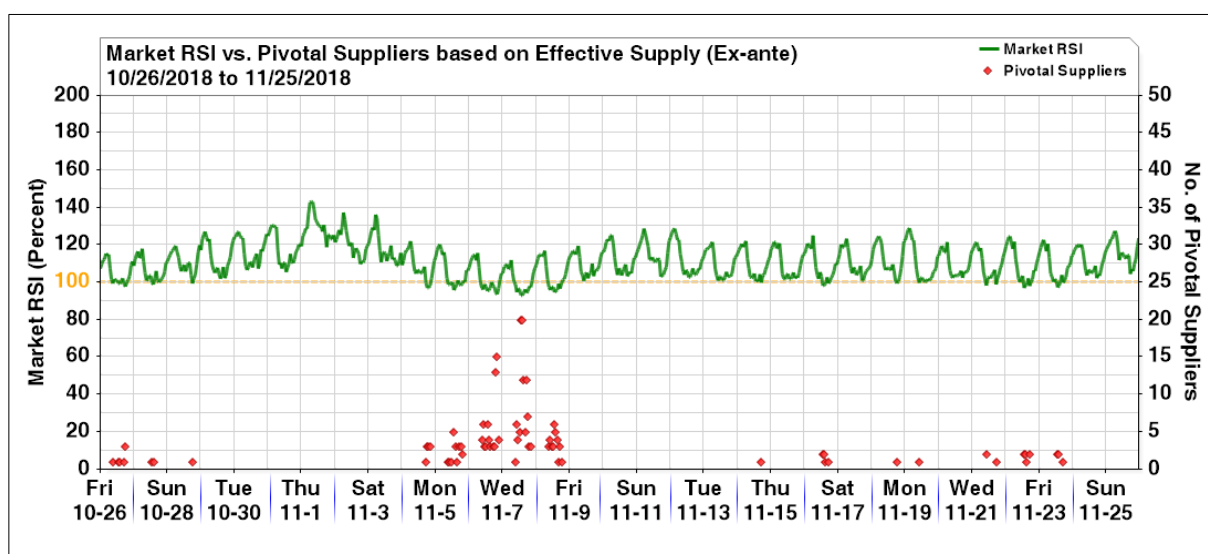


VIII. Residual Supply

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

The hourly market RSI exceeded the 100 percent mark for 90 percent of the time or in 673 trading intervals, an increase from previous month's 79 percent or 569 trading intervals. This indicated that fewer trading intervals had pivotal suppliers.

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



⁹ 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 Suppliers¹⁰

A total of 17 Luzon plants emerged as pivotal suppliers during the November billing month led by natural gas plants Ilijan NGPP for having been pivotal for 9.4 percent of the time and Sta. Rita NGPP for 6.5 percent. Other Luzon plants namely Sual CFTPP, Pagbilao CFTPP, and Mariveles CFTPP.

Three (3) Visayas plants namely Leyte A GPP, PEDC CFTPP, and CEDC CFTPP emerged as pivotal supplier this billing month at 0.8 percent, 0.4 percent, and 0.3 percent, respectively.

Figure 20. Pivotal Supplier Frequency Index - Luzon, November 2018

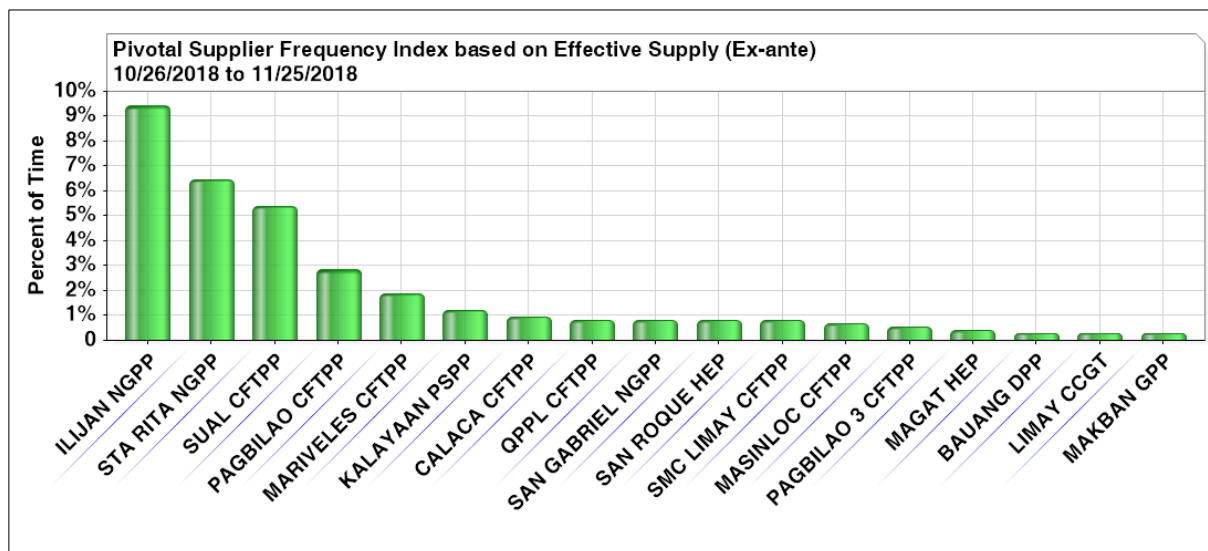
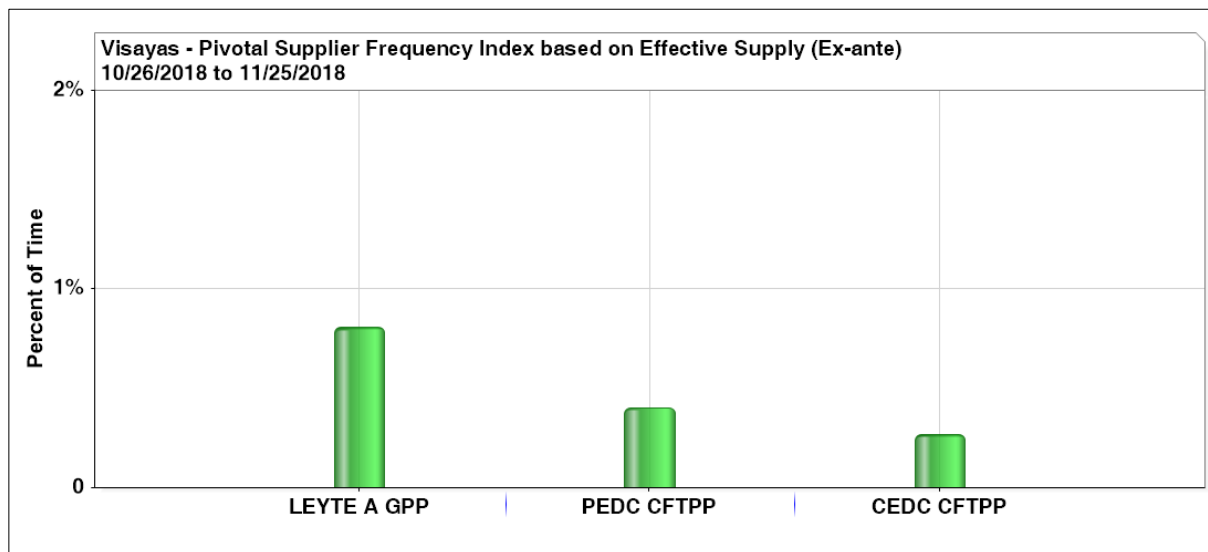


Figure 21. Pivotal Supplier Frequency Index - Visayas, November 2018

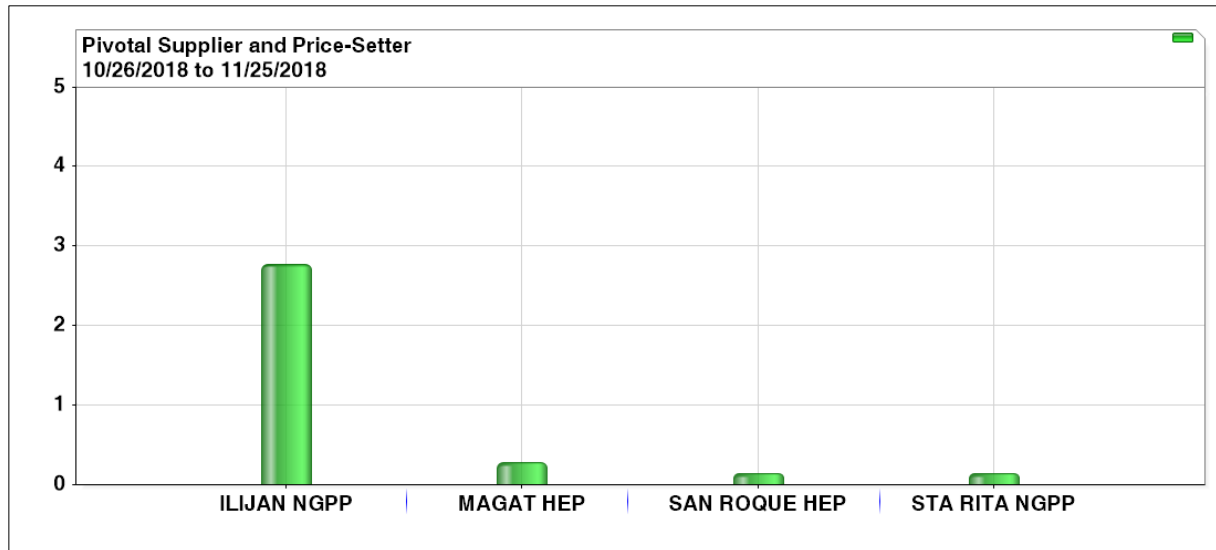


¹⁰ The Pivotal Supply Index (PSI) measures how critical a particular generator is in meeting the total demand at a particular time. It is a binary variable (1 for pivotal and 0 for not pivotal) which measures the frequency that a generating is pivotal for a particular period.

X. Price-Setters and Pivotal Plants

Natural gas plants Ilijan NGPP, Sta. Rita NGPP and hydro plants Magat HEP and San Roque HEP became price setters while it was pivotal for 2.8, 0.28, 0.1 and 0.1 percent of the time respectively during the November billing month.

Figure 22. PSI vs. PSFI, November 2018

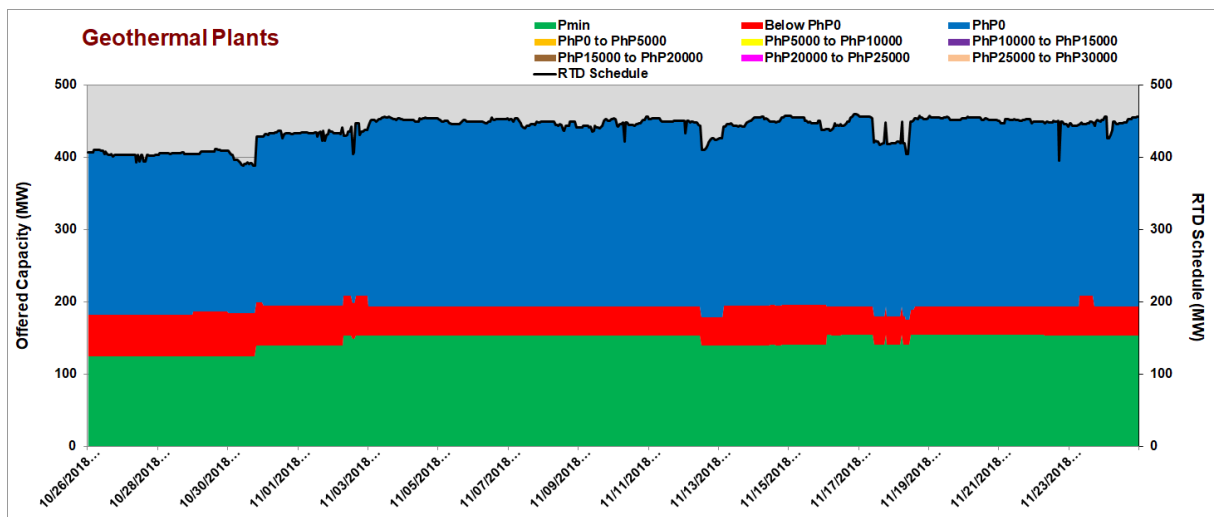


XI. Generator Offer Pattern

Geothermal plants in Luzon submitted almost its entire capacity (99.9 percent) at PhP0/MWh and below. About 56.3 percent of the offer prices were at exactly PhP0/MWh, while the remaining 43.6 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.

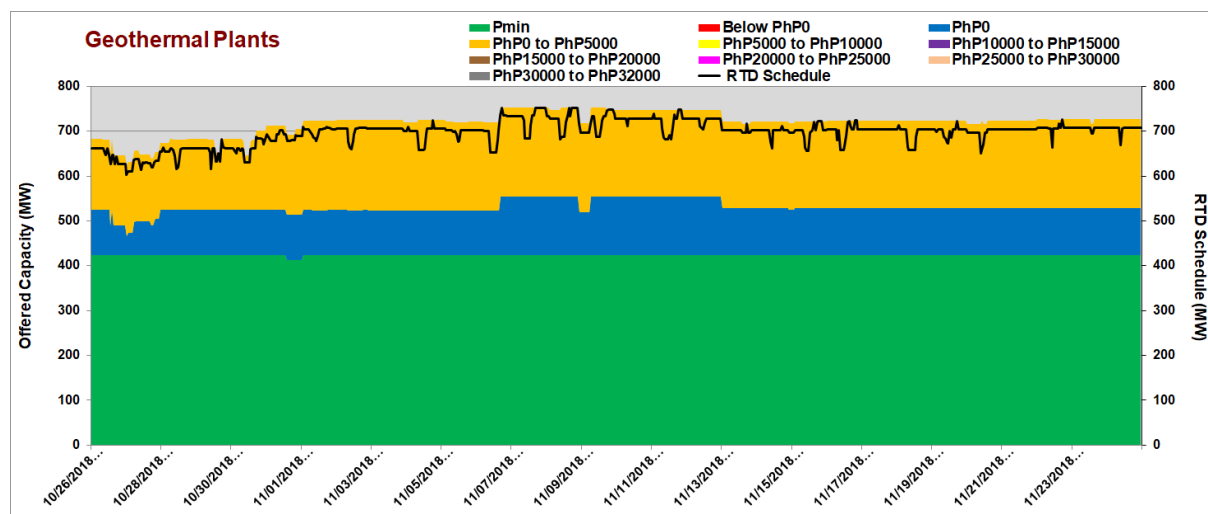
Figure 23. Geothermal Plants Offer Pattern, Luzon – November 2018



Geothermal plants in the Visayas demonstrated slightly higher-priced offers compared with the geothermal plants in Luzon. While about 73.7 percent of its capacity offers were priced at PhP0/MWh and below, the remaining 26.3 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.

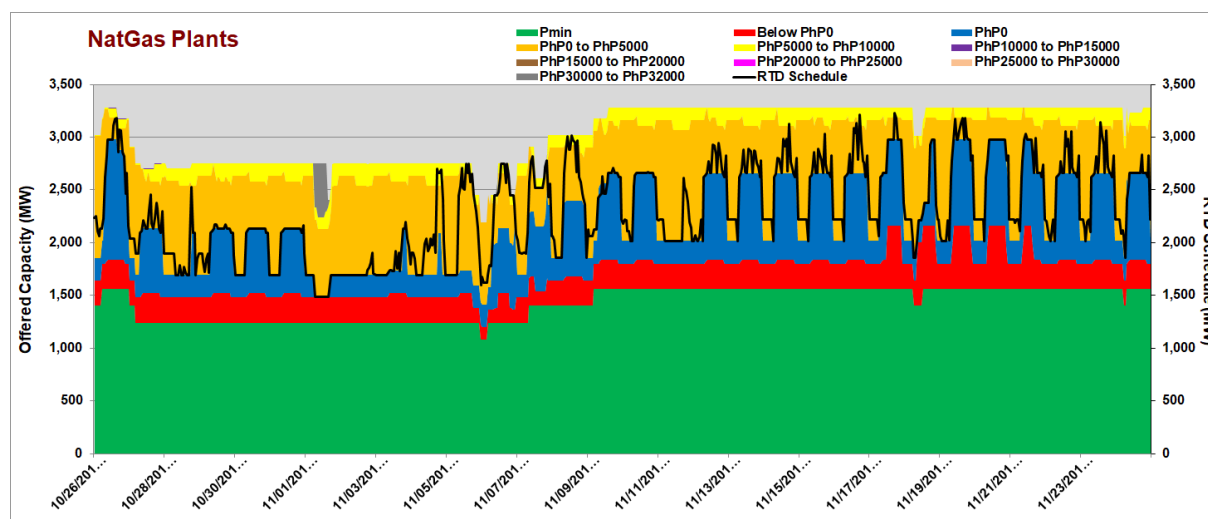
Figure 24. Geothermal Plants Offer Pattern, Visayas – November 2018



Natural gas plants offered 72.2 percent of its capacity at PhP0/MWh and below. The remaining 23.5 percent comprised of higher offer prices ranging above PhP0/MWh to PhP5,000/MWh, while another 4.1 percent were offers priced above PhP5,000/MWh to PhP10,000/MWh and 0.2 percent were offers priced ranging from PhP30,000/MWh to PhP32,000/MWh.

Correspondingly, 78.7 percent of the offers submitted by natural gas plants were scheduled for dispatch during the month.

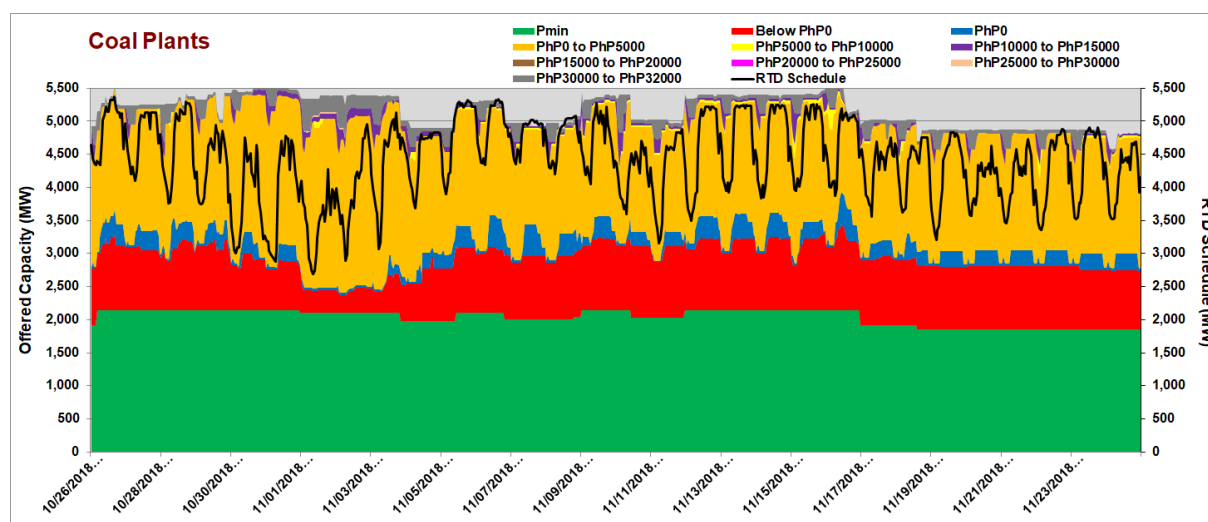
Figure 25. Natural Gas Plants Offer Pattern, Luzon – November 2018



Luzon coal plants offered 60.4 percent of its capacity at PhP0/MWh and below, and a considerable portion (35.6 percent) at prices ranging above PhP0/MWh to PhP5,000/MWh which indicates a higher month-on-month comparison, having offered only 33.3 percent of its capacity at this price range in October. The remaining capacity was offered at higher prices. 1.4 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.

The month-on-month increase in its offer prices resulted to 85.8 percent of the offered capacity of Luzon coal plants was scheduled for dispatch during the month, a decrease from last month's 92.7 percent.

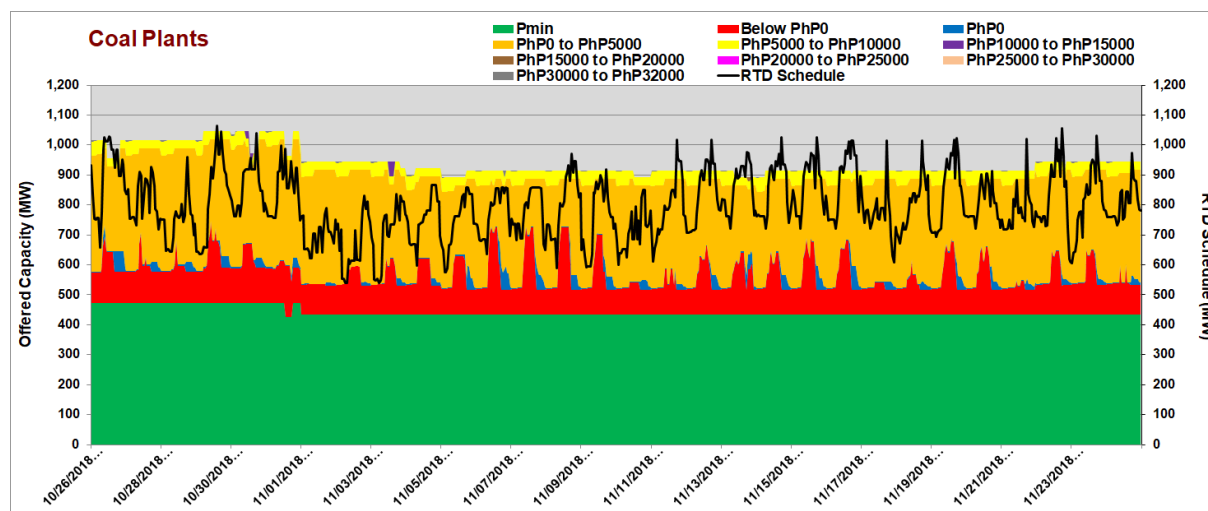
Figure 26. Coal Plants Offer Pattern – Luzon, November 2018



On the other hand, Visayas coal plants submitted 61.4 percent of its capacity offers at PhP0/MWh and below. Another 34.8 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 3.7 percent of its offers were priced above PhP5,000/MWh to PhP10,000/MWh (from last month's 2.6 percent).

84.9 percent of its total offered capacity was scheduled for dispatch in the market during the November billing month, lower than last month's 85.5 percent.

Figure 27. Coal Plants Offer Pattern, Visayas – November 2018

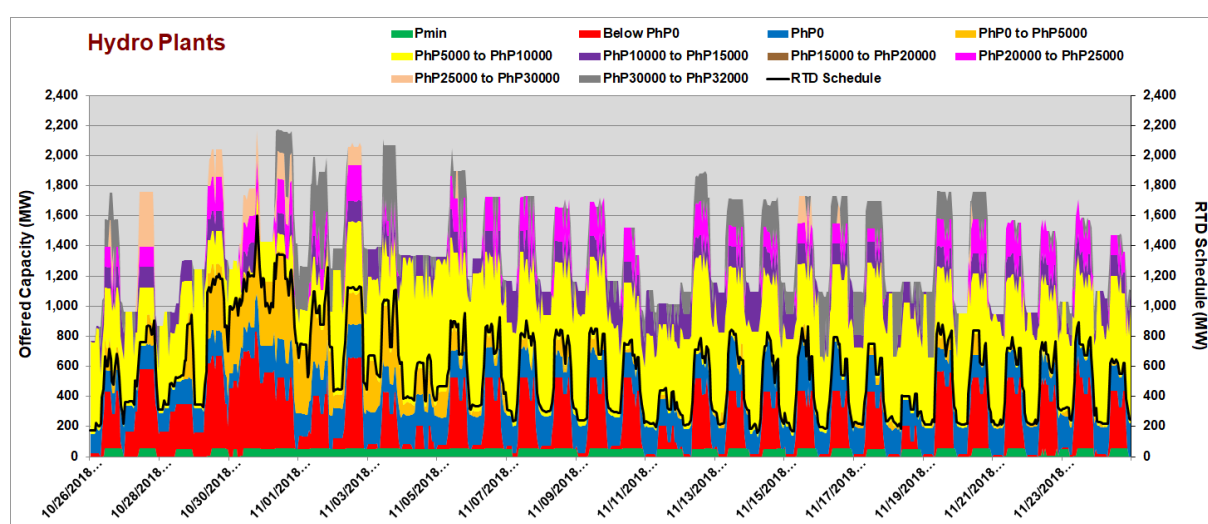


Luzon hydro plants submitted 32.5 percent of its offers at PhP0/MWh and below, 7.0 percent at above PhP0/MWh to PhP5,000/MWh, and a considerable portion (37.4 percent) at higher prices ranging above PhP5,000/MWh to PhP10,000/MWh.

23.1 percent were priced even higher at above PhP10,000/MWh. Of which, 7.7 percent comprised of offer prices distributed above PhP10,000/MWh to PhP15,000/MWh, 5.9 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 8.0 percent were offer prices ranging above PhP30,000/MWh to PhP32,000/MWh. It is noted that Luzon hydro plants submitted a slightly higher offer prices this month when compared with the previous billing month which recorded only 21.9 percent of its offer prices at above PhP10,000/MWh.

Accordingly, 41.5 percent of the offered capacity of Luzon hydro plants was scheduled for dispatch.

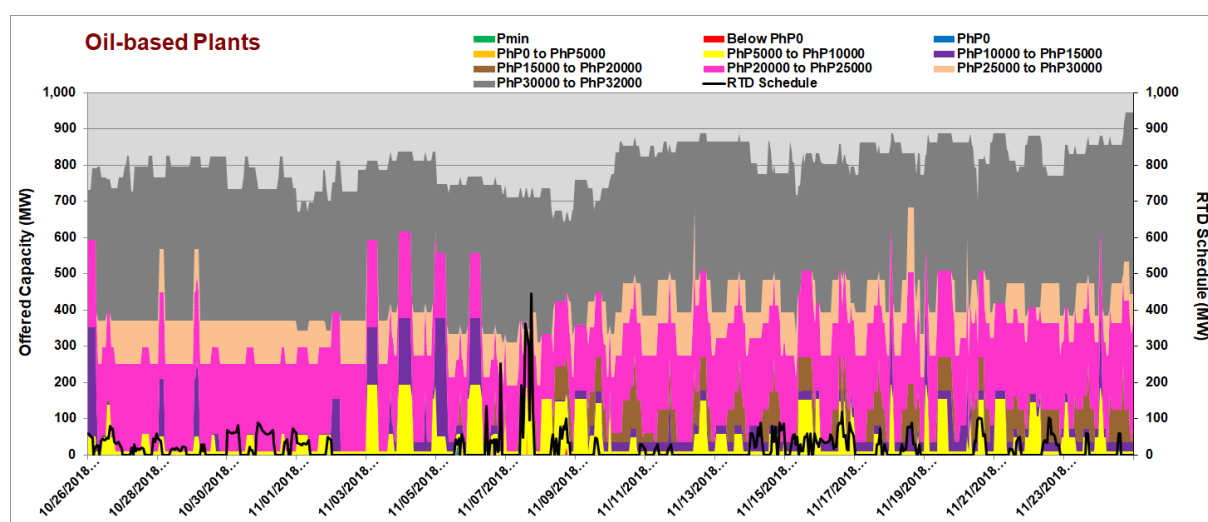
Figure 28. Hydro Plants Offer Pattern, Luzon – November 2018



Luzon oil-based plants submitted the highest offer prices this month with bulk of their offers, at 46.8 percent, priced above PhP30,000/MWh to PhP32,000/MWh. Meanwhile, 14.5 percent were priced above PhP10,000/MWh to PhP20,000/MWh, 28.8 percent of the offered prices were ranging from PhP20,000/MWh to PhP25,000/MWh and only 9.8 percent were offered above PhP25,000/MWh to PhP30,000/MWh.

Correspondingly, 2.1 percent of the offers were scheduled for dispatch in the market, a decrease from 3.5 percent posted in the previous month.

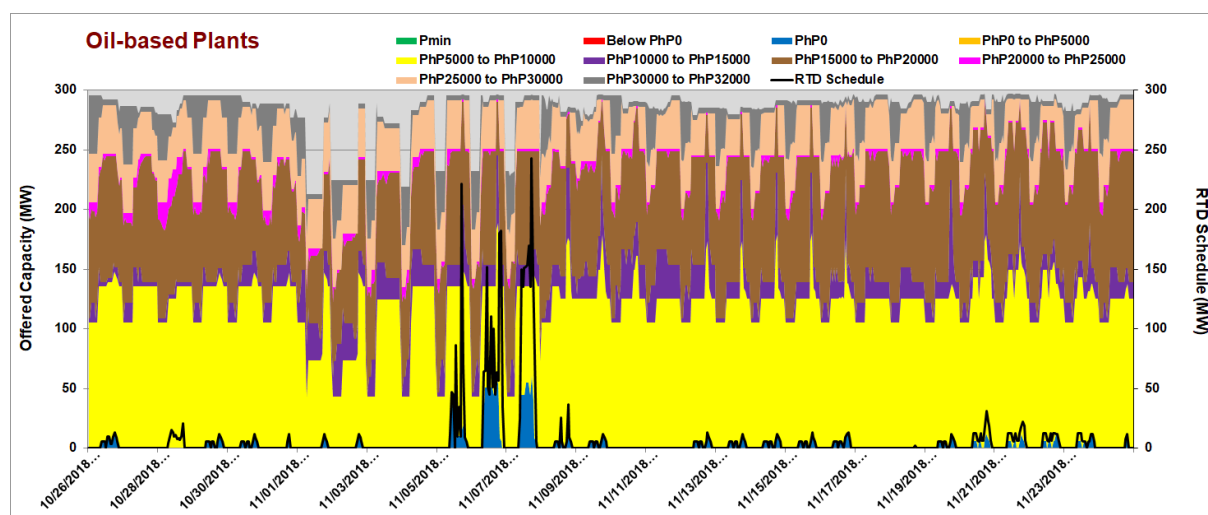
Figure 29. Oil-based Plants Offer Pattern, Luzon – November 2018



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 ranging from PhP5,000/MWh to PhP10,000/MWh (41.1 percent) and the 31.6 percent were prices above PhP15,000/MWh to PhP20,000/MWh. 6.6 percent of the prices were offered from PhP10,000/MWh to PhP15,000/MWh and the remaining 19.6 percent were prices above PhP20,000/MWh to PhP32,000/MWh. A small portion, at 1.1 percent, were offer prices at PhP0/MWh.

2.3 percent of the capacity offered by Visayas oil-based plants were scheduled for dispatch during the billing month. This was lower than last month's 3.6 percent.

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



XII. Capacity Factor

Luzon

In terms of registered capacity, natural gas plants recorded the highest capacity factor among the Luzon resource types at 69.9 percent, followed by coal plants at 67.2 percent, geothermal plants at 45.4 percent, hydro plants at 24.7 percent and oil-based plants at 1.3 percent.

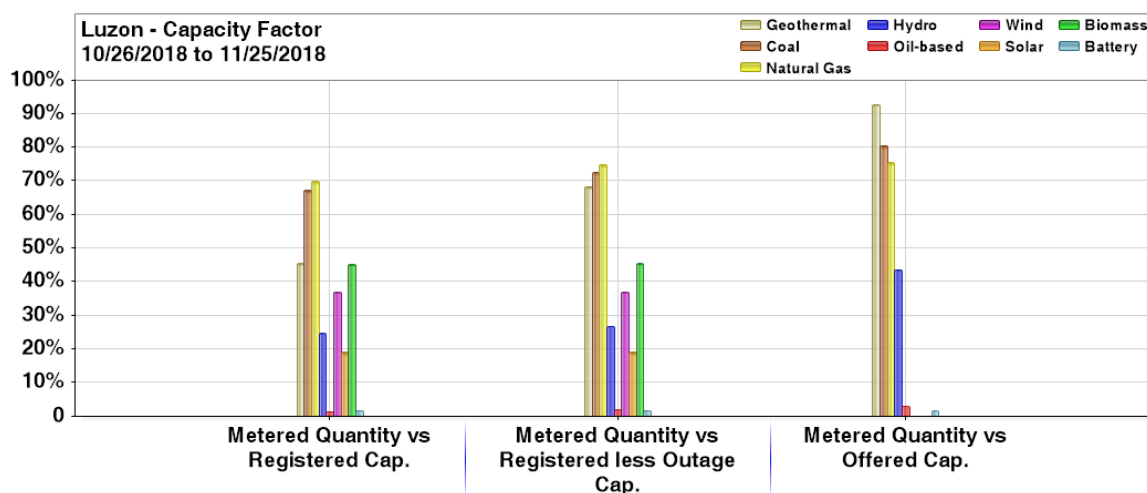
Natural gas plants likewise obtained the highest utilization when measured in terms of registered capacity net of outage, at 74.8 percent. Coal plants came next at 72.7 percent, geothermal plants at 68.4 percent, hydro plants at 26.8 percent, and oil-based plants at 1.9 percent.

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 92.6 percent. Coal and natural gas plants followed with 80.5 percent and 75.5 percent, respectively. Lower utilization levels were recorded by hydro plants at 43.7 percent and by oil-based plants at only 3.0 percent.

Meanwhile, the capacity factors of preferential dispatch plants, measured in terms of registered capacity, are posted at 37.0 percent for wind, and 19.0 percent for solar while biomass recorded a capacity factor of 45.1 percent in terms of registered capacity and about 45.4 percent when measured in terms of registered capacity net of outage.

The sole battery energy storage facility in the WESM – Masinloc Battery, posted a capacity factor of 1.5 percent each when measured in terms of registered capacity, registered capacity net of outage, and offered capacity.

Figure 31. Capacity Factor – Luzon Plants, November 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 74.6 percent, followed by coal plants at 44.1 percent, hydro plants at 33.1 percent and oil-based plants at 2.5 percent.

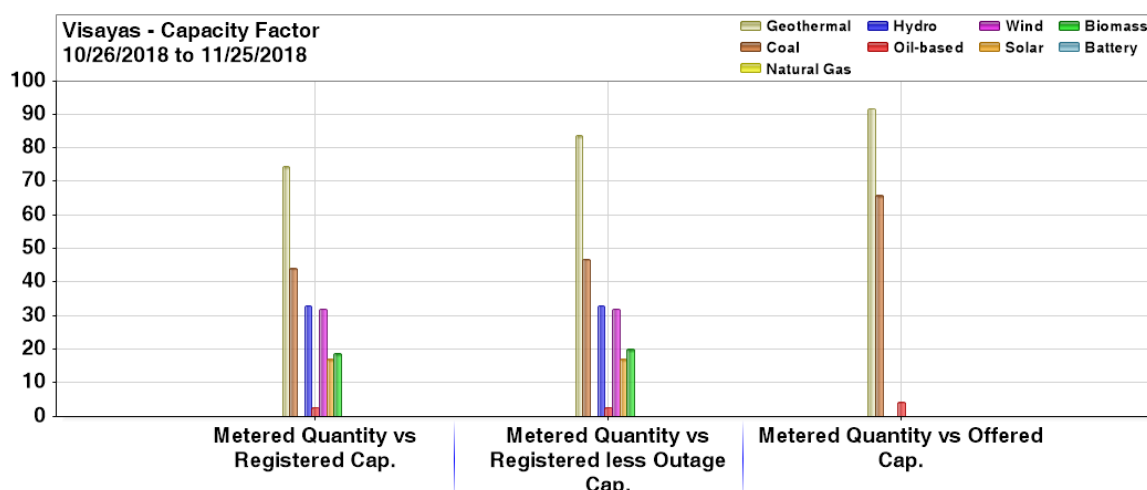
Similarly, it was the Visayas geothermal plants which topped the list in terms of utilization based on registered less outage capacity at 83.9 percent, followed by coal plants at 46.9 percent, hydro at 33.1 percent and oil-based plants at 2.5 percent.

Higher utilization levels were obtained based on offered capacity, with geothermal plants recording 91.8 percent, coal plants at 65.9 percent and oil-based plants at 4.1 percent.

Wind plants' capacity factors based on registered capacity and based on registered capacity net of outage were posted at 32.1 percent while solar plants recorded the same at 17.1 percent, respectively. Biomass plant recorded a capacity factor of 18.9 percent when measured in terms

of registered capacity and 20.1 percent when measured in terms of registered capacity net of outage.

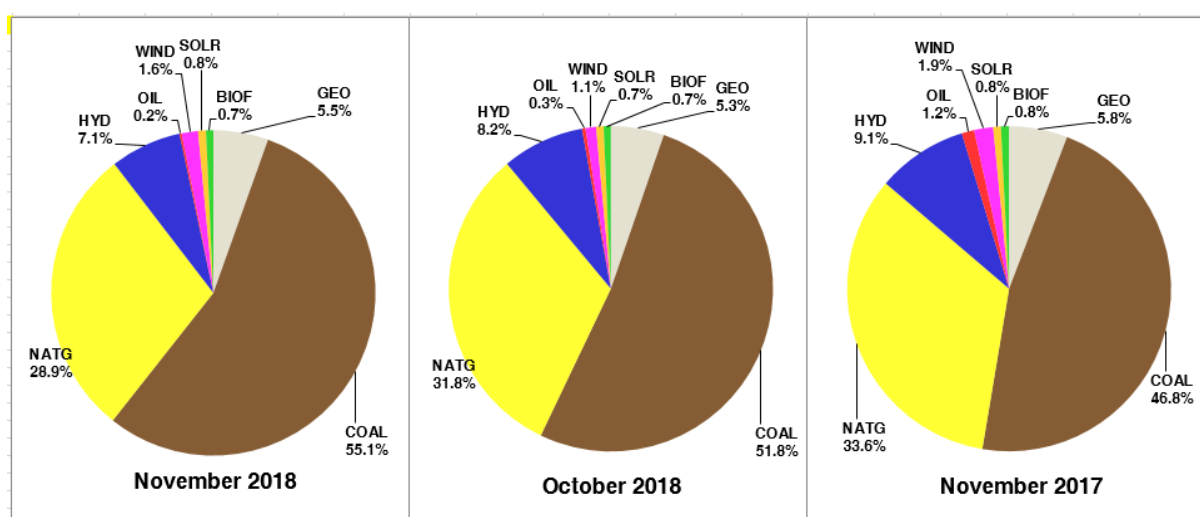
Figure 32. Capacity Factor, Visayas Plants – November 2018



XIII. Generation Mix

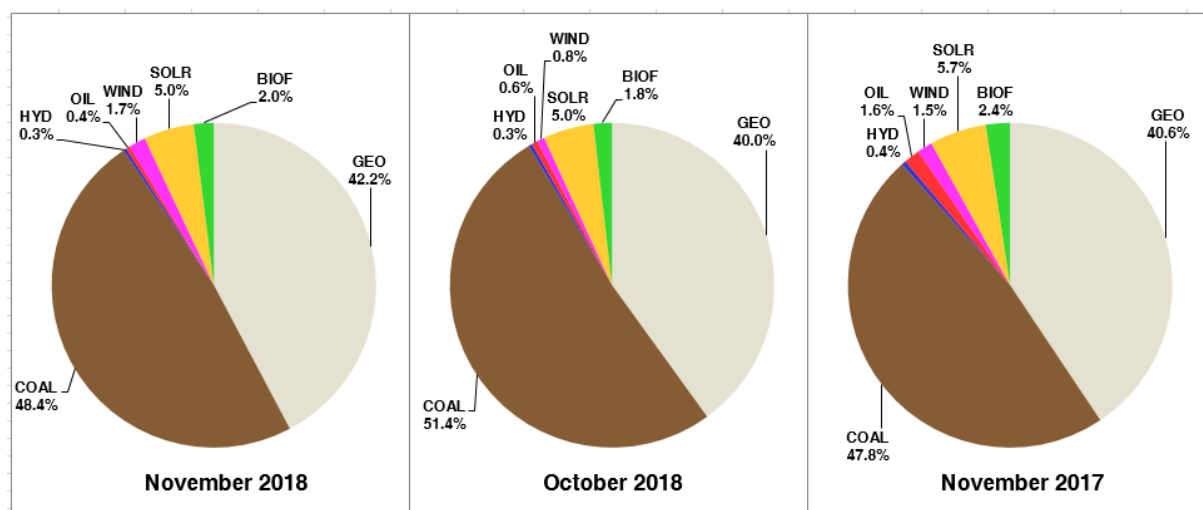
Coal plants held the largest portion of the total metered quantity in Luzon at 55.1 percent (from previous month's 51.8 percent), followed by natural gas plants at 28.9 percent (previous month's 31.8 percent), hydro plants at 7.1 percent, geothermal plants at 5.5 percent and oil-based plants at 0.2 percent. Meanwhile, the contribution of preferential and must-dispatch generating units was recorded at 3.1 percent.

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



Coal plants had the highest contribution to the Visayas generation mix at 48.4 percent (from previous month's 51.4 percent) followed by geothermal plants at 42.2 percent (previous month's 40.0 percent). Oil-based and hydro plants came next with 0.4 percent and 0.3 percent, respectively. Meanwhile, solar plants' contribution was at 5.0 percent, wind plants at 1.7 percent and biomass at 2.0 percent.

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



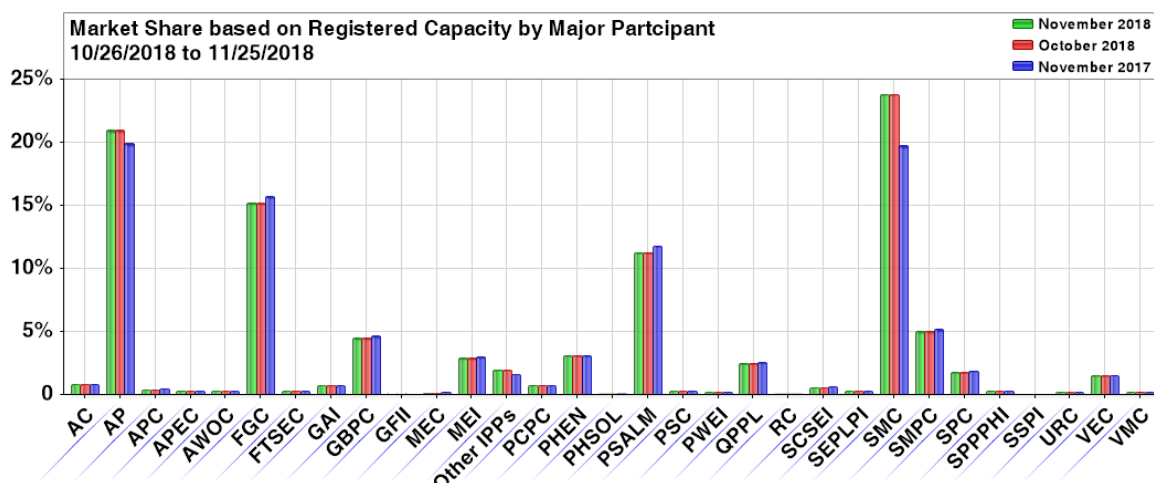
XIV. Market Concentration

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 November 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).

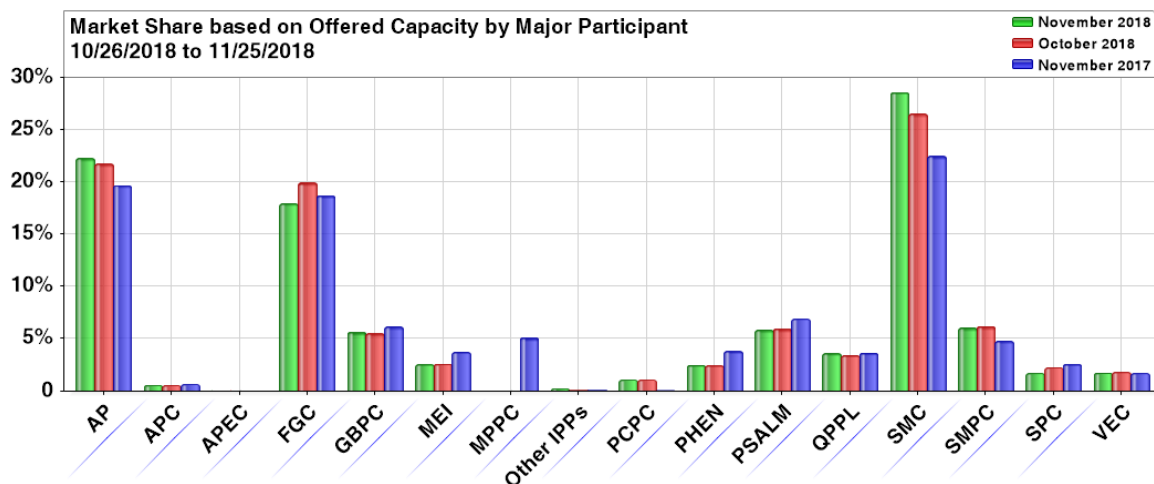
Semirara Mining Power Corporation (SMPC) and Global Business Power Corporation (GBPC) distantly followed at 5 percent and 4.5 percent, respectively.

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



SMC likewise held the largest share of the market at 28.5 percent based on offered capacity. AP held the second largest share at 22.2 percent followed by FGC at 17.9 percent. In distant fourth is SMPC at 6.05 percent followed by PSALM at 5.9 percent and GBPC at 5.6 percent.

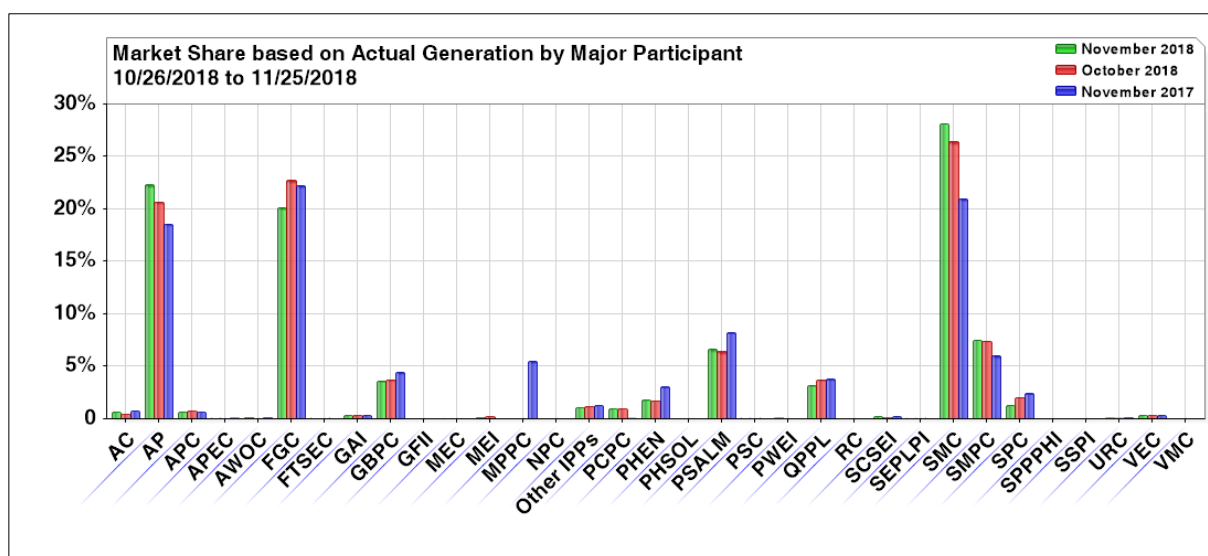
Figure 36. Market Share by Major Participant Group based on Offered Capacity, November 2018, October 2018, November 2017



Market share calculated based on actual generation also showed the SMC group with the largest market share at 28.1 percent. FGC and AP then followed at 22.3 percent and 20.1 percent, respectively.

SMPC and PSALM were also among the highest market shareholders 7.5 percent and 6.7 percent of the actual generation, respectively.

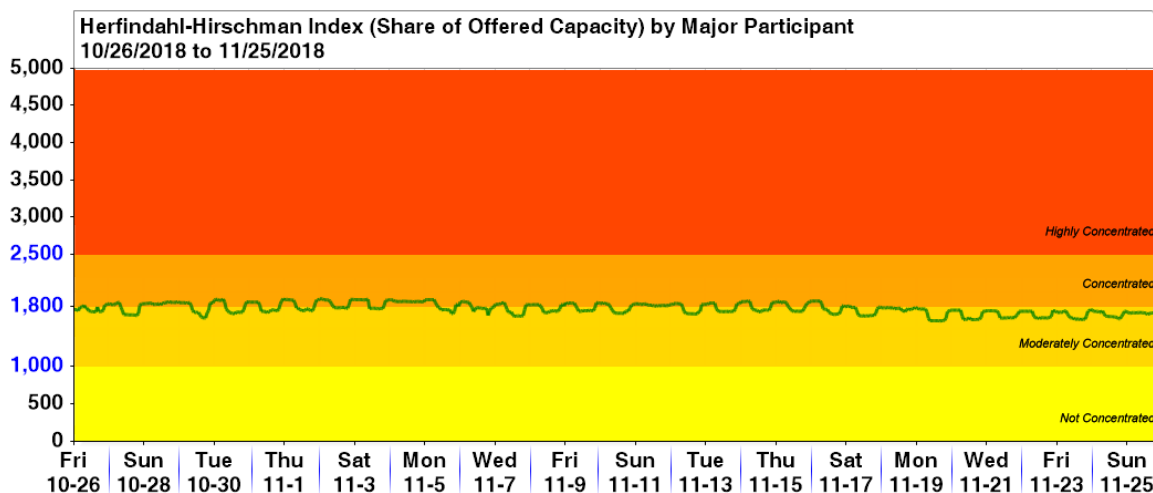
Figure 37. Market Share by Major Participant Group based on Actual Generation, November 2018, October 2018 and November 2017



b. Herfindahl-Hirschman Index (HHI)

The Herfindahl-Hirschman Index (HHI)¹¹ calculated based on offered capacity by major participants' grouping indicated a moderately concentrated market for 453 trading intervals (61 percent) of the time and concentrated market for the remaining 291 trading intervals (39 percent) during the November billing month.

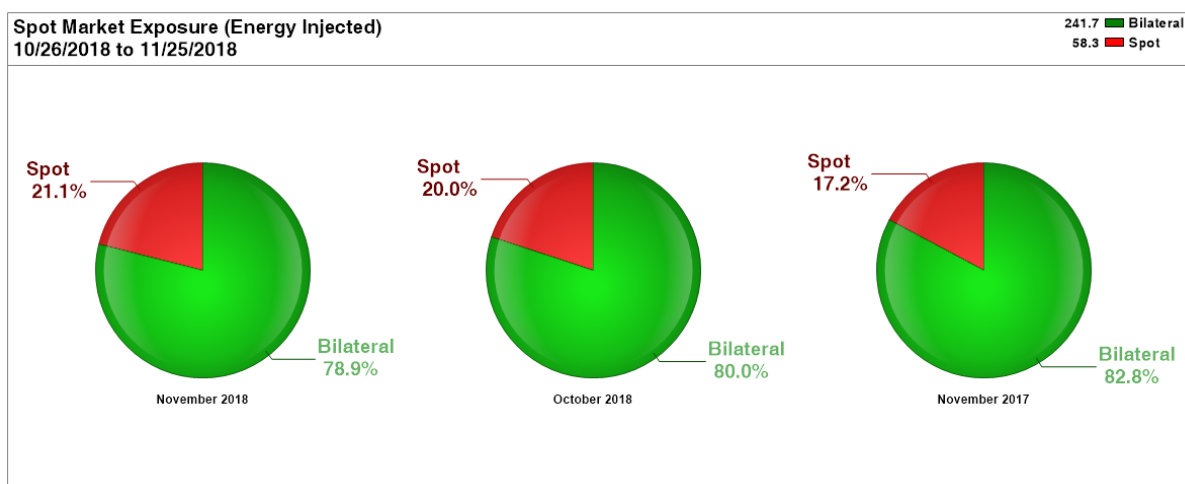
Figure 38. Hourly HHI based by Major Participant Grouping, November 2018



XV. Spot Exposure

The spot market exposure of generator-trading participants comprised about 21.1 percent of the total energy transaction in the WESM. This was higher than previous month's 20.0 percent and previous year's 17.2 percent. Still, majority of the total energy injected into the grid was covered by bilateral contracts.

Figure 39. Spot Market Exposure, November 2018, October 2018, and November 2017



¹¹ 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.

Appendix A. Major Plant Outages

Region	Plant Type	Plant / Unit Name	Capacity (MW)	Date Out	Date In	Duration	Outage Type	Remarks
LUZON	GEO	Twil 3	43.7	2005-10-23 13:26:00		31.00	Deactivated Shutdown	Twil 3 decommissioned since May 26 2003
LUZON	GEO	Makban 6	55	2013-04-11 22:44:00		31.00	Deactivated Shutdown	Conducted gas compressor test
VISAYAS	GEO	PGPP2 Unit 4	20	2014-06-27 06:07:00		31.00	Forced Outage	Steam being utilized by Nasulo plant
LUZON	GEO	Makban 5	55	2017-03-12 01:55:00	2018-11-01 11:38:00	6.48	Forced Outage	High turbine vibration
LUZON	HYD	Angat M3	50	2018-01-29 00:01:00		31.00	Planned Outage	Annual overhauling until 23 July 2018
LUZON	OIL	Malaya 2	350	2018-05-19 13:01:00		31.00	Forced Outage	Burn air heater 2A
LUZON	COAL	SLFGC 2	122.9	2018-06-18 06:14:00		31.00	Forced Outage	Isolated due to tripping Calaca-Salong Line
LUZON	OIL	Limay 3	60	2018-06-22 08:01:00	2018-11-24 15:46:00	23.66	Planned Outage	Maintenance outage until 23 October 2018
LUZON	GEO	Twil 1	53	2018-08-12 11:11:00		31.00	Forced Outage	Low steam supply
LUZON	GEO	Makban 1	63	2018-08-30 12:08:00	2018-11-22 21:02:00	27.88	Forced Outage	Busted bushing at high side phase A of Makban Unit Transformer
LUZON	GEO	Makban 9	20	2018-08-30 19:19:00		31.00	Forced Outage	On reserve shutdown pending availability of steam supply
LUZON	COAL	Sual 1	647	2018-08-31 23:48:00	2018-10-26 03:42:00	0.15	Planned Outage	On maintenance until 30 October 2018
VISAYAS	GEO	Upper Mahiao 1	32	2018-09-03 06:01:00		31.00	Forced Outage	Tripped
VISAYAS	GEO	Upper Mahiao 2	32	2018-09-03 06:01:00		31.00	Forced Outage	Tripped
LUZON	GEO	Makban Ormat 1	3	2018-09-30 09:30:00		31.00	Forced Outage	Loss of power supply of PGPC injection pump
LUZON	GEO	Makban Ormat 2	6	2018-09-30 09:30:00		31.00	Forced Outage	Loss of power supply of PGPC injection pump
LUZON	HYD	Calaya 2	14	2018-10-01 00:01:00	2018-11-14 21:47:00	19.91	Planned Outage	Planned outage until 14 November 2018
LUZON	OIL	Limay 7	60	2018-10-01 00:01:00		31.00	Maintenance Outage	Maintenance outage until 15 November 2018
LUZON	OIL	Limay 7	60	2018-10-01 00:01:00		31.00	Maintenance Outage	Maintenance outage until 15 October 2018
LUZON	OIL	Limay 7	60	2018-10-01 00:01:00	2018-11-20 12:00:00	25.50	Maintenance Outage	Maintenance Outage
VISAYAS	COAL	TPC Sangi 2	85	2018-10-01 09:12:00		31.00	Forced Outage	AFFECTED BY TRIPPING OF DASCON L1 and 2. AND CARCON L1 and 2
LUZON	OIL	SLPGC 3	23	2018-10-15 00:01:00	2018-11-03 13:07:00	8.55	Maintenance Outage	Maintenance Outage until 11032018
LUZON	OIL	SLPGC 4	25	2018-10-15 00:01:00		31.00	Maintenance Outage	Maintenance Outage until 11032018
LUZON	OIL	SLPGC 4	25	2018-10-15 00:01:00	2018-11-22 11:55:00	27.50	Maintenance Outage	Maintenance Outage until 11052018
LUZON	COAL	SMC 4	150	2018-10-15 14:13:00	2018-10-30 21:56:00	4.91	Forced Outage	On Commissioning Test.
VISAYAS	GEO	Leyte 3	36	2018-10-19 02:15:00	2018-11-06 10:26:00	11.43	Planned Outage	PMS
LUZON	GEO	Makban 2	63	2018-10-24 09:21:00	2018-10-30 19:48:00	4.82	Forced Outage	Emergency Shutdown due to unit 2 Main Transformer Oil
VISAYAS	OIL	Bohol 3	4.2	2018-10-24 17:02:00	2018-10-26 10:23:00	0.43	Forced Outage	High temperature at shaling of raw water circulating pump
LUZON	NATG	Sta. Rita 2	255.7	2018-10-24 21:58:00	2018-10-26 03:51:00	0.16	Forced Outage	Steam leak at condensate pre-heater pipe.
LUZON	HYD	Magat 2	95	2018-10-25 00:00:00	2018-10-28 14:00:00	2.58	Forced Outage	Limited allow able water release due to zero irrigation diversion requirement
LUZON	OIL	TMD Unit 4	46.8	2018-10-25 23:23:00	2018-11-05 06:14:00	10.26	Planned Outage	Scheduled maintenance outage
VISAYAS	GEO	PGPP1 Unit 1	37.5	2018-10-26 11:13:00	2018-10-26 12:10:00	0.04	Forced Outage	Auto tripped due to high condenser level
VISAYAS	GEO	PGPP1 Unit 1	37.5	2018-10-26 13:21:00	2018-10-26 18:23:00	0.21	Forced Outage	Auto tripped due to high condenser level
VISAYAS	GEO	PGPP1 Unit 1	37.5	2018-10-26 18:51:00	2018-10-26 22:55:00	0.17	Forced Outage	Auto tripped due to high condenser level
VISAYAS	GEO	Leyte 1	35	2018-10-26 22:00:00	2018-10-27 03:06:00	0.21	Forced Outage	Under assessment
LUZON	NATG	San Lorenzo 2	261.8	2018-10-27 00:18:00	2018-11-08 12:01:00	12.49	Maintenance Outage	Maintenance outage until Nov. 02, 2018
LUZON	NATG	San Lorenzo 2	261.8	2018-10-27 00:18:00	2018-11-08 12:01:00	12.49	Maintenance Outage	Maintenance outage until Nov. 02, 2018, extended
LUZON	NATG	San Lorenzo 1	264.8	2018-10-27 04:55:00	2018-11-07 07:16:00	11.10	Maintenance Outage	Maintenance outage until Nov. 02, 2018
LUZON	NATG	San Lorenzo 1	264.8	2018-10-27 04:55:00	2018-11-07 07:16:00	11.10	Maintenance Outage	Maintenance outage until Nov. 02, 2018, extended
VISAYAS	GEO	PGPP1 Unit 1	37.5	2018-10-27 15:41:00	2018-10-27 17:30:00	0.08	Forced Outage	Auto-tripped due to high condenser level
LUZON	NATG	Awton 2	50.3	2018-10-28 00:07:00	2018-10-28 17:12:00	0.71	Maintenance Outage	Maintenance outage until 1700H October 28
VISAYAS	SOLR	Isolad 2	27.2	2018-10-28 07:32:00	2018-10-28 16:15:00	0.36	Forced Outage	Affected by PMS along 63kV Bacolod-San Enrique Sub TL per TLOS V BAC-2018-10-0004
LUZON	HYD	Kalayaan 3	180	2018-10-29 12:50:00	2018-10-29 13:31:00	0.03	Forced Outage	Emergency shutdown due to Hotspot near phase reversal switch. RECLASSIFIED FROM FORCE. OMC OUTAGE
LUZON	HYD	Magat 1	95	2018-10-30 07:07:00	2018-10-30 16:59:00	0.41	Forced Outage	Isolated. Tripping of Santiago-Bayombong L1L2
LUZON	HYD	Magat 2	95	2018-10-30 07:07:00	2018-10-30 16:59:00	0.41	Forced Outage	Isolated. Tripping of Santiago-Bayombong L1L2
LUZON	HYD	Magat 3	95	2018-10-30 07:07:00	2018-10-30 16:40:00	0.40	Forced Outage	Isolated. Tripping of Santiago-Bayombong L1L2. RECLASSIFIED FROM FORCE. OMC OUTAGE
LUZON	HYD	Magat 4	95	2018-10-30 07:07:00	2018-10-30 16:40:00	0.40	Forced Outage	Isolated. Tripping of Santiago-Bayombong L1L2. RECLASSIFIED FROM FORCE. OMC OUTAGE
VISAYAS	OIL	Bohol 3	4.2	2018-10-30 17:55:00	2018-10-30 22:19:00	0.18	Forced Outage	Excessive fuel oil leak
VISAYAS	COAL	PEDC 2	83.7	2018-10-31 11:56:00	2018-10-31 15:57:00	0.17	Forced Outage	Level valve problem
VISAYAS	GEO	PGPP2 Unit 1	20	2018-10-31 12:42:00	2018-10-31 23:47:00	0.46	Forced Outage	Emergency shutdown due to high vibration of vacuum pump motor
LUZON	HYD	Magat 2	95	2018-10-31 22:36:00	2018-10-31 23:42:00	0.05	Forced Outage	Tripped due to Rotor Earth Fault
LUZON	COAL	SLPGC 1	150	2018-11-01 00:12:00	2018-11-08 10:37:00	7.43	Forced Outage	Emergency Shutdown to facilitate inspection and unclogging of coal bunker A and B
LUZON	OIL	TMD Unit 3	53.4	2018-11-01 00:41:00	2018-11-09 23:28:00	8.95	Maintenance Outage	Preventive maintenance until november 28, 2018
VISAYAS	COAL	Keppco Salcon 1	103	2018-11-01 00:43:00		24.97	Planned Outage	APMS
LUZON	GEO	Makban 5	55	2018-11-01 11:53:00	2018-11-02 04:00:00	0.67	Forced Outage	Tripped while plant on test
LUZON	HYD	Magat 3	95	2018-11-01 11:53:00	2018-11-01 12:20:00	0.02	Forced Outage	Affected by the tripping of Unit 4
LUZON	HYD	Magat 4	95	2018-11-01 11:53:00	2018-11-01 18:08:00	0.26	Forced Outage	Tripped by unit transformer differential relay actuated
LUZON	GEO	Makban 7	20	2018-11-02 12:06:00	2018-11-02 15:50:00	0.16	Forced Outage	Tripped due to tie line trouble
LUZON	GEO	Makban 8	20	2018-11-02 12:06:00	2018-11-02 15:50:00	0.16	Forced Outage	Tripped due to tie line trouble
LUZON	GEO	Makban 3	63	2018-11-02 18:21:00	2018-11-13 01:15:00	10.29	Forced Outage	Manually tripped for steam optimization due to insufficient steam supply caused by geothermal reservoir limitation
VISAYAS	OIL	PB102 Unit 3	6	2018-11-03 17:53:00		22.25	Forced Outage	Internal trouble
VISAYAS	OIL	PB102 Unit 4	6	2018-11-03 17:53:00	2018-11-03 21:27:00	0.15	Forced Outage	Internal trouble
VISAYAS	COAL	Pagbilao 2	382	2018-11-03 21:40:00	2018-11-05 08:09:00	1.44	Forced Outage	Superheater control valve leak
LUZON	OIL	Limay 1	60	2018-11-05 00:02:00	2018-11-10 01:00:00	5.04	Maintenance Outage	Maintenance outage until November 11, 2018
LUZON	NATG	Iljan A1	190	2018-11-05 16:23:00	2018-11-06 08:26:00	0.67	Forced Outage	Tripped with 300MW load, including reduction in ST loading
LUZON	HYD	San Roque 2	145	2018-11-05 22:06:00	2018-11-05 23:43:00	0.07	Forced Outage	Isolated due to tripping of PCBs of Nagisaag - San Roque 230kV Lines 1 and 2 at San Roque side only
LUZON	NATG	Sta. Rita 1	257.3	2018-11-05 22:06:00	2018-11-06 03:50:00	0.24	Forced Outage	Gas Turbine protection actuated
LUZON	HYD	Kalayaan 2	180	2018-11-06 01:00:00	2018-11-11 01:40:00	5.03	Planned Outage	Maintenance Outage until November 10, 2018
LUZON	NATG	Iljan A1	190	2018-11-06 17:18:00	2018-11-06 22:59:00	0.24	Forced Outage	Combustion problem
LUZON	COAL	Masinloc 1	315	2018-11-06 18:49:00	2018-11-08 22:51:00	2.17	Forced Outage	Tripped with 223MW load. Pulverizer Mill fire
LUZON	OIL	SLPGC 3	25	2018-11-06 22:40:00	2018-11-08 16:17:00	1.73	Forced Outage	Unit transformer trouble
LUZON	HYD	Botocan 1	10	2018-11-07 08:01:00	2018-11-12 14:35:00	5.27	Planned Outage	Maintenance outage until 12 November 2018
LUZON	NATG	Iljan A1	190	2018-11-07 10:47:00	2018-11-07 19:24:00	0.36	Forced Outage	Combustor leak problem
LUZON	HYD	Binga 1	35	2018-11-07 22:54:00	2018-11-08 05:18:00	0.27	Forced Outage	Tripped due to unit 2 Transformer trouble
LUZON	HYD	Binga 2	35	2018-11-07 22:54:00	2018-11-08 06:03:00	0.30	Forced Outage	Unit Transformer 2 trouble
LUZON	GEO	MGFP 1	20	2018-11-08 04:43:00	2018-11-08 07:07:00	0.10	Forced Outage	Forced outage
VISAYAS	OIL	Bohol 3	4.2	2018-11-08 11:15:00	2018-11-08 20:09:00	0.37	Forced Outage	Engine governor problem
LUZON	NATG	San Lorenzo 3	261.8	2018-11-08 12:30:00	2018-11-08 19:03:00	0.27	Forced Outage	Tripped with 75MW load
LUZON	GEO	Twil 6	57	2018-11-08 14:40:00	2018-11-08 15:04:00	0.02	Forced Outage	Condenser low vacuum
VISAYAS	GEO	PGPP1 Unit 3	37.5	2018-11-08 22:05:00	2018-11-09 06:09:00	0.34	Forced Outage	Offline to conduct fit-up and actual measurement in preparation to replace the old 4.16kV OCB with the new VCB
LUZON	NATG	San Lorenzo 2	261.8	2018-11-08 22:21:00	2018-11-09 03:17:00	0.21	Forced Outage	To facilitate repair of leak at LP control valve

Appendix A. Major Plant Outages

VISAYAS	SOLR	Montesol 1	14.4	2018-11-10 07:01:00	2018-11-10 16:09:00	0.38	Forced Outage	Affected by APMS of 69kV Amlan-Gulhungan Sub TL
LUZON	COAL	Pagbilao 1	382	2018-11-10 10:00:00	2018-11-11 21:05:00	1.46	Forced Outage	Submerge flight conveyor trouble
LUZON	HYD	Kalayaan 1	180	2018-11-11 06:03:00	2018-11-11 08:12:00	0.09	Forced Outage	Not available due to turbine valve trouble
LUZON	HYD	Botoan 2	10	2018-11-11 07:05:00	2018-11-16 16:01:00	5.37	Planned Outage	Maintenance outage until 16 November 2018
LUZON	GEO	Malban 5	55	2018-11-12 10:56:00	2018-11-16 00:17:00	3.56	Forced Outage	Generator under voltage due to excitation problem
LUZON	HYD	Kalayaan 1	180	2018-11-13 00:01:00	2018-11-17 17:33:00	4.73	Planned Outage	Planned outage until 17 November 2018 (GOMP)
LUZON	HYD	Kalayaan 1	180	2018-11-13 00:01:00	2018-11-17 17:33:00	4.73	Planned Outage	Planned outage until 17 November 2018 (GOMP)
VISAYAS	GEO	Leyte 2	36	2018-11-13 01:13:00	2018-11-25 12:58:00	12.49	Maintenance Outage	Annual PMS up to 01 December 2018
LUZON	HYD	Ambuklao 3	35	2018-11-14 10:30:00	2018-11-14 14:41:00	0.17	Forced Outage	Turbine wicket gate shear pin broken
LUZON	OIL	Limay 1	60	2018-11-15 04:47:00	2018-11-15 09:09:00	0.18	Forced Outage	Nozzle blow off valve liquid fuel circuit breaker trouble
LUZON	HYD	Angat M1	50	2018-11-15 08:26:00	2018-11-15 16:42:00	0.34	Maintenance Outage	Affected by the outage of main transformer A
LUZON	HYD	Angat M2	50	2018-11-15 08:26:00	2018-11-15 16:42:00	0.34	Maintenance Outage	Affected by the outage of main transformer A
LUZON	HYD	Ambuklao 2	35	2018-11-16 01:30:00	2018-11-16 03:09:00	0.07	Forced Outage	Tripped due to broken shear pin
LUZON	GEO	Malban Dimat 2	3	2018-11-16 01:51:00	2018-11-16 10:51:00	0.38	Forced Outage	Low Pressure Seal Oil
LUZON	GEO	Malban Dimat 2	6	2018-11-16 01:51:00		9.32	Forced Outage	Low Pressure Seal Oil
LUZON	HYD	Angat M4	50	2018-11-16 08:17:00	2018-11-16 16:24:00	0.34	Maintenance Outage	Affected by the outage of Main Transformer B
VISAYAS	OIL	Bicol 3	4.2	2018-11-16 13:03:00	2018-11-16 17:08:00	0.17	Forced Outage	Emergency shutdown due to fuel oil leak
LUZON	COAL	Sual 2	847	2018-11-16 23:28:00		9.02	Maintenance Outage	Maintenance outage until 16 Dec 2018
VISAYAS	SOLR	Silay	20	2018-11-17 07:03:00	2018-11-17 17:21:00	0.43	Forced Outage	Offline due to PMS of 69kV Bacolod-Silay-VMC Line and Bacolod 100MVA TR2. TLDS V CEB-2018-11-0001
LUZON	GEO	Malban 5	55	2018-11-17 10:06:00	2018-11-17 16:13:00	0.25	Forced Outage	Correction of Turbine vibration
LUZON	GEO	Malban 5	55	2018-11-17 19:06:00	2018-11-18 03:30:00	0.35	Forced Outage	Correction of Turbine vibration
LUZON	GEO	Malban 5	55	2018-11-18 05:51:00	2018-11-18 09:08:00	0.14	Forced Outage	Sudden closure of motorized operating valve
LUZON	NATG	Sra. Rita 4	264	2018-11-18 06:33:00	2018-11-18 10:57:00	0.18	Planned Outage	Gas turbine/compressor washing
LUZON	COAL	SMC 1	150	2018-11-18 13:20:00		7.44	Forced Outage	High furnace pressure
LUZON	OIL	Limay 1	60	2018-11-18 17:38:00	2018-11-18 18:22:00	0.03	Forced Outage	As RR, tripped due to high exhaust temperature
LUZON	OIL	Limay 2	60	2018-11-18 19:50:00	2018-11-19 01:52:00	0.25	Forced Outage	Flame off problem. 2 failed start-up as reported by the BCCPP. As RR in lieu of Limay 1
LUZON	HYD	San Roque 3	145	2018-11-19 08:01:00	2018-11-23 23:07:00	4.63	Planned Outage	Planned Outage until 23 November 2018
VISAYAS	OIL	PE101 Unit 3	6	2018-11-19 14:02:00	2018-11-19 15:19:00	0.05	Forced Outage	Internal trouble
LUZON	GEO	Malban 4	63	2018-11-19 21:35:00		6.10	Planned Outage	Maintenance Outage until 13 December 2018
LUZON	OIL	Limay 1	60	2018-11-20 09:55:00	2018-11-20 11:30:00	0.07	Forced Outage	Flame off problem
LUZON	OIL	Limay 7	60	2018-11-20 12:36:00	2018-11-20 13:16:00	0.03	Forced Outage	Flame off problem
LUZON	OIL	Limay 7	60	2018-11-20 15:23:00	2018-11-25 15:02:00	4.39	Forced Outage	Flame off problem
LUZON	HYD	Kalayaan 3	180	2018-11-21 00:01:00		5.00	Planned Outage	Maintenance Outage until 25 November 2018
LUZON	GEO	Malban 7	20	2018-11-23 19:16:00	2018-11-23 21:16:00	0.08	Forced Outage	Tripped at 16MW load
LUZON	HYD	Kalayaan 4	180	2018-11-24 00:01:00		2.00	Planned Outage	Planned Outage until 28 November 2018 (GOMP)
LUZON	NATG	San Lorenzo 1	264.8	2018-11-24 04:53:00	2018-11-24 06:32:00	0.07	Forced Outage	Tripped at 16MW load. System Frequency is 59.64Hz
LUZON	NATG	Avon 1	50.3	2018-11-24 08:01:00	2018-11-24 17:00:00	0.37	Maintenance Outage	Maintenance outage until 1700H. 24 November 2018
VISAYAS	SOLR	Montesol 1	14.4	2018-11-24 15:54:00	2018-11-24 16:55:00	0.04	Forced Outage	Isolated due to emergency opening of 69kV Amlan-Gulhungan Sub TL, replacement of broken crossarm at str. 364 type B at Barangay Tupaz, Manjuyod, Negros Oriental
LUZON	NATG	Avon 2	50.3	2018-11-25 08:01:00	2018-11-25 17:00:00	0.37	Maintenance Outage	Maintenance outage until 1700H
LUZON	OIL	Limay 1	60	2018-11-25 15:01:00	2018-11-25 16:03:00	0.04	Forced Outage	Failed to synchronized as RR due to flame off problem

Methodology in Determining Interesting Pricing Events

Supply margin is defined as the MW difference between the system effective supply¹ and demand requirement plus reserve schedules².

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 thresholds³. 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.

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”.

¹ 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).

² 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.

³ 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.